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and Its Practical Applications

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INDEX TO VOLUME LXXIX

January—June, 1922

GENERAL INDEX

Entries from the Digest of Current Electrical Literature are indicated by D (Digest)

Pages by Weeks

January 7	1	to	64
January 14	65	to	114
January 21	115	to	164
January 28	165	to	214
February 4	215	to	264
February 11	265	to	314
February 18	315	to	364
February 25	365	to	414
March 4	415	to	464
March 11	465	to	514
March 18	515	to	564
March 25	565	to	614
April 1	615	to	664
April 8	665	to	714
April 15	715	to	764
April 22	765	to	814
April 29	815	to	864
May 6	865	to	914
May 13	915	to	984
May 20	985	to	1054
May 27	1055	to	1104
June 3	1105	to	1154
June 10	1155	to	1204
June 17	1205	to	1254
June 24	1255	to	1304

A

Accident prevention:
——California's new electrical utilization safety orders near completion, 350.
——Carelessness, why should accidents due to unaccountable, occur? (editorial), 217.
——Fire extinguishers, experience with carbon-tetrachloride. By H. J. Burton, 189.
——Hasty station operation often results in accidents. By Frank Gillooly, *336.
——Illumination and traffic accidents. By Earl A. Anderson and O. F. Haas (D), 242.
——Illumination and traffic accidents, *80.
——Kite, the deadly. By H. J. Burton, 46.
——Lessons learned from forty electrical fatalities, 1032.
——Mine telephones, safety standards for, 1121.
——Nails in soles of electrical workers' shoes are suicidal. By George F. Paul, *135.
——Pole guards bar mischievous boys. By E. F. Pearson, *838.
——Repair and construction work on electrical circuits, safeguarding. By A. L. Johnston, 685.
——Safety engineering should begin at the drafting board (editorial), 369.
——Safety regulations acceptable, making, 738.
——Welding, safety rules for electric. By D. N. Louis, 485.
——Welding, yellow or amber glasses best when. By H. L. Umland, 1172.
Accounting:
——Construction projects, for. By W. Paxton Little, *1211, comment, 1209.
——Municipal plants should be compelled to follow standard procedure (editorial), 219.
——Records of material in stock should be simple. By Roy Page, *1170.
Accumulators (see Batteries, storage).
Adams, Agden A., 563.
Adams, Robert W., 1046.
Advertising (see Public relations and Commercial).
Ahearn, Thomas, *816.
Airplane has attractive advantages in hydro-electric surveys, construction and transmission maintenance, *1210.
Allen, Elbert G., 975, 1046.
Allen, W. C., 754.
Alloys electrolytically produced, calcium-barium lead. By Cowen, Simpkins and Hiers (D), 93.
Alloys: the inner structure of the pearlite grain. By Col. N. T. Belaiew (D), 1284.
Alternating-current:
——Curve, average value of an unsymmetrical. By Vladimir Karapetoff, *234.
——Load problems, graphic solution of. By J. A. Van Tilburg (D), 1182.
——Problems simplified by imaginary quantities, solution of. By Vladimir Karapetoff, 383.
Alternators:
——Distortionless, theory of. By G. Shimidzu (D), 892.
——Synchronous operation of, through capacitance. By T. Michi (D), 1037.
American Association of Engineers holds well attended convention, 1240.
American Cities Company reorganization plan ready, 50.
American Electrochemical Society elects new officers, 1043.
American Engineering Council (see Federated American Engineering Societies).
American Engineering Standards Committee (see Standardization).
American Institute of Electrical Engineers:
——Business meeting, annual, officers formally elected at, 1087.
——Convention, annual, six groups of papers make up program for, 968.
——Convention, annual, at Niagara Falls, daily program for, 1240.
——Convention, spring, radio-operated relay gets enthusiastic attention at, 796, St. Lawrence seaway project criticized at, 845.
——Chicago section's spring meeting, 644.
——Meetings, changes scheme of, 36.
——Midwinter meeting, plans for, 51, 246, report, 346, papers at, *376.
——New York section discusses economies of generation and distribution from operators' viewpoint, 448.
——Pittsburgh section: industrial manufacturers and utility engineers to confer, 496, maintenance of industrial equipment, theme of, 597.
——Presidency of, candidates for, *347.
——Presidency of, Jewett receives nomination for, 595.
——President says power is a vital factor in reconstruction, 397.
——Standardization, pushes, 36.
American Society of Mechanical Engineers spring meeting, plans for, 750, boilers, welding and fuel discussed at Atlanta, 1042.
American Welding Society:
——Convention, annual, 750.
——Turns from sellers to users, 39.
Arana, Victor M., 704.
Appliances, electrical (see Trade and market conditions, also commercial).
Argon, the motion of electrons in. By J. S. Townsend and V. A. Bailey (D), 1133.
Arnold, Charles E., 1244.
Associated Maufacturers of Electrical Supplies:
——Annual meeting adjourned to June, 447, plans for, 600, 1041, 1139.
——Co-operate effectively with other bodies, 38.
——President of, discusses economic and human relations, 196.
Association of Edison Illuminating Companies has its own field, 38.
Association of Iron and Steel Electrical Engineers:
——Advances reported despite inactivity in steel industry, 37.
——Discuss electric rolling mills, 1090.
Atkins, William Henry, *986.
Atkinson, G. W., *204.
Atlanta, electrical rules covering construction work in, 297.
Atcms:
——New light on the (editorial), 989.
——Structure study, Dr. Aston tells of advances in, 971.
Austria:
——Styria expects 450,000 hp. from water-power development, 332.
——Water power development, 480.
Auxiliaries, adequate protection essential on station, 1127.

B

Babcock, Clifford D., 1143.
Bacharach Bill (see Commission regulation).
Baekeland patents sustained, 1040.
Bagley, Victor, 203.
Bailey, John M., 903.
Baily, George, *1143.
Baird, R. I., *54.
Barker, Sir Francis, 453.
Barker, William J., *404.
Barry, J. G. *1294.
Barstow, Ralph, 903.
Bastian, A. J., 754.
Batteries, flashlight. By Eugene H. Mathews (D), 1037.
Batteries, oxide-of-copper, that can be regenerated. By M. Leblanc Fils (D), 966.
Batteries, storage:
——Charging method, fixed-resistor, receiving more attention. By F. L. Spangler and A. J. Horton, 282.
——Common metals and acids cause little injury to, 1177.
——Control battery in series with station main lighting system, 636.
——Electrolytes, resistance of, at high frequencies. By John J. Dowling and Katherine M. Preston (D), *794.
——Lead-hydrate (D), 1084, comment, 1058.
——Overhauling. By Chester Schenck (D), 543.
——Progress. By H. Beckmann (D), 693.
Battery, Paul L., 754.
Bearings:
——Babbitt pouring, definite temperature control necessary in. By Karl F. Smith, 886.
——Ball, for electrical machinery. By H. A. Allen (D), 393.
——Metal, new. By F. Schneider (D), 743.
——Rebabbitting. By M. M. Brown, 434.
——Ring lubricated, should not be neglected, 1076.
Beavers, Frank J., 853.
Bechtel, S. B., 653.
Becker, Joseph H., 103.
Bell, E. D., *1142.
Bell with built-in transformer, door-. By M. Kerbaker (D), *1183.
Bellinger, W. F., 753.
Bender, Major Louis B., *252.
Benn, Sir John W., Bart., 903.
Bent, Irving J., 976.
Bickel, W. T., 1047.
Birch, W. A., 704.
Blake, Edward, Jr., 903.
Blakeslee, D. W., 403.
Blaschke, F. L., 1143.
Bliven, Harry W., *1047.
Board, V. L., *553.
Bodler, S. F., 903.
Boiler room:
——Ash handling in large generating stations. By L. R. Lee (D), 343.
——Boiler and furnace economy. By D. S. Jacobus (D), 47.
——Carbon-dioxide recording instrument, electric. By M. Moeller (D), *293.
——Condenser circulating-water pipe repaired with concrete. By J. W. Andree, *1174.
——Condenser tubes, cracking in. By H. Moore and S. Beckinsale (D), 1038.
——Instruments and control, centralization of, an aid to greater economy, 990.
——Iron and steel plants, efficient burning of fuel and use of waste gases in. By W. W. Pettibone (D), 742.
——Methods that help increase operating efficiency, *786.
——Tests on steam equipment, preparation necessary for. By Frank H. Broome, 236, comment by J. J. Storrow, Jr., 964.
Boilers:
——Air, excess, causes serious losses in boiler plant. By W. E. Thomson, *887.
——Load-dispatching system for working correct number of. By Charles E. Hague, *88.
——Oil-fired, determining heat content of gases from. By N. G. Hardy, *137.
——Power-station design, developments in (D), 542.
——Running, at proper ratings cuts operating costs, *587.
——Scale and corrosion, electrolytic protection of steam boilers, against. By Prof. W. Philippi (D), 47.
——Steam operation, expectation of efficiency of. By H. R. Carr (D), 1283.
——Very high steam-pressure plants, economies of. By Wilhelm Schmidt (D), 542.
——Water going into steam lines, proper care prevents. By W. E. Thomson, *1224.
——Water purification for boiler feed. By F. J. Crolius (D), 1182.
Book reviews:
——Aldred, J. E., lectures on engineering practice, 1920-21, p. 294.
——America's power resources. By Chester G. Gilbert and Joseph E. Pogue, 1185.
——Atom, within the. By John Mills, 694.
——Code at a glance, the. By Hubert S. Wynkoop, 94.
——Costruzioni Elettromeccaniche. By Prof. Ettore Morelli, 694.
——Elektrische Fördermaschinen. By Prof. W. Philippi, 1185.
——Furnace, the electric. By J. N. Pring, 494.
——Grimsehl's Textbook on Physics, 494.
——In one man's life. Theodore N. Vail, 294.
——La Théorie et la pratique des Radiocommunications, Vol. II. By Leon Bouthillon, 294.
——Practical electrical engineering—divert currents. By Harry G. Cisin, 1185.
——Protective relays. By Victor H. Todd, 1185.
——Radio questions and answers on government examination for radio operator's license. By Arthur N. Nilson, 294.
——Radiotelegraphisches praktikum. By Dr. Ing. H. Rein, 94.
——Silvanus Phillips Thompson: His life and letters. By J. S. Thompson and H. G. Thompson, 494.
——Switching equipment for power control. By Stephen Q. Hayes, 694.
——Tecnica degli impianti elettrici per luce e forza. By Emilio Piazzoli, 1185.
——Testing of electrical machinery. By J. H Morecroft and F. W. Hehre, 494.
——Turbine, die saugstrahl. By Dr. Hans Baudisch, 694.
——Water powers of Georgia, third report on. By B. M. Hall and M. R. Hall, 94.
——Westinghouse, a life of George, *228.
——Winning the public. By S. M. Kennedy, 94.
Boston:
——Edison Electric Illuminating Co.:
  Business boom for Boston electrical family, *438.
  Businss boom, extension of, *590.
  Preparing employees to meet unfair criticism of their company, 538.
  Rate, establishes prewar, 348.
  Refilled lamps unacceptable to, 399.
  System operation on a higher plane, putting. By William H. Atkins, *1219, comment, 1208.
——Industrial lighting exhibit "sells" $75,000 in equipment, 600.

*Indicates illustrated articles

Boston (Cont.):
——Municipal lighting plant order vetoed, 295.
Bournonville, Antoine, 1143.
Bowser, F. S., 604.
Boyle, John C., 902.
Bozell, H. V., 1293.
Bradley, Ernest, 754.
Braun, David J., 104.
Braymer, D. H., 1293.
Brazil, electric iron and steel plant for. By N. A. V. Paulsson (D), 48.
Brinkerhoff, H. A., 104.
Brisbane, Robert, 854.
Brooks, Judds J., Jr., 453.
Brown, A. A., 1294.
Brown, J. H., 1194.
Brown, Roy M., 204.
Brown, W. E., 1093.
Brown, W. J., 902.
Brownell, F. W., 1142.
Bryant, Waldo Calvin, *716.
Brushes:
——Fit, insuring an exact. By Edward A. Gibbs, 785.
——Voltmeter, locating proper brush position with a. By Edward A. Gibbs, 534.
Budd, H. C., 804.
Building, industrial states will lead in, 95.
Bullivant, F. J., 753.
Bullock, Peter H., 902.
Bunker, F. L., 804.
Burnham, Roy R., 1046.
Burrell, H. D., 1244.
Bus, double, improved design of heavy-duty 6,600-volt. By W. R. McCann, *1275.
Buses, current distribution in multi-conductor, single-phase. By C. F .Wagner, *526, comment, 519.
Business (see Trade and Market Conditions and Manufacturing and Distributing).
Business conditions, "Electrical World barometer" of, *1215.
Business conditions in the electrical industry on the upgrade. By R. M. Davis, *939.
Business development—What it means to the central station. By Earl E. Whitehorne, *921.
Byllesby to increase capacity 32 per cent, 1041.

C

Cables (see also Conductors and Wire):
——Bolt eye and wiped joint facilitate pulling of. By A. A. Barbera, *634.
——Conductivity of soils, effects of moisture on the thermal. By G. B. Shanklin, *383, (D), 594.
——Electroscope, balanced-crane, as means of detecting high tension potential on underground. By W. J. McIlvane (D), 243.
——High voltage, maximum rating of. By M. Höchstädter (D), 966.
——Insects attack cables in Canal Zone, how. By A. R. Lane, *134.
——Kenotron should prove attractive for testing high-voltage cable if shortcomings are eliminated, *1060.
——Lead-covered, corrosion of, by oak. By P. Dunsheath (D), 1284.
——Lead-covered 600,000 circ.mil, span suspended by messenger. By W. R. Gibson, *288.
——Lugs sweated in vertical position, *239.
——Mines, trend toward standardization of trailing cables for, 239.
——Park, laid across marshland in shallow trench at low cost. By F. A. Westbrook, *1174.
——Protection, Ferranti system of automatic. By P. Testard (D), 794.
——Skin effect, Bessel function for calculating. By H. B. Dwight, *964.
——Skin effect in large stranded (editorial), 469, comment by H. B. Dwight, *964.
——Submarine, duplex balancing of long. By E. S. Heurtley (D), 343.
——Submarine, laid across river by steam winch. By F. A. Westbrook, *634.
——Submarine, laying of high-tension. By L. Kunst (D), 643.
——Three-conductor, save space in substation, *1224.
——Voltage stress in, echo from Europe on maximum (editorial), 218.
——Underground, system of locating faults in. By Luigo Selmo (D), 193.
Calder, C. E., *153.
Calhoun, Ernest N., 804.
California:
——Los Angeles distribution system, purchase of, completed by city, 446.
——Los Angeles-Southern California Edison contract consummated, 1085.
——Pole lines, safety standard of, 1090.
——Power act, proposed:
  Analysis of, 280, comment, 269.
  Menace to industry, says banker, 444.
  Power and irrigation interests clash, 448.
  War in earnest over, *499.
  Politicians organize to push, 547.
  State ownership probabilities, 848.
  Pacific coast jobbers discuss, 971.
  Pacific Coast Section considers menace of, 1136.
  Bankers condemn, 1235.
——San Francisco:
  Great Western to buy out Spreckels block power company, 549.
  Hetch Hetchy power units, awards contracts for, 971.
——San Joaquin Light & Power obtains license for 266,000 hp. development, 799.
——Southern California Edison Co.:
  Customer ownership growth, 638.
  Equipment contracts for $3,500,000 let, 549.
California (Cont.):
  Natural-gas generation cheaper than fuel oil in southern California, 299.
  Termites invade California and destroy poles, crossarms and pins. By R. E. Cunningham, *603, comment by B. A. Behrend, 1173.
  To spend $22,500,000 this year, 295, comment, 319.
——220-kv. transmission lines in, development of. By A. W. Copley (D), 1132.
Campbell, Reginald M., *504, 704.
Campbell, W. H., 854.
Campe, H. A., *253.
Canada:
——Canadian Electrical Association's annual convention, program, 1191, report, 1239, new officers, 1286.
——Chippawa project, royal commission appointed to investigate, 795.
——Chippawa-Queenston hydro-electric plant of Hydro-Electric Power Commission of Ontario, *1260, comment, 1258.
——Export of Canadian power, would stop, 896.
——Hydro-electric progress in (D), 844, during 1921, p. 876.
——Ontario Hydro-Electric Commission:
  Bad faith by, charged, 495.
  Drury government to investigate, 596.
  Beck denounces attacks on, 746.
——Ontario hydro-electric system investigated by W. S. Murray, *471, comment, 467.
——Ontario Power Company's units, accidents cripple 159,000 hp. of, *895, comment, 867.
——Ottawa River, large development planned on, 397.
——Water powers of British Columbia (D), 142.
——Water-power resources. By J. T. Johnston (D), 1284.
——Winnipeg City's hydro-electric system. By E. V. Caton (D), 1283.
Canning, William J., *453.
Cansfield, Charles E., 1046.
Carle, Nathaniel A., *353.
Carlson, Iner, 975.
Carmichael, Joe., *153.
Carolina Power & Light Company capacity, plans being made to increase, 499, contracts for 20,000 kw. of energy, 696.
Carpenter, W. M., 1142.
Carraway, J. Leake, 504.
Carty, John J., 652, 1293.
Case, S. L., 754.
Central station commercial practice (see Commercial).
Central station output and revenue (see Statistics).
Central stations (see Generating stations).
Chamber of Commerce of the U. S., convention, tenth annual, 894.
Chart:
——Cabinet for records, revolving. By E. H. Perry, 387.
——Organization, that correlates work. By R. A. Hammack, 238, correction, 584.
Chase, Frank E., *403.
Chicago:
——Commonwealth Edison Co.:
  Billboards to boost electric vehicles, *91.
  Calumet plant, first unit started, on 49, two new units for, 798, to reinforce industrial section of Chicago, *1110, comment, 1108.
  Distribution of energy, 746.
  Stock, planning increase in authorized capital, 297.
  Stockholders' meeting, more than 1,500 attend, 497.
——Fire wipes out stocks of four electrical distributors, 547.
Circuit breakers:
——Oil qualities desirable for. By C. J. Rodman, *1271, comment, 1257.
——Oil, remarks on rupturing speed of. By G. Longue (D), 1037.
——Reactor type, deserve investigation (editorial), 1158.
——Reduce maintenance when replacing fuses, new. By Joseph Suerth, *484.
Clark, William Jared, 652, *666.
Clarke, Alfred, 903.
Clarke, E. W. C., 652.
Clarke, William C., *303.
Cliff, E .Parley, 1195.
Clifford, Oscar, 1093.
Coal (see also Fuel):
——Bituminous output increases, 1135.
——Buyer, is the coal, never to have peace? (editorial), 567.
——Chamber of Commerce to bring coal producer and consumer together, 967.
——Congressional powers in regulating coal mining, supreme court defines, 1235.
——Crisis, Hoover forsees, 195.
——Electric utilities have built up coal reserves, 295.
——Electric utilities reserve increased, 645.
——Fires and how to prevent them, pile. By J. E. Williams, *1127.
——Freight rates on coal, lower, believed certain, 547.
——Government interference, against. By W. F. Fickle, 283.
——Keep bins well stocked (editorial), 867.
——No danger of general shortage for six weeks, 896.
——Price conference, Hoover calls, 1088.
——Prices, Secretary Hoover's efforts to keep, down bear fruit, 1187.
——Reserve stocks shrinking toward "danger mark," 1288.
——Situation, let us have the whole truth on the (editorial), 617.
——Situation, no alarm over (editorial), 767.
——Strike, Hoover takes hand in, 1043.
——Strike on April 1, less danger of, seen, 345.
——Superpower plants justify themselves in coal emergency, 645.
Coal (see also Fuel) (Cont.):
——Wage conference by operators and miners, Harding demands, 495.
——Wage cuts, annoucemets of April 1, 245.
Code (see Natioal Electrical Code).
Coale, S. P., 1195.
Coils:
——Choke, turning of. By F. Moether (D), II, 1083.
——Distributed capacity between inductance, and the ground, some effects of. By Gregory Breit (D), 243.
——High-frequency inductance, resistance of. By Gregory Breit (D), 693.
——Petersen earth. By R. N. Conwell and R. D. Evans, *377, (D), 492.
Cole, A. B., *104.
Collier, Charles A., *252.
Collier, W. Rawson, *252.
Colorado River (see under Hydroelectric development).
Columbus, Ga., consolidation of public utilities, 1086.
Commercial activities, central station:
——Appliance factories, central-station executives should visit. By Cyrus Barnes, *789.
——Appliance selling, house-to-house. By O. R. Hogue, *1128.
——Appliance sellings will be intensified and increased in 1922, p. 33.
——Boston electrical family, business boom for, *438.
——Central-station company as merchandiser is an asset to the industry, *240.
——Central stations should be pacemakers in electrical merchandising. By F. M. Houston, 539.
——Day-service standards in the small community, maintaining, 438.
——Get ready for the fishing now (editorial), 567.
——Hartford Company's facilities for service make New Gear window display, *191.
——Hartford, more co-operative window displays at, *639.
——Heat control, efficiency of electric, makes industrial window display, *1129.
——House-wiring campaign, the story of the Cleveland. By S. D. Heed, 1068.
——House-wiring campaigns in many cities, planning, 35.
——Illinois, comprehensive commercial policy brings results in, 1280.
——Lighting opportunity for electrical dealers, *1229.
——Lumber plant, by-products saved in, pay power fills and show a profit. By H. W. Derry, 241.
——Meters, Baltimore system of leaving, alive. By R. N. Bonsall, *178.
——Open the central-station doors wider to new business. By William Gould, 960.
——Percolators; an experience in coffee and wafers, *90.
——Policy, two views of central-station, 90.
——Power business, a program for obtaining more. By George H. Jones, *638.
——Power, prospects for more, considered very promising, 33.
——Radio fans, central-station company installs wireless aerials for, 1228.
——Rate decrease makes graphic window display, a, *1080.
——Rural business, new interest and activity apparent in, 290.
——Salesmen, a tonic for fair weather, 738.
——Selective selling and salesmen's compensation (editorial), 917.
——Signs, store-door demonstration of electric, *192.
——Street-lighting, some brand new arguments for better, *140.
——Vancouver, B. C., has 85 per cent of houses wired for electric service, 1280.
——Warships use central-station service in San Diego. By P. P. Pine, *390.
Commission regulation and rulings (see also Rates):
——Abandonment of unprofitable territory with commission's consent forbidden, 702.
Commission:
——Advertising, public utility, indorsed, 1242.
——Bacharach bill to limit jurisdiction of federal courts over commission decisions, 395, 695, 795, 847, 1089, 1238, comment, 767.
——California Commission has a backbone (editorial), 368.
——California commission replies to criticism by Governor Stephens, 396.
——California commission's valuation dicta, 1141.
——California muncipalities under regulation, move to place, 195.
——California utilities to finish rebuilding overhead systems, 299.
——Capitalization and depreciation reserve, 1292.
——Charges on extraordinary extensions cannot be imposed on domestic consumers, 602.
——Combined electric plant and lumber mill, rules governing, 901.
——Commissioner may publicly criticize company without forfeiting right to sit at hearing, 1193.
——Commissions, public service, have come to stay (editorial), 1157.
——Companies must present complete rate case, 702.
——Cost of electricity, production, 901.
——Cost of selling securities, 802.
——Cost of service, equalizing, 702.
——Deposits for extensions should be refunded in all save extraordinary cases, 352.
——Depreciation reserve and business conditions, 302.
——Depreciation reserve in its relation to continuous efficient service, 102.
——Determination of connected power load, 802.
——Duty to utilities, commission's, 451.
——Extensions of service, reasonable, 102.

*Indicates illustrated articles

Commission (Cont.):
——Extension of lines, 602.
——Extensions to real estate tracts, 1242.
——Fair return during business depression, 1092.
——Fees and salaries for small company, extravagant, 251.
——Free municipal service, off-peak service and discrimination, 602.
——Funded debt, ordered to reduce, to improve financial condition, 898.
——"Going value" reflected in purchase price cannot be allowed, 1242.
——Guy wrongly placed on its pole, company held liable for, 300.
——Ice department to electric power company, relation of, 402.
——Illinois commission holds hearings on rural service rules, 1238.
——Inadequate service, public service commission may penalize, 595.
——Indiana public service commission, abolition of, threatened, 1136.
——Interconnected power lines and effect on utility regulation, evolution of. By M. H. Aylesworth, 325, comment, 318.
——Invasion of territory authorized where established company had refused service, 251.
——Investment cost as basis for valuation condemned, 752.
——Lighting ranked above power service, 202.
——Los Angeles protests against state regulation, 548.
——Malden case, service charge approved in, 894.
——Massachusetts commission disapproves capitalization of premiums, 244.
——Massachusetts commission on service charge, 1242.
——Massachusetts, service charge permitted in, 1045.
——Merchandise and jobbing business and central-station expenses, 1045.
——Meters, letting customers pay for, with refund in installments, 202.
——Money expended from earnings for additions and betterments excluded from valuation, 1092.
——Motion-picture theaters, price of energy to, 602.
——Municipal power line, permission for construction of, refused, 974.
——Nebraska commission's powers, 552.
——New York Commission says utilities may not recover losses from customers, 1090.
——Oregon, public service commissioners of, recalled, 1235.
——Overbuilt plant, return on, 901.
——Payment, penalty for slow, 152.
——Pole erected in street not part of line extension, 402.
——Portland, Me., stock dividends allowed at, 974.
——Protest against a commission's decision, a public, *398.
——Rate confusion would exist if Indiana commission were abolished, says McCardle, 495.
——Rebate to irrigation customers, apportioning, 352.
——Renewals and replacements, faulty method of calculating cost of, 302.
——Returns, eight per cent not a uniform standard of proper utility returns, 901.
——Rural lines donated by consumers excluded from rate base, 402.
——Rural service, differentials in, 202.
——Secondary demand for mine hoisting, 102.
——Service charge authorized in Massachusetts, 1141.
——Service charge and the public, 1141.
——Service extension, rates of capital expenditure to revenue in, 702.
——Service extensions on customer's demand, 752.
——Service must not be abandoned, 702.
——Stock, apportionment of capital, 302.
——Surcharge, abolition of, 651.
——Surcharge continued, 502.
——Taxes, federal income and excess-profits, in relation to operating expenses, 651.
——Transmission line extension and fair return, 202.
——Twenty-four-hour service, should, be supplied in small communities?, 402.
——Unremunerative branch of utility must not be recouped by paying branch, 852.
——Utah commission forbids discrimination, 901.
——Utah, municipal operation in, 602.
——Valuation during period of fluctuating costs, 251.
——Waste caused by competition, 202.
Commissioners, railway and utilities, champion fair rates, 39.
Commutators (see Motors).
Concrete:
——Effect of moisture content upon the expansion and contraction of plain and reinforced. By Torata Matsumoto (D), 543.
——Reinforced, in power station construction (D), 1038.
Condensers:
——Discharge through an air gap, phenomena of. By Charles P. Steinmetz, 382.
——Static for power-factor improvement. By M. Misserey (D), 1232.
——Static, table for correcting power factors of motors. By J. L. Merrill, 637.
Conductors:
——Armature, heat losses in stranded. By Waldo V. Lyon (D), 142, 382.
——Size of, method of obtaining most economical. By D. W. Blakeslee, *1124.
——Skin and proximity effect in tubular. By Herbert B. Dwight, 383.
——Steel, effect of cross-section on impedance of. By L. S. Loomie, *884.
Conduit:
——Cement covering used to protect, in coal bunker. By M. M. Brown, 336.
——Embankment, forced through, by air drill, *237.
Contractors (see National Association of Electrical Contractors and Dealers).
Control, motor (see Motor control).
Converters:
——Rotary, peculiar behavior of. By E. E. Channing, 289, 837.
——Synchronous, causes of flushing of. By E. B. Shand, *381.
Cooking, electric (see Heating, electric).
Cooper, H. S., 503.
Corona:
——Amplifier and loud-speaking telephone for studying, formation. By J. B. Whitehead and N. Inouye, *382.
——Wave form and amplification of, discharge. By J. B. Whitehead and N. Inouye (D), 394.
Costs:
——Central-station equipment, 1227.
——Distribution material, recent unit costs of central-station, 1126.
——Power, how to follow up. By N. A. Craigue (D), 293.
——Transmission line, 33,000-volt, cost is $1,757 per mile. By C. W. Otis, 1277.
Court decisions (see also Rates):
——Agreement under workmen's compensation act cannot be collaterally attacked, 1141.
——Arizona corporation commission's powers, 53.
——Arizona statue regulating transmission lines invalid, 502.
——Armstrong radio feed-back circuit upheld, 648.
——Assumption of risk, 451.
——Burden of proof falls, where, 352.
——California Railroad Commission's powers, 1092.
——Child labor law found unconstitutional by Supreme Court, 1134.
——Claim that power company furnishing steam is not a public utility as regards the latter service untenable, 1242.
——Coal mining, supreme court defines congressional powers in regulating, 1235.
——Commissions bound by definitions in statutes creating them, 702.
——Commission's course found to constitute a denial of due process of law, 552.
——Commission order validity, where commissioners were succeeded by others after testimony and before order, 802.
——Commission upheld in basing valuation on company's books, 1045.
——Commission's power over equipment in public streets, 102.
——Company's only duty to license on its property is to refrain from wilfully injuring him, 302.
——Company's responsibility for accident due to proximity of decayed tree to transmission line, 552.
——Confiscation, United States Supreme Court again rules on, 1292.
——Contract, compliance with, cannot be compelled after company, acting within its terms, has caused its abrogation, 352.
——Contract entered into by electric plant prior to its dedication to public service not void, 651.
——Contract made by power company to furnish energy to city plant may be upset by commission, 1092.
——Contract right to construct tunnel under land of another not lost by Laches, 302.
——Contracts between public service corporations which involve obligations to public are subject to commission's control, 1092.
——Contributory negligence a question of law when there is no dispute about facts, 1292.
——Contributory negligence for the jury, 451.
——Contributory negligence, issue of, wrongly taken out of hands of jury, 352.
——Contributory negligence of lineman bars recovery for death, 302.
——Cost, increase in, due to war, should be considered in fixing value, 352.
——Court not bound by conclusion of commission on disputed evidence, 752.
——Courts should be slow to interfere with discretion of commission, 802.
——Dam, reciprocal rights in maintenance of, denied, 974.
——Damage from wire owned by another, liability of company for, 1141.
——Damage suit, when court may dismiss, upon demurrer, 152.
——Damage suits, permissible instructions in, 1193.
——Damages against two companies jointly, in action for, details of company agreement need not be proved, 802.
——Damages allowed against electric companies for destruction of grain, 802.
——Damage caused by grant of right of way, measure of, 202.
——Damages for failure to serve, law governing, 852.
——Danger from electric wires when their presence was not shown erroneous, instruction to jury concerning, 1045.
——Death from electricity transmitted for household lighting puts burden on company to prove itself not negligent, 1141.
——Debts, commission lacks jurisdiction to compel public utility to pay, 802.
——Deprivation of reasonable returns is confiscation, 402.
——Discontinuance of service for refusal to pay bills sustained, 974.
——Electricity personal property, 451.
Court Dicisions (see also Rates) (Cont.):
——Employee sustaining compensable injury entitled to sue wrongdoer, 901.
——Enforcement of contract with municipality cannot be interrupted by claim that it will bankrupt utility, 1193.
——Extensions, commission may compel utility to make, 451.
——Franchise to dam stream, compensation due holder of, when rights are appropriated by state, 402.
——Free service, municipality cannot compel, 502.
——Georgia valuation questions, supreme court asked to pass on, 644.
——"Going concern" value, supreme court on, 852.
——Going value, confusing decision on (editorial), 867.
——Good will and earning power often worth more than tangible property, 974.
——Grain, damages allowed against electric companies for destruction of, 251.
——Income tax, federal, must not be included in operating expenses, 451.
——Income tax in operating expenses, United States Supreme Court on including federal, 974.
——Indiana commission's powers, 802.
——Indiana law, findings of fact made by commission not conclusive under, 451.
——Injury "arising out of and in course of employment," what constitutes an, 752.
——Injury caused by horseplay of fellow laborers does not arise out of employment, 202.
——"Insulated properly," unusual definition of, 602.
——Insulator case, suspension-, Ohio Brass gets final decision in, 149.
——Kansas Industrial Court, constitutionality of, again affirmed, 152.
——Lamp patents, appellate court again upholds General Electric, 750.
——Lamp patent case, stay of injunction asked in Langmuir, 800.
——Lamp patent case, stay of injunction in Langmuir, denied, 850.
——Liability of electric service company for death from shock when wire was not installed by it, 651.
——Light on bridge built by railroad but maintained by municipality, city must provide, 974.
——Linemen, duty of utmost protection to, 251.
——Los Angeles contract with central-station companies sustained, 1045.
——Meter charge not subject to penalty or discriminatory, 251.
——Michigan commission's powers, 602.
——Municipal powers under Ohio law, 152.
——Neglect constituted by high-tension wires with worn insulation 20 ft. above street, 852.
——Negligence. (See also contributory negligence.)
——Negligence established where absence of guy wire allows pole to sag, 852.
——Negligence presumed in case where telephone exchange caught fire from power-transmission wires, 901.
——Negligence, principle of comparative, and apportionment of damages, 202.
——Negligence, sample of wire admissible to show, 402.
——New Jersey supreme court can set aside commission order as "unjust and unreasonable," 302.
——New Orleans commission council held to be rate-making body, 648.
——New York court of appeals sustains the legality of service charge, 500.
——New York gas laws confiscatory, declares United States Supreme Court, 552.
——New York Public Service Commission law interpreted by state's highest court, 352.
——New York State 80-cent gas law, supreme court gives final blow to, 1092.
——New York Transit Commission not an unconstitutional body, 202.
——North Carolina Company, federal court sustains, against Southern Power Company, 1088.
——Obligation to serve competitor, 1193, comment, 1157.
——Ohio, jail sentence and fine for theft of current in, 649.
——Ohio, powers of commission and of municipalities in, 702.
——Party participating in inquiry cannot complain of lack of notice, 702.
——Pennsylvania commission, Supreme Court of United States upholds, 702.
——Pole, when shying mules demolish, the mules, not the pole, are proximate cause of injury, 302.
——Public utility, what constitutes a, 451.
——Punitive damages, when they may be allowed, 802.
——Readiness-to-serve charge, utility operating under ordinance fixing minimum charge cannot make additional, 752.
——Reasonable rate of return-division of towns into two groups authorized, 651.
——Refund because of inefficient service, commission may order, 901.
——Right-of-way, assessing damages caused by, 102.
——Right-of-way, implied promise to pay for, where written agreement is lacking, 152.
——Service at a loss and proper measure of inability to pay, 53.
——Service charge is not sent, why a, 1292.
——Service charge, the theory of a, 552.
——Service deposit must be asked from all customers alike, 1242.
——Sliding scale, what constitutes a?, 352.

*Indicates illustrated articles

Court Decisions (see also Rates) (Cont.):
——Southern Power and North Carolina Public Service companies, order continued in dispute between, 152.
——Telephone line owner not liable for injury caused by felling tree, 53.
——Taxpayer and customer not allowed to intervene in suit between city and utility, 1045.
——Texas commission, status of, 402.
——Tree, use of, to fasten guy wire does not impose duty to keep tree safe, 302.
——Waiver of valuation proceedings no ground for reversing commission's order, 802.
——Watercourses, vested rights in, 251.
——Water-power contract held to permit abrogation by either party when supply proved unsatisfactory, 152.
——Water power claims, supreme court, wiping out state lines in, sets up priority, 1236.
——West Virginia commission's powers, 752.
——Whether excess charges were paid under duress a question for jury, 1242.
Cox, Frank P., *976.
Craft, Edward B., *703.
Cranes:
——Apparatus for, selection of electrical. By R. H. McLain (D), 892.
——Controllers. By J. F. Schnabel (D), 1183.
——Telephone system, electric, at Plymouth Gas Works. By H. Blyth (D), 194.
——Three-phase, new control of lowering speed on. By C. Ritz (D), 194.
——Traveling, with single-phase brush-shifting motors. By E. Altschul (D), 742.
Creed, E. E., 404.
Crimmin, E. V., 1142.
Crites, O. E., 1094.
Crosby, Warren William, 563.
Cross, H. W., 204.
Cross, J. D. A., *704.
Crossan, Thomas E., 902.
Crowell, Arthur H., 903.
Cudebec, Albert B., 754.
Culver, Charles A., *553.
Cunningham, Noel, 704.
Cunnington, H. M., 1195.
Customer ownership:
——Benefit of, anecdote of the, 689.
——Central Maine Power Company's preferred stock, repeat orders for, 590.
——Dividends, inducing customer-owner to reinvest them, 141.
——Insull managers discuss problems, 300.
——Maintaining marketability on customer-owned securities, *955.
——Stock campaigns, how to put on a. By Percy H. Whiting, *779, comment, 769.
——Stock, local selling of holding company. By H. E. Weeks, *521.
——Stock salesmen, Central Maine Company's "ten points" for employee, 839.
Çzechoslovak Republic's plans for electrification, *677.

D

Dana, Robert Knight, 304.
Darling, Nelson J., *1047.
Davies, William W., 404.
Davis, Harry Phillips, *416.
Dayton Power & Light $4,750,000 expansion program under way, 799.
Dekle, T. I., 54.
Department of Commerce: what it is doing for industry. By F. M. Feiker, 71; Comment, 67.
Detroit Edison Company:
——Connors Creek plant, heat balance of. By C. H. Berry and F. E. Moreton, *242.
——Connors Creek production expense, comparison of, *635.
——Gains shows, 197; Comment, 197.
Diesel engines (See Engines, Diesel.)
Discharge, certain types of electric. By D. H. Mallick and A. B. Das (D), 243.
Dickinson, Leonard T., *54.
Distribution:
——Construction for circuits, economical, *86.
——Costs of central station distribution material, recent unit, 1126.
——Extensions, unit costs for estimating line. By D. C. Hopper, 188.
——Loose-leaf prints of curcuits help distribution force, *686.
——Pilot circuits. By Allain Launay (D), 965.
——Rural load fed by 6,600-volt line, characteristics of, *835.
——Rural lines, considerations for the construction of, 1276.
——Secondary construction of proved value. By L. C. Peterman, *1167, Comment, 1159.
——Suburban, rear-line circuits as a solution of. By Louis Bell, 633.
——Three-phase, four-wire, why the hesitancy in adopting (editorial), 818.
——Underground networks being equipped with manhole circuit breakers, *370.
——West Penn Power Company, Connellsville, Pa.; economical increase of distribution system rating, *961, comment, 918.
Downing, Paul M., 853.
Dubois, J. Frank, *353.
Duncan, A. S., 754.
Dunbar, F. E., 1195.
DuRieu, E. F., 1094.
Dwellings in the U. S., a survey of rural and urban, *688.
Dynamos (See generators.)

E

Eagle, C. C., Jr., 1143.
Eardley, Edward H., 453.
Eberhard, O. I., 354.
Edison, Thomas A., 1293.
Edison Illuminating Cos. (See Association of —)
Editorial Comments:
——Are we content with this? 265.
——Arms conference and the Senate, the, 267.
——A source of help that should not be ignored, 1059.
——Bigger men or a bigger job?, 1207.
——Bonus, business and the, 315.
——Bonus, real problem of ex-service man, 517.
——"Club life in business," promoting, 818.
——Coal menace, the never-ending, 117.
——Competition has no place in the electric light and power business, 1157.
——Co-operation by classes among electrical men, 317.
——Co-ordination essential in engineering and sales department work, 219.
——Costs of service must be known, classified, 317.
——Dates, Another case of mixing, 667.
——Debt to pure scientists should be recognized, 518.
——Dignified appeal to public opinion, 667.
——Election engineering, great achievements expected in, 119.
——Engineer, the mission of the, 467.
——Engineering reports, financier pleads for unbiased (editorial), 819.
——Engineers worship idols too often, 417, comment by F. G. Baum, 584.
——Erroneous information from official sources, 817.
——Farmer, industry must consider the, 217.
——Ford, Henry, teaches a much-needed lesson, 267.
——Fuel quality, burning tests to determine, 118.
——Government control means higher taxes, 1257.
——Governments' incompetence in business affairs, 617.
——Heating, more accurate knowledge of industrial electric, vitally important, 119.
——Information given means money gained, when, 167.
——"Interests, the," who are?, 1205.
——Lighting code deserves general adoption, 117.
——Meeting dates, clearing house for, is needed, 367.
——Municipal power, public education needed on the source of, 418.
——Questionnaires, conclusions from, must be drawn with caution, 418.
——"Old men for counsel," 465.
——Our cliques in corners, 665.
——Prosperity again with us, 1057.
——Residence district, reclaiming the abandoned, 819.
——Revival of the industry during the new year, 3.
——Secrecy, the curse of, 715.
——Ships, our waiting, 615.
——System analysis and adequate maintenance essential to proper protection, 1208.
——The new year one of opportunity for the manufacturer, 5.
——The voice of that small group, 1057.
——This day of promise, 1.
——Trends in our trade and the laws which bring them, 4.
——Underwriters' service: inspection or obstruction?, 415.
——Utility ownership: the invested interest will not be forgotten, 118.
——What does it cost to wait?, 65.
——What kind of business?, 865.
——Why crack nuts with a trip hammer?, 768.
——Yourself-applied as Capital, 719.
Education:
——Economies, study of, urged in engineering colleges, 969.
——Electrical industry, quick success must not be expected in. By Louis Bell, 483.
——Electrical students, registration of new, materially decreased, *275, comment, 268.
——Engineering courses and our secondary schools (editorial), 1107.
——Engineering education—Can it include business education? (editorial), 988.
——Engineering enrolment in harmony with economic conditions. By Herbert A. Wagner, 583.
——Engineering students, college deans favor five-year course for, 1138.
——Engineering students, preparing, for the industry. By H. A. Calderwood, 1074.
——Heating, industrial, two more courses begin April 24, *750.
——Johns Hopkins lectures upon engineering practice, annual, 500.
——Meter course at Yale, to give short, 550.
——Meter course, Yale University's, has public policy slant, 970.
——Metermen, school for electric. By C. Francis Harding, 134.
——Metermen's course at Florida University, 599.
——Registration in electrical engineering college: no ground for fear. By J. B. Whitehead, 483.
——S. P. E. E., better teaching the slogan at convention of, 1137, champions engineering leadership in production, 1288.
——Tufts College has wireless college faculty, *1290.
Edwards, F. W., 1195.
Eitzen, Louis C., *504.
Electric Hoist Manufacturers' Association makes extensive studies, 39.
Electric Power Club:
——Annual meeting, progress made at, 1189.
——City ordinance, helps to defeat bad, 38.
——Russell, R. J., elected president of, 1236.
——Transformer ratings, preferred standards of, 1236.
Electrical dealers, Portland (Ore.), may regulate its retail, 53.
Electrical engineering progress and development, (D), 1084.
Electrical equipment, achievements in. By Allen M. Perry, *12.
Electrical industry during 1921, some developments in. By John Liston (D), 493.
Electrical Manufacturers' Council reorganizes and broadens its scope, 245.
Electrical Safety Conference keeps active, 39.
Electrical Supply Jobbers' Association:
——Convention, report of, 1137.
——Pacific Coast Division meeting, large and optimistic attendance at, 299.
——Statistics, compile, 39.
Electrode materials, length-voltage-current-pressure characteristics of normal arcs for different. By W. N. Eddy (D), 966.
Electrodeposition of metals. By W. E. Hughes (D), 48.
Electrolysis research under way in the South. By H. S. Warren, 784.
Electrolytes, conductivity of copper-refining. By E. F. Kern and M. Y. Chang (D), 1284.
Electrolytic:
——Iron, a commercial product. By Bradley Stoughton (D), *343.
——Iron, manufacture of. By G. F. McMahon (D), 1184.
——Magnesium, production of metallic. By S. T. Allen (D), 493.
——Reduction, roasting zinc ores for. By Thomas French (D), 543.
——Silver-reclaiming plants, small. By G. Eger (D), 493.
Electronic construction of matter. By. W. R. Whitney (D), 93.
Emmet, H. L. R., *854.
Emory, D. F., 703.
Employee relations (See Labor.)
Elevators, passenger and freight, electric power application to. By Harrison P. Reed (D), 543.
Engine, combustion, compounding the. By Elmer A. Sperry (D), 293.
Engine generating plants, comparison of five diesel-, 1225.
Engines, diesel, operate for year at cost of $0.0139 a kilowatt-hour, 637.
Engineering problems, some economic, to think about. By Louis R. Lee, 957, comment, 918.
Engineers:
——Baltimore engineers oppose legislation to license profession, 146.
——Human-relations problem, the engineer and the (editorial), 769.
——With commercial or executive ability, demand for. By G. H. Stickney, 533.
Ernsberger, Earl R., *603.
European practices tend toward greater economy. By A. Dyckerhoff, *421, comment, 469.
Excitation troubles, operating instructions for handling, 487.
Exports (See Trade, foreign.)

F

Faccioli, Giuseppe, 1244.
Fairweather, James., 154.
Fans (see Trade and market conditions)
Farm-lighting plants, electric (D), 1283.
Farm service (see Rural electric service.)
Farm system, the "Estrade." By A. Delamarre (D), 743.
Federal Power Commission:
——Alaska and Iowa projects seek permit, 146.
——Applications for preliminary permits, 297.
——Applications total 20,473,548 hp., water power, *1072.
——Depreciation regulation, no decision reached on waterpower, 398.
——Federal waterpower projects up to December, 1921, (D), 443.
——High Dam project, new proposition made on, 200.
——Idaho Power applies for license for transmission lines, 448.
——Licenses and permits issued, 648.
——Michigan and Florida projects seek permits, 898.
——New York State government contends that federal power law is invalid, 1134.
——Niagara power, keen competition for, foreshadowed in new application, 1186.
——Pacific Coast waterpower projects, five, licensed by, 850.
——Pacific Power & Light asks permit to develop 650,000 hp., 648.
——Permits, applications for, 599,800.
——Power act, state attorneys-general asked to discuss constitutionality of, 1187.
——Waterpower permit asked by Mokelumne River Power & Water Company, 549.
Federated American Engineering Societies:
——American Engineering Council: Discusses licenses, plans ahead and fetes Hoover, 100.
——Executive board meets, 1137.
——Muscle Shoals investigation, not favorable to, 547.
——Patent bills, clearances pending, 895.
——Patent office conditions, to take up, 52.
——Officers confer with President Harding, 849.
Feeder station, automatic, with "supervisory control" system, 435.
Feiker, F. M., 203.
Fellows, J. L., *804.
Felthousen, John H., 604.
Ferguson, L. C., 354.
Ferguson, Samuel, *166.
Ferguson, Walter, 804.
Ferree, L. L., *1243.
Financing:
——April financing on 6½ per cent basis average, 899.
——Australian utility comes into American money market, 246.

*Indicates illustrated articles

Financing (Cont.)
——Bill to prohibit tax exemption of securities strongly opposed, 1043.
——Blackstone Valley common stock offered on 7 per cent basis, 1290.
——Boston Edison offers short-term securities under 6 per cent, 100.
——Budget system in utility operation, advantages of (comment), 467.
——California companies issue new securities totaling $13,000,000, p. 196.
——California securities market shows healthy condition, 240.
——Cohoes Power 6 per cent bonds issued at a premium, 747.
——Common stock, public utilities not financing enough by; 745.
——Commonwealth Edison planning increase in authorized capital stock, 297.
——Commonwealth Holding Company, bond issue of $12,500,000 sold by, 1088.
——Customer-owned securities, maintaining marketability on, *955.
——December, 1921 financing, preferred stocks prominent in, 51.
——Economics of the public utility business. By Samuel Insull, 581, comment, 567.
——February, many utilities engaged in financing in, 449.
——Five per cent issues begin to appear, 295.
——Fixed-capital records, better, are needed (editorial), 987.
——General Gas & Electric to reclassify stock on non-par basis, 646.
——Insurance companies, utility securities as investments for life. By H. Fiske, 1117.
——January yield down to 6.28 per cent on new financing, 249.
——Light and power stocks take upward turn, *184.
——Los Angeles bond sale declared illegal, 197.
——March yield on new financing down to 6.62 per cent, 649.
——Massachusetts' utilities condition improving, 145.
——May financing reaches the highest total of the year, 1139.
——Money again under 6 per cent (editorial), 1107.
——1921, security yields show material decrease during, *133.
——1922, public utility securities falling due in, total $432,934,890, p. 146.
——North American Company acquires interest in Cleveland Electric Illg. Co., 700.
——Northern Ohio Traction & Light issues $7,500,000 in 6 per cents at 96, p. 549.
——Ontario, Province of, bonds on a 5.55 per cent basis, 52.
——Pacific Gas & Electric sells $11,300 of stock daily for 2,300 days, 439.
——Pennsylvania Power & Light non-par preferred stock, 245.
——Philadelphia Electric offers $7,500,000 in bonds yielding 5.53 per cent, 1085.
——Providence company to issue $2,720,000 new stock, 50.
——Public utilities, how should they be financed. By H. M. Addinsell, 941.
——Savings banks association considering public utility investments, 967, comment, 918.
——Seattle's light and power bonds to bring 5.70 per cent, 200.
——Sound financing the aim of utilities. By W. S. Barstow, 7.
——Stock campaign, how to put on a. By Percy H. Whiting, 779, comment, 769.
——Stock, local selling of holding company. By H. E. Weeks, *521.
——Stocks, upward trend in price of light and power, *942.
——Tax-exempt securities outstanding, fifteen billion dollars of, 695.
——Tax-exempt securities: penalizing industry for the sake of government (editorial), 167.
——Tax-exempt securities, resolution prohibiting issuance of, reported, 897.
——Tax-exempt securities, the increasing menace of, (editorial), 267.
——Utah Light & Traction offers $12,471,000 in bonds to yield 5.70, p. 1089.
——Utilities' credit must not be impaired, says large investment banker, 1138.
——Utility securities as investments for life insurance companies. By Haley Fiske, 1117.
——Utility securities' stability shown graphically, *20.
——War-time government loans, electric utilities repay 60 per cent of, 195.
Finland's rural electrification increasing, 232.
Fire extinguishers:
——Liquid, effective for quenching generator fires, *585.
——Precautions must be taken when using. By H. J. Burton, 535.
Fires: (see also National Fire Protective Association and Accident Prevention.)
——Chicago, value of drainage and separated feeders demonstrated during, *736.
——False fire accusations, running down (editorial), 817.
——Reporters make a double score, the "electric fire." By Frank W. Chase, 733.
Fisher, R. E., *303.
Flanagan, Thomas, 976.
Flashlamps and Flashlights:
——Batteries. By E. H. Mathews (D), 1037.
——Characteristics. By T. Spooner and C. F. Royce (D), 1132.
Fleming, Jr. Col. Samuel W., 1046.
Floods, middle west; do no serious damage to electrical systems, 796, bring operating difficulties, *849.
Flynn, Valére Alfred, *566.
Forbes, Allen H., 252.
Foster, Charles, *1093.
Foster, Richard L., 903.
Fouch, William O., 154.
France:
——Electrification contract, French place $8,000,000 in, 1086.
——Lannemezan, electro-chemical plant at. By I. Waternaux (D), 1233.
——Paris, water-cooled generators in 200,000 kw. plant in, *129 comment by O. C. Sheldon, 533.
——Super power transmission systems, international conference on March, 199.
Franck, Charles, 854.
Frankel, Harry, *354.
Franklin, William Suddards, *616.
Fraser, Daniel M., *604.
Frech, T. W., 154.
Freight-rate, lower—decision, 695.
Freight rates cut 10 per cent, 1089.
Fried, M. J., *563.
Frost, F. B., 503.
Frueauff, Frank Wheatcroft, *866.
Frykman, Oscar M., 853.
Fuel (see also Coal)
——"Hogged"; generating power from waste. By H. S. Bastian, *373, comment 369.
——Hogged, successful handling and storing of. By H. S. Bastian, *1077.
——Powdered coal, preparing and distributing. By E. C. Greisen (D), *642.
——Powdered, future of, in power plants (editorial), 168.
——Powdered, in power plants. (editorial), 168, comment by E. B. Powell (Feb. 11), by John Anderson. By Frederick A. Schaeffler, 1073.
——Pulverized coal as fuel in the United States (D), 242.
——Pulverized coal as power-plant fuel past trial stage. By E. B. Powell, 273.
——Pulverized coal, first large plant using exclusively, *721.
——Pulverizing anthracite coal practical and economical. By Harlow Hardinge, 433.
——Tree stumps hogged for fuel in Sweden. By Edy Veiander, 333.
Furnaces, electric:
——Anode-furnace charges in a copper refinery, calculation of. By C. M. Brister, Jr. (D), 493.
——Arc, three-phase for copper and brass. By E. Russ (D), 1283.
——Baking vitreous enamel, operating costs for, *286.
——By H. M. St. John (D), 493.
——Cast iron as produced in the, and some of its problems. By George K. Elliott (D), 1084.
——Cast iron melting, history of electric. By W. E. Moore (D), 1084.
——Electrode regulation for, hydraulic-automatic. By J. Ritz (D), 1133.
——Electromagnetic motions in. By Carl Hering (D), 1133.
——Heat-treated parts, over-all cost of. By C. I. Ipsen (D), 643.
——Heat-treated parts' cost reduced to minimum by. By C. L. Ipsen, *1125.
——Heroult, new 7-ton (D), 443.
——Iron foundry, in the. By L. C. Judson and H. P. Martin (D), 1233.
——Iron, synthetic cast. By J. L. Cawthon, Jr. (D), 1283.
——Iron, synthetic cast, manufacture of, in electric furnace. By W. L. Morrison (D), 594.
——Pig iron manufacture of, from iron ore. By R. C. Gosbrow (D), 1233.
——Reactance requirements need consideration. By P. B. Short, *81, comment, 68.
——Smelting, electrics, as a means of utilizing low-grade iron ore (editorial), 518.
——Stability of conducting hearth structures. By Frank Hodson (D), 143.
——Steel for manufacture of. By Alfred Stromboli (D), 1232.
——Steel, 17.4 lb. of, annealed per hour. By Alan S. Dauch, *579, comment, 569.
——Transformer mounted on truck to save running heavy loads. By Alfred L. Williams, *684.
Moneture, electrically equipped, the use and future of. By Earl E. Whitehorne, *224.
Fuses (see Trade and Market conditions).

G

Garman, H. O., *103.
Garrett, W. H., 975.
Garside, W. A., 754.
Gas, the disappearance of, in the electric discharge. By N. R. Campbell and H. Ward (D), 1284.
Gases, behavior of electricity in ionized. By W. M. Thornton (D), 243.
Gates, Robert M., 354, 754.
General Electric Company:
——Department of Justice to investigate, 149.
——La Follette prints charges against, in "Record," 1135.
——1921 billings $221,000,000, p. 747.
——Patent cases (see under patents).
——Workers, interpreting the corporation to the. By C. M. Ripley, *1281.
——Young and Swope succeed Coffin and Rice as executives of, *1040.
Generating stations (see also Hydro-electric plants).
——Commonwealth Edison Company's Calumet plant, 49, two new units for, 798.
——Connors Creek, Detroit Edison Company, heat balance of. By C. H. Berry and F. E. Moreton (D), *242.
Generating stations (see also Hydro-electric plants) (cont.):
——Danville (Va.), municipal plant expands, 696.
——Design, still greater reliability the aim in. By B. G. Jamieson, *32, developments in design (D), 48, 843, 1183.
——Duquesne Power Company's Colfax, contract for additions to, announced, 52.
——Easton (Pa.), to be enlarged, 397.
——Economies in large electric, possible. By Emile Rauber (D), 393.
——El Paso, entire electrical bay built outdoors, *670, 782.
——European tendencies in design. By A. W. H. Griepe (D), 292.
——European tendencies in design. By A. W. H. Griepe (D), 292.
——Expenses of six plants, operating, 131.
——Franklin Mfg. Co., H. H., new power plant of the (D), 1132.
——Heat balance in steam-power. By Hopping, Lawrence, Keenan and Clarke (D), 47.
——Hell Gate, United Electric Light & Power Co., New York City, *820, *870, comment, 869.
——Kansas City, being increased 50 per cent in capacity, 549.
——Maine Waterpower company, oil-burning standby plant for, 397.
——Milwaukee Electric Railway & Light Company's Lakeside plant uses pulverized coal exclusively, *721.
——New Orleans, contract for additions to, announced, 52.
——Oil-burning steam power plants, operation of. By C. H. Delany (D), *593.
——Oklahoma, to be center of large distributing system, 798.
——Paralleled stations, unstable operation of. By D. D. Higgins, 285.
——Runcorn, England, station at (D), 142.
——St. Louis supply, to build six-million-dollar steam station for, 598.
——Sheffield, England (D), 48.
——Small hydro-electric and steam-generating. By G. Fisler (D), 342.
——Steam, most economical utilization of, is deciding factor (editorial), 668.
——Waste heat in, utilizing (D), 692.
——Windsor (W. Va.), West Penn Power again expanding generating capacity of, 397.
——Youngstown, Ohio, addition going ahead rapidly, 646.
Generation:
——Cost of 1921 extensions $100 per kva., 838.
——Factory power generating conditions discussed, methods of improving, 248.
——Iron and steel industry, application of electric power in the. By W. S. Hall (D), 843.
——N. E. L. A. prime movers committee report performance of equipment and trends in station practice, *1033.
——Protection, isolation of disturbances the tendency in station (editorial), 719.
——Waste heat utilized to produce electric power. By C. H. Reeder (D), 142.
Generators:
——Central station generators' rating totals 14,466,915 kw., *679, comment, 669.
——Engine-type, erector's instructions for installing. By James Dixon, 187.
——Engine-type, installing, with limited equipment. By James Dixon, *437.
——Flux distribution in air gap and teeth of dynamos. By Alfred Still (D), 742.
——High-frequency, development of, in Russia. By V. Woldgdin (D), 1182.
——Single-phase, theory of the. By G. Shimidzu and K. Ito (D), 965.
——Standby, for power-factor correction, finding way to start. By C. R. Reid, 686.
——Synchronous condensers, starting generators for operation as. By C. R. Reid, 885.
——Temperature ratings, testing installed generators to determine. By Eustace C. Soares, 388.
——Three-phase, with vertical shaft. By G. Lewinneck (D), 542.
——Two-phase and three-phase, theory of. By G. Shimidzu and K. Ito (D), 1083.
——Ventilating system for cooling turbo-generator, closed-circuit. By C. R. Beardsley, *735.
——Ventilation, closed-circuit and prevention of fires, 1176.
——Water-cooled, in 200,000-kw. Paris plant, *129.
Gentry, Rufus G., *902.
Germany (see also Patent convention and Trade, foreign):
——Berlin 100,000-volt lines through streets of, *120.
——Development of electrical supply undertakings in (D), 643.
Gerry, M. H., 54.
Gibbony, Arthur G., 1194.
Gibson, Burton Y., *453.
Gibson, Jr., Daniel D., 976.
Gibson, J. J., *976.
Gibson, Langdon, *854.
Gibson, Russell S., 804.
Glover, J. R. S., 704.
Goddard, P. L., 804.
Goldhammer, M. H., 1244.
Goodiff, John D., 804.
Goodwin, C. F., 253.
Gore, James W., 554.
Gossler, Philip G., 853.
Grounding:
——Chains are inadequate, some. By Alfred Herz, *177, comment, 169.
——Neutral, the question of grounding the. By B. Szapiro (D), 393.
Great Britain (see also Trade, foreign):
——Blackburn power station. By L. C. Kemp (D), 793.
——Chester bulk supply scheme (D), 142.

*Indicates illustrated articles

Great Britain (see also Trade, foreign (Cont.)
——Developments in the electrical industry. By T. F. Wilmshurst (D), 192.
——Instruments and relays, new electrical (D), 193.
——Interconnection in, electrical, 572.
——London and the home counties, electricity supply in (D), 243.
——1921, the year in English practice (D), 643.
——Runcorn, new electric power station at (D), 142.
——Water power resources committee, report of (D), 243.
——Wireless chain, British imperial (editorial), 618.
——World power conference scheduled for London, 795.
Groome, R. L., 1244.
Grosvenor, H. J., 704.

H

Hammer, electric drop, operating on induction-motor principle. By P. Trombetta (D), 965.
Hammer, theory of water. By C. F. Mancini (D), 1233.
Harnischfeger, Henry, 554.
Harries, Gen. G. H., *1194.
Harsh, J. E., 1194.
Hartmann, Prof. Francis, 403.
Harvey, J. G., 903.
Harza, F. L., 652.
Hauck, S. F., 1143.
Hawkes, T. D., 1142.
Hawthorne as an electrical prophet, 1172.
Haynes, Pierre E., 854.
Hays, T. H., 204, *754.
Head, Daniel G., 204.
Head, W. B., 303.
Headrick, E. C., *452, 554.
Heat balance, relative merits of three methods of obtaining, *687.
Heating, electric:
——Commercial and industrial, utility view of. By A. Strauch, 84.
——Comparative investigations on heating apparatus. By P. Schlapfer (D), 293.
——Cooking apparatus, comparative investigations on. By P. Schlapfer (D), 293.
——Heat treating, field of electric, extending rapidly, 130.
——House, limits of. By E. A. Loew, *623, comment, 619.
——Industrial, courses to start Feb. 6, p. 196.
——Industrial, courses, two more begin April 24, *750
——Industrial, need for data on (editorial), 269.
——Japan, baking, on automobile fenders. By James W. Carpenter, 138.
——Radiant heaters, energy distribution of. By C. F. Wagner (D), 1084.
——Water heaters, electric. By A. Gottert (D), 594.
——Water supply, domestic. By J. A. MacDonald (D), 492.
Heising, R. H., 103.
Hemler, J. J., *404.
Hering, Dr. Carl, 1093.
Herlitz, Ivar, 503.
Hewlett, Edward Marrcott, *366.
Hibben, Samuel G., *653.
Hickok, L. E., 1143.
Hilton, W. Ross, 1047.
Hitchner, A. E., *453.
Hogan, J. V. L., *753.
Hoists, electric (see also Electric Hoist Manufacturers' Association):
——Gearing for motor-driven cargo hoists and winches, selecting. By J. A. Jackson (D), 1038.
——Mine, and electric winding engines. By H. H. Broughton (D), 443.
Holcomb, A. B., 504.
Home Electric:
——An all-. By P. F. Apfel, 235.
——Boulder, Col., central-station manager lends his new bungalow as, *889.
——Broadening the appeal of the. By C. E. Greenwood, 1228.
——Building business around an idea (editorial), 217.
——Building contractor's appreciation of, *1080.
——Cleveland's, some significant attendance data on, 839.
——Denver, designed and built by electrical men, *1279.
——Editorial: A mortgage on America, 515.
——How to organize and conduct a "Home Electric." By J. E. North, *475.
——More, are needed, another reason why, 390.
——Portable demonstration for scattered territory, *1179.
——Review of experience in "home-electric" demonstration, *947.
——Utica, N. Y., draws 15,124 visitors, *270, *291.
——Why can we not learn this lesson now? (editorial), 468.
Home ownership, a broad study of, *589.
Hopkins, H. C., 563.
Hopkinson, M. P., Dr. Edward, 304.
Housley, J. Elmer, *1293.
Hovey, Francis J., *504.
Hoyt, F. O., 453.
Hunter, C. W., 1093.
Hunter, E. E., 1093.
Hunting, F. S., *1244.
Hutcheson, J. P., 1094.
Hydro-electric development (see also Hydro-electric plants and Water power):
——Alabama Power Company completes final unit on Coosa River, 198.
——Canada, review of, in (D), 844.
——Colorado River:
Commission meeting, Jan. 26, p. 49.
Commissioners favor development of river as whole, 247.
Hoover's Commission favors boulder dam, 595.

Hydro-electric development (see also Hydro-electric plants and Water power (Cont.)
Reclamation service report on, completed, 596.
Commission to meet again in July or August, 796.
Government would control the, 845.
Bill, progress of development, to be slow, 896.
Power projects on the, *1117.
——Davis Bridge, Vermont, $7,000,000 development progressing, 798.
——First under Federal Water-power act, *23.
——Hydraulic accumulation of energy by means of pumps. By J. Godin (D), 292.
——Muscle Shoals:
Ford's offer, Congress to pass on, 150.
Ford offer, Congress gets new, 247.
Hearings started this week, 297.
Alabama Power makes offer for, 345.
General Beach comes out for long term lease, 346.
Editorial. Muscle Shoals not for private exploitation, 367.
Alabama Power's offer makes favorable impression, 399.
House hearing coming to an end, 445.
Commission to settle problem, would create, 495.
Commission should decide fate of (editorial), 517.
Delay in settlement, possible, 545.
American Engineering Council not favorable to investigation of, 547.
Hearings concluded, 595.
Congress deadlock over, *697.
Bidders likely to be asked for increased offers, 747.
Heavy power demand awaiting development of, 799.
Congress may put disposal of, up to Secretary Weeks, 847.
Ford modifies offer and makes concessions, 897.
McClellan urges that engineering board consider, 967.
Senate committee against accepting private offers, 968.
Secretary of Federal Power Commission attacks Ford offer, 1041.
Adsit, C. G., attacks, as source of power, 1042.
Another proposal, 1043.
Senate committee not likely to favor Ford's offer, 1089.
House and Senate are likely to become deadlocked on, 1135.
House committee reports bills favoring Ford's offer, 1187.
No decision yet in sight at Washington, 1238.
Muddle the (editorial), 1258.
Minority report, new, assails Ford offer, 1285.
——Ontario hydro-electric system investigated by W. S. Murray, *471, comment, 467.
——Ottawa River, large development planned on, 397.
——Philadelphia conference on, is held, 597.
——Projects involve an expenditure of $150,000,000, p. *951.
——St. Lawrence River:
Report (D), 48.
N. Y. grants preliminary permits, 52.
Report in hands of state department, 100.
International joint commission reports, 150, 342.
Ontario Hydro-Electric Commission's report (D), 194.
Report reaches committees of the House, 195.
Lake Ontario, proposed regulation of (D), 443.
Debate on water-power possibilities of the, 447.
Navigation, solving the problem of. By Charles P. Loveland (D), 642.
International Joint Commission recommendations (D), 693.
Seaway project criticized at A. I. E. E. convention, 845.
Canadians refuse to negotiate treaty now, 1134.
——South American. By Theo. Stevens (D), 92.
——Styria, Austria, expects 450,000 hp. from development, 332.
——Tugalo, Georgia Railway & Power to complete, 95.
——Winnipeg City's hydro-electric system. By E. V. Caton (D), 1283.
Hydro-electric plants:
——Alabama Power Company's unique power house on the Coosa River, *620.
——Alabama Power Company: semi-outdoor hydro-electric plant with backwater suppressor. By John A. Sirnit, *1161, comment, 1158.
——Arctic circle, generating electricity within the, 125.
——Automatic, cost of. By R. E. Barrett, 333.
——Bathurst, N. B., hydro-electric development near. By James Dick (D), 542.
——Buitreras, Spain (D), 593.
——Chippawa-Queenston. Hydro-Electric Power Commission of Ontario, *1260, comment, 1258.
——France, La Basse-Isère. By A. Dumas (D), 1083.
——Hydraulic equipment as affecting power house design. By Max V. Sauer (D), 1183.
——Ice formation fought by discharge of tepid water into river, 146.
——Indiana company starts building first of chain of, 798.
——Induction generator plant at Lee Moss, use of small water powers simplified by, *573, comment, 569.

Hydro-electric plants (Cont.):
——Interconnected, operating, for best system economy. By J. W. Andree, *933, comment, 1058.
——Interconnection of small. By A. Soulier (D), 1037.
——Italian, to yield 16,000,000 kw.-hr. a year, 372.
——Newhalem Creek, two governors on hydraulic unit give advantageous regulation, *138.
——Niagara Falls Power Co., another unit for, 1289.
——Niagara Falls Power Company, generators rated at 65,000 kva. for, 1186.
——Niagara Falls Power Co. to install three 70,000 hp. units, 697.
——Parnahyba, increasing capacity of. By H. P. Quick (D), 843.
——Seira, Spain. By J. Reyval (D), 692.
——Southern Power Company's Mountain Island, work under way on new, 549.
——Spain, Buitreras station on the river Guadiaro (D), 965.
——Western States Gas & Electric Company's new, work started on, 596.
Hyperbolic functions, rudiments of, should be discussed repeatedly. By Lloyd N. Robinson, 85.

I

Illinois:
——Public Service Company of Northern Illinois' extensive power development program, 616.
——Utilities to discuss greater energy consumption, 448.
——Utility operators discuss electric grading and business problems, 600.
——Utility properties reorganized, 500.
Illuminating Engineering Society:
——Convention to be at Boston, annual, 447.
——Harrison, Ward, elected president of, 1236.
——Street lighting, reports new types of, 37.
Illumination (see Lighting.)
India, Electric light and power in, *175.
Indiana:
——Commission, abolition of public service, threatened, 1136, Indianapolis mayor recedes from stand for abolution of commission, 1188, comment, 1157.
——Indiana Electric Corporation:
Commission approves merger of utilities, 247.
Merger of utilities gives rise to vigorous protests, 299.
Mob scene, the lesson of the Indianapolis (editorial), 367.
Cities take merger case to courts, 449.
Building first of chain of water-power plants, starts, 798.
Norway (Ind.) power, makes contract for, 200.
——Indianapolis Light & Heat Company:
Expands to meet demand, 244.
System, additions being made to, 899.
——Industries 60 per cent electrified. By Robert M. Davis, *321.
——Overhead construction rules, considering, 396.
——Southern, to increase service in, 696.
Inductive interference:
——Attorney, viewed by an (editorial), 319.
——Business problem, as a, 676.
——Fundamentals of, the (editorial), 469.
——General joint committee of N. E. L. A. and Bell Telephone System adopts principles, 1031, comment, 987.
——Legal phases of, 481, comment, 469.
——Ohio report avoids detailed sales on, 395.
——Reactor, the grounding. By Sadatoshi Bekku (D), 693.
——Report of joint committee on, 545.
——Research not money, will solve problems (editorial), 217.
——Technical problem, is basically a, 571, comment, 568.
Ingalls, C. E., 453.
Inspection and maintenance:
——Systematic inspection scheme for preventing breakdown. By Alex E. Bauhan, *943, comment, 918.
Institute of Radio Engineers reports standardization, 37.
Insulation:
——Appliances for electric (D), 793.
——Communication line, of a. By J. G. Hill (D), 443.
——Heat's effect on electric strength of some commercial insulating material. By W. S. Flight (D), 743.
——Micas, properties and uses of (D), 1133.
——Pressboard, industrial research on. By A. P. M. Fleming and Allan Monkhouse (D), *143.
——Properties and characteristics of insulating materials. By R. T. Fleming (D), 394.
——Resistance and breakdown strength correlation of, would be welcomed (editorial), 768.
——Testing apparatus with 6,000 volt range, simple. By Eustace C. Soares, *288.
Insulators:
——Behaviour of, under effect of high frequency voltages. By F. Grünewald (D), 193.
——Chains, determination of the sag of overhead lines with heavy. By K. Guernot (D), 843.
——Chain type, new viewpoints in the criticisms of. By W. Weiker (D), 192.
——Disk type, distribution of voltage along. By G. Viel (D), 841.
——High tension. By Borgquist (D), 1132.
——Line, standard practice in testing. By C. L. Kasson (D), 1039.
——Porcelain, electrical tests for porosity of. By J. E. Shrader (D), *743.
——Suspension, safety factors for different types of. By P. Testard (D), 1182.

*Indicates illustrated articles

Insulators (Cont.):
——Suspension, with spherical head, new type of (D), 742.
——220,000-volt bus construction, replaceable units used in, *588.
Insull, Fred W., 803, 1093.
——Insull properties, customer ownership problems discussed by managers, 300.
Insurance rates on power houses, reduced, soon to be effective, 348.
Interconnection (see under Transmission).
Intermountain electrical men hold first annual conference, 850.
Ionization by cumulative action. By K. T. Compton (D), 966.
Iron and Steel Electrical Engineers (See Association of Iron and Steel Electrical Engineers.)
Italy:
——Aldred, J. E., negotiates purchase of water powers in North, 1041.
——80,000-volt cable being installed in. By Philip Torchio, 76, comment, 68.
——Hydro-electric plant to yield 16,000,000 kw-hr. a year, 372.
——Hydro-electric problem in. By Domenico Civita (D), 893.
——Hydro-electric troubles are over. By G. G. Ponti, 964.
——Power shortage from lack of snow confronted by, 579, comment by G. G. Ponti, 964.

J

Jackson, Dugald C. Prof., 803.
James, H. D., *554.
James, Mark S., 903.
Jamestown (N. Y.), Niagara, Lockport & Ontario Power Co. to supply, 746.
Japanese double-deck outdoor switching station, *220.
Jennings, John Edward, *766.
Jewett, Frank Baldwin, *347, *1056.
Jewett, Frank N., 204.
Jobbers (See Electrical Supply Jobbers Association and under Manufacturing and Distributing.)
Jockers, W. J., 976.
Johnson, E. V. D., 253.
Jones, H. L., 754.
Jones, Philip C., *902.
Joseph, Henry, 1294.
Jourdet, Lon, 1195.
Junkersfeld, McClellan and engineering organization incorporated, 348.

K

Kettering, C. F., 354.
Kearney, James R., *154.
Kebler, Leonard, 453.
Keer, Louis A., 975.
Kelly, Thomas J., 1046.
Kenney, T. O., *503.
Kent, Pieter J., 603.
Kerschner, Edward, 253.
K[illegible], H. W., 1294.
Killelea, H. S., 804.
Kendall, Dexter S., 1243.
Kimber, H. A., 153.
Kinney, Clarence W., 1094.
K[illegible], G. I., 453.
K[illegible], S. M., *753.
K[illegible], Horace F., 704.
Knight, E. W., 976.
K[illegible], P[illegible], J., 1244.
Krug, Frederick, 975.

L

Labor (see also Coal):
——Coal operators and railroad men form alliance, 396.
——Coal wage conference by operators and miners, Harding demands, 495.
——Coal wage cuts, announcements of April 1, 245.
——E[illegible] improvement in employment situation among, 795.
——Interpreting the corporation to the workers. By C. M. Ripley, *1281.
——Non-employment, to study basic causes of, 395.
——O[illegible] watchdog not (editorial), 815.
——Turnover causes need study (editorial), 118.
——Used in modern power plant is 10.62 man-days per kilowatt, 1172.
——Wage problems, central station, *488.
——Women in electrical industry, *132.
Lace industry, electricity in the. By J. F. Crowley (D), 892.
Lambert, [illegible], 554.
Lamps, arc new tungsten, has one-point source of light, 938.
Lamps, incandescent:
——Gas filled tungsten, interlaboratory photometric comparisons of. By W. E. Forsythe and F. E. Cady (D), 542.
——L[illegible] investigation, 97, 147, 197, comment 117.
——Motion picture projection and Mazda lamps. By H. H. Magdsick and C. E. [illegible] (D), 965.
——Mill type [illegible] standard reflectors and [illegible]. By J. M. Ketch, *107.
——Patents, General Electric Company sustained by higher courts, 93. General Electric wins another injunction in suits, 699. Upheld by appellate court again, 750.
——Patents, Langmuir: Stay of injunction asked in case, 800. Stay of injunction denied in, 850.
——Temperatures as related to modern lighting practice. By Chester L. Dows and Willard C. Brown (D), 47.

Lamps, incandescent (Cont.):
——Tungsten wire, invention of drawn. By Colin G. Fink, 384.
——Vacuum-type, measurement of pressures in. By Duncan MacRae (D), 892.
Lane, H. A., *753.
Langmuir, Irving, *116.
Lasher, N. Harwood, 976.
Launey, R. O., *153.
Lavier, Thomas, Jr., 154.
Lawrie, O. A., *804.
Learnard, George E., 653.
Lee, Rufus E., *803.
Lee, Major Thomas B., 903.
Legal decisions (see Court decisions)
Leggett, F. H., *104.
Lemon, J. R., 1047.
Leonard, Vreeland Y., 1093.
Levis, C. C., 153.
Lewis, G. E., 804.
Lewis, George E., *503, 804.
Lieb, John W., 553.
Lieb, John W., lecture for Italian benefit attended by electrical men, 200.
Lieb, John W., warmly greeted in Italy, *1239.
Light, cold, important steps made in studying, (editorial), 868, comment by D. McFarlan Moore, 1223.
Light of other days, concerning the. By Louis Bell, 46.
Lighting (see also Illuminating Engineering Society):
——Aerial navigation, light as an aid to. By L. F. Blandy (D), 1232.
——Better an economy measure. By Ward Harrison (D), 892.
——Boston industrial lighting exhibit "sells" $75,000 in equipment, 600.
——Calculations, use of "alignment chats" for illumination. By L. Bloch (D), 492.
——Charts, ease of using illumination. By I. W. Gross, *134.
——Church illumination; field for greater cooperation between architect and engineer. By A. L. Powell, *180, comment, 169.
——Clothing industry. By A. B. O'Day and R. W. Peden (D), 542.
——Code, I. E. S. (D), 193.
——Colors for Traffic signals, conference called on, 949.
——Daylight artificial. By J. S. Dow (D), 692.
——Dentistry, artificial lighting in. By Percy Russell (D), 692.
——Developments, a few, *34.
——Eye as affected by illumination, the. By G. H. Stickney and A. L. Powell (D), 393.
——Eye, pathological effects of radiation on the. By F. H. Verhoeff and Louis Bell (D), 593.
——Factory lighting design. By J. R. Colville (D), 593.
——Foundry, the elements of good. By J. M. Shute (D), 1083.
——Illinois industrial lighting code requirements, need for new, shown, 300.
——Lighthouse to aid aerial navigation, electric. By C. H. Dantin (D), 342.
——Massachusetts issues tentative code for industries, 971.
——Merchandising illumination. By W. L. Goodwin (D), 1182.
——Metal working plants. By A. L. Powell (D), 793.
——Milwaukee, a better lighting campaign in, *389.
——Mines and mining properties, lighting coal. By S. G. Hibben (D), 142.
——New Orleans, Knights Templars conclave, *1160.
——Printing plants, of. By A. D. Bell (D), 47.
——Progress in 1921. By S. E. Doane, 9.
——Public buildings. By A. L. Powell and Edgar Parker (D), 142.
——Public spaces and offices, recent departures from usual lighting practice in. By A. D. Curtis and J. L. Stair (D), 492.
——Sign design, illuminating engineering factors in electric. By C. A. Atherton (D), 393.
——Sign legibility, factors that determine. By C. A. Atherton, *1061, comment, 1108.
——Signs and billboards. By J. M. Shute (D), 492.
——Sources, brightness of light. By W. E. Forsythe, 235.
——Stores, large dry goods and department. By A. L. Powell (D), 692.
——Stores, retail, lighting of (D), 642.
——Surgical, dental and ophthalmological professions, use of light in. By L. P. Tingley (D), 742.
——Units, non-ventilated, show increase in use. By Chester L. Dows, 387.
——Washington, industrial lighting code proposed in state of, 971.
——Wastage of light, reduce your. By Ward Harrison and J. R. Colville (D), 292.
——Wireless lights—interesting if true (editorial), 719.
Lighting fixture manufacturers (see National Council of —)
Lighting, street:
——Amherst, N. Y. to illuminate all its highways, 748.
——Highway lighting—a fertile field for activity (editorial.) 218.
——Lincoln Highway, improved lighting system to be installed on. By H. H. Bell, *731.
——Overhead service feeds ornamental lamp standard, *436.
——Reading (Pa.) will substitute electricity for gas on all streets, 146.
——Road illumination, novel method of, *234.
——Switch control, remote, for street lamps. By L. Maas (D), 1037.

Lighting, street (Cont.):
——Traffic accidents and illumination, *80.
——Transformer, standard, boosts series circuit voltage. By H. S. Rush, *385.
Lightning arresters:
——Corona discharge as a relief to line surges (editorial), 1058.
——Defense of standard practice in. By E. E. F. Creighton, *377, comment, 369.
——44,000-volt transmission line, protection, *785.
——Gap, same wet and dry sparkover obtained with compensated impulse. By C. E. Bennett, *1065, comment, 1109, comment by author, 1223.
——Operating practice, analysis of. By Q. L. Hunt, 376.
——Protection against lightning. By E. Poirson (D), *442.
——Swedish engineers' opinion on protection. By Edy Velander, 1036.
——Water-barrel give satisfactory service. By H. M. King, *586, correction, 787.
——Water-tube type compares favorably with others. By George H. Middlemiss, *838.
Lightning generator affords new tool for high-voltage investigation, *470.
Little, A. M., *354.
Liunde, Paul, 603.
Locke, Milton H., 1093.
Lockwood, Arthur, 354.
Lof, Eric A., *253.
Long, Carl C., 1142.
Loveland, Col. H. D., 1244.
Lyndun, Lamar Dr., 603.

M

MacDonald, E. G., 503.
Machines, Electric:
——Induction, mechanical device indicates performance of. By Vladimir Karapetoff, 381.
——Magnetic side pull in rotating electric machines, correcting. By A. M. Dudley (D), 193.
——Polyphase commutator, analysis of energy loss in. By. A. B. Reed, 382.
——Rating (See under R.)
——Temperature rise of, on intermittent duty. By G. E. Luke, *1069, comment, 1059.
Magnet, theory of the intrinsic field of a. By J. R. Ashworth (D), 844.
Magnetic:
——Air brake blow outs. By J. F. Trittle (D), *1132.
——Chucks, direct or alternating-current for. By B. Wittkuhns (D), 493.
——Testing methods of. By T. Spooner (D), 48.
Magnetos, mathematical theory of the induced voltage in high tension. By F. B. Silsbee (D), 342, 594.
Mailloux, C. O., 353.
Management, Central Station:
——Conference of executives from scattered territories, *590.
——Industrial demand, how to balance reduced. By T. I. Jones, 26.
——Interdependence of engines and sales forces (editorial), 818.
——Meeting, running a—electrical or otherwise. By Kassandra, 389.
——Office arrangement, effective, viewed as a good will asset, *488.
——Prices, turnover and expansion. By W. W. Freeman, 371.
——Security sales, making purpose of, clear to public. By John F. Gilchrist, 24.
——Utica and Dayton companies hold joint meeting, *339.
——Utility outlook brightest in industry's history. By George N. Tidd, 24.
——Wage problem, central station. By Samuel Ferguson, 26.
——Wage problems, the central station, *488.
Mann, R. M., 1294.
Manning, James H., 503, *603.
Manufacturing and distributing (see also Trade and market conditions):
——Appliance business, direct sales to dealer and good servicing the key to large. By a manufacturer, 641.
——Appliance campaign selling, the secret of, is right methods. By Christian J. Litscher, 591.
——Appliances the only way to sell. By R. J. Strittmatter, *1230.
——Appliances, the safety, suitability and soundness of domestic. By Charles Edward Lucke, 890.
——Appliances, these "outsiders" who sell editorial), 617.
——Appliances, who will sell electrical; an answer to the question. By Fred Wardell, *690.
——Batteries, dry-cell, standardization of specifications for, 392.
——Building, comparisons of the volume and cost of, *1131.
——Building contracts awarded, volume of, *641.
——Building costs decrease, *541
——Building increases with declining costs, *341.
——Buildings, normal demand for new, *1231.
——Building operations, trend of, *890.
——Business: "time he was bracing up," *740.
——By "Hire" and "Hire Purchase" (editorial), 669
——Car loadings, rapid increase in, *842.
——Cash discount as a factor in. By F. M. Bernadin, 333.
——Cash, the price of, 891.
——Census of electric manufactures for 1919 analyzed, 726.
——Cost of distributing electrical supplies, some reasons for the excessive. By W. I. Bickford, 392.
——Cost of doing business at retail, 541.

*Indicates illustrated articles

Manufacturing and distributing (see also Trade and market conditions) (Cont.)
——Cost of doing business in large stores composite data on 740
——Cost slow turnover and excessive stock duplication By Geo A Hughes *440.
——Costs distribution of building *592
——Department stores large electrical appliances not profitable to some 641
——Distribution costs more figures wanted on (editorial) 717
——Distribution problem the small manufacturer's pressing By one of them 1282
——Dollar budget division of a business *392
——Dollar the increased purchasing power of the *1181
——Electrical manufacturing industry the By A W Berresford, 428 comment, 418
——Employment conditions of engineering *841.
——Export business the way it must be won By E W Drooster *791
——Exporters warning to By J Klein 491
——Failures causes of business, 1131
——Foreign market for electrical specialties developing the By R C Lamphier *540.
——Fase problem common to all who make or sell appliances By H T Bussman, 740.
——"It may hurt, but its got to be done" *440
——"It only requires a little confidence" *592
——Inventory the value of a perpetual 592
——Jobber must produce volume sales of specialties as well as staples By a jobber 741
——Jobber representation in every town the impossibility of By W R Herstein, 842
——Jobber should be considered a part of manufacturers' organization By a Pacific Coast Jobber, 1082
——Jobber situation further comment on the By N J Harvey 384.
——Jobber the case for the electrical By O D Street 271 comment 269
——Jobber the future of the (editorial) 165
——Jobbers cost of doing business statistics on 1222 comment, 1207.
——Jobbers must do their part in co-operation with manufacturers By Aristides 584
——Jobbers out of screwdriver electricians, making, 541.
——Jobbers' sales and costs, a study of By Earl E. Whitehorne, 577, comment, 568
——Jobbing craze among dealers By a manufacturer 1181
——Living costs decline more than wages, *491.
——Manufacturer and jobber, problems of By Earl E. Whitehorne, 19.
——Manufacturers should limit the number of representatives in territories, By Willard W. Low, 491.
——Nickel-chromium patents what will happen when they expire? By M. C Turpin, *490
——Overhead as a test of management. By H. F. Stratton, 1231.
——Pioneering needs a balanced plan to make it pay. By W. R. Herstein, 341.
——Price cutting prevention essential to jobbers' prosperity, 842.
——Prices in four countries wholesale commodity. *1082.
——Prices in nine commodity groups compared. *741
——Prices, wholesale, *591.
——Prices why should we chase, down the spiral? By Le Roy Clark, *1081.
——Problems of the electrical manufacturer and the jobber. By Earl E Whitehorne, 19.
——Production America's contribution to the worlds', 891.
——Products, real profit in the elimination of an excess variety of 792
——Radio business the need for organization in the. By Christian J. Litscher, 841.
——Radio equipment market, stabilizing the. By Frank S. Price, *1130.
——Relation of trade discount turnover and profit. By J. J. Keith, 1130.
——Reorganizing for business (editorial), 1107.
——Research must be "sold". By C E Skinner, 690.
——Secrecy in manufacturing (editorial), 1105.
——Small-order problem, letters on, 441.
——Spare parts should be purchased from the original manufacturer. By F. H. Daniels 591
——Stick to his trade, let the manufacturer jobber and dealer. By W. C. Bryant, *340.
——Transformer prices, mass production important factor in future. By M O Troy, 1082.
——Transmission-line materials, a problem confronting manufacturers of. By C. M. Semler, 341.
——Turnover's relation to profit, *691.
——Underwriters' inspection, influence of on quality. By W E Robertson *640
——Wiring devices, waste elimination possible in electric. By Howard R Sargent. *1180.
——Wiring, the need of educating the public on quality. By Tie. Bibbins, 791.
——Workers, interpreting the corporation to the. By C. M. Ripley, *1281.
Markle, E. W., 153.
Markwart A H, *353
Marrais, L. A. de., 404.
Marsh, John R., 803.
Marshall H B *154.
Marso, L. W., 404.
Martin, E. T., 204.
Martin, W. E., *903.
Mason M F 703
Massachusetts interconnection expected important 1289
Massachusetts issues tentative lighting code for industries 971
Massachusetts textile mills lead in industrial energy consumption in. By Robert M. Davis *1260, comment 1259
Material handling (See Vehicles electric)
May H A 604
McAllister, Dr. A. S., 252.
McClellan and Junkersfeld engineering organization incorporated 348
McCullough, C. H., 804.
McDevitt, William, 652.
McDonald Morton 754
McGivray C F *1294
McGrath, Richard H 1094
McInnis, William H., 803.
McKernan Joseph L 903
McLain, R H 804 *1094
McMillen Emerson, 1195
Measuring and Measurements:
——Acoustic impedance and its. By A E. Kennelly and K Kurokawa (D) 48
——Coil capacities method of measuring and standardizing wavemeters By Gregory Breit (D) 794
——Fluxmeter, theory of the Grassot. By R B. Burrowes (D), 594.
——Industrial, electrical instruments for. By Ezer Griffiths (D) 394
——Instruments care of electrical. By John H. Miller, 86
——Oscillographic investigations of fields and emfs. induction motors. By W. Stiel (D), 893.
——Surface-condenser leakage by electrolytic conductivity method, of. By Earl A. Keeler (D), 394.
——Telecompass the (D) 594
——Temperature of electric machines, measuring. By G. Keinath (D), 1133.
——Three-phase wattless power, of. By G. W. Stubbins (D), 48.
Memphis Gas & Electric Company receivership may end July 15, p. 1137, T. H. Tutwiler may head, 1290.
Merchandising (See Commercial and Manufacturing & Distributing).
Merriam E. B., *503.
Metals, fatigue of, investigation of. By H. F. Moore and J. B. Kommer (D), 194.
Metcalf, S. B., 653.
Meters:
——Average-kva. demand, university student invents, 846.
——Calibration of, on customers' premises. By W. Janvier (D), 643.
——Chart for studying accuracy of large number of meters By H W. Peck *337
——Current transformer used as phantom load for testing meters. By Dan C. Hoffmann *238.
——Development since the war. By K Schmiedel (D) 1184
——Electrolytic By J Schalk Hammer (D), 443.
——Henry (inductance) direct-reading. By R Barthelmy (D) 1284
——High voltage electric with fault indicator By A Kieppele (D) 1184
——Jewel inspection essential for proper operation By F C. Holtz, 1275.
——Outdoor installations facilitated by standardizing construction By M F Smalley *536
——Records checked by use of tags. By W. R. Gibson, *788.
——Scheduling departure of, by portable truck saves time By H L Thomson *887
——Shadow By Dr Norden (D) 343
——Supply cut outs and meter cabinets safe method of mounting, *189.
——Testing arrangement of terminals and links that facilitates By H S Edwards, *636.
——Transportation and handling of standard. By H. R. Thomas, *1278.
——Voltmeter, static, determines phase rotation on two lines. By D. D. Clarke, *337.
——Watt-hour, adapting old types of, to safety entrance boxes. By S. C. Henton, *236.
——Worcester, meter problem conference at, 398
——Yale, to give short meter course at, 550.
——Yale University's meter course has public policy "slant," 970.
Metering:
——Demand, paralleling current transformer leads facilitates. By H. R Thomas, *1227.
——Florida University has metermen's course, 599.
——High-tension outdoor metering, is it always desirable? By E. C. Ferree, 737.
——Outdoor equipment cost of. By H R Wakeman, 783.
——Power factor, comparison of, favors kva. demand By J E. Doran J B. Hodtum and R. C. Fryer, *1216, comment, 1208.
Metric System:
——Chamber of Commerce referendum, no, at this time, 348.
——Mental inertia must be overcome to establish. By M. L. Staley, 633.
——Norway use of would help American engineering practice in By Chr Grassdal, 285.
Metz, Herbert 204.
Meyer, Edward B, *152.
Mexico railroad electrification, 1085.
Michael Charle C., 1017.
Michigan:
——Detroit (See under D)
——Sleet storm severe, visits Wisconsin and 145
——Utilities planning spring expansion programs, 697
Miller G M 803
Miller H D 803 1093
Milligan, D. D., 704.
Milligan R A Dr 652
Mills:
——Inspection and maintenance practices By Arthur J. Whitcomb (D), 343
——Motor-driven adjustable speed with By K A Pauly (D) 142
——Rubber industry and electric power By Byron T Mottinger (D) 143
——Textile flexibility of electrical service in large (D), 693
——Textile industry and public electricity supply By W J H Wood (D) 693
——Woolen, electric driving in Scottish. By A W Stevenson (D) 844
Mills, Steel:
——Bar for alloy steel semi-continuous By F. L. Prentiss (D), 293.
——Economy of electricity recognized in By R. B. Gerhardt, 28.
——Power generation in By D. M. Petty (D) 193.
——Reversing-roll electric drives, things that cause trouble in. By A. J. Whitcomb (D), 793.
——Rolling electric discussed by steel engineers 1090
——Rolling, electric drive of (D), 243.
Mines and Mining:
——Cables for mining locomotive gatherings reels and cutting machines. By F. A. Westbrook, 436.
——Coal mining motor loads demand factor of. By Carl Lee, *233.
——"Explosion proof" electrical apparatus present status of mine By W Philippi (D) 93
——Locomotives efficient service from (editorial), 668.
——Locomotives, when should battery, replace mules and when be preferred to trolley equipment? By Charles E. Stuart (D), 742.
Minier, W. C., 154.
Mississippi, bill to create public utilities commission defeated in, 646.
Mitchell, Sidney Z., *916.
Moore, L. J., *203.
Moore, Nelson S., 104.
Morrell, E. S., 354.
Morris, William J., 653.
Morrow, L. W. W., 1194.
Morrow, M. C., 1047.
Motor control:
——Central By Orville F Long (D), 1283.
——Delayed-time, low-voltage release is required. By G. E. A., 783.
——Elevator-machine alternating-current motor controller, operation of a drum-type By William Zepernick (D), 965.
Motor repairs:
——Armatures, locating faults in direct-current. By B. A. Briggs (D), 47.
——Armatures, locating short circuits in direct-current—repairing faults. By B A Briggs (D) 342
——Armatures split and layer windings for small. By A. C. Roe (D), 692.
——Coils, methods for laying out. By A. C. Roe (D), 1283.
——Commutator insulation failures. By J. L. Rylander (D), 47.
——Induction motors, repair-shop prices for rewinding (D), 593.
——Welding reduces cost of repairing motor generators, *885.
——Wind fractional-horsepower direct-current motors, how to. By A. C. Roe (D), 393.
Motors, electric:
——Armature coils in slots, heating of. By Otto Böhm (D) 92
——Auxiliaries, variable-speed alternating-current motors for, *734.
——Cascade group of a synchronous and commutator. By R. Langlois (D), 1283.
——Commutators, refilling. By A. Hervey (D), 193
——Direct current speed regulation and stability of. By Scott Hancock (D), *843.
——Fractional-horsepower design of. By W. J John (D) 1233
——Hoisting, factors affecting installation of electric motors for By Gordon Fox *171, comment, 168, correction, 584.
——Induction-, calculation, application of current hours to single-phase. By J. K. Kostko, 381.
——Machine tools, electric drive for reversing. By A. L. Harvey (D), 892.
——Induction, for textile service. By O. C. Schoenfeld (D) 92
——Plant production increased by electric drive and push button control By Thomas W C Hartmann *787
——Polyphase induction starting and operating By Leroy A Francis (D) 1182
——Rating should express a definite limitation a machine (editorial) 519 comments by Fred M Kimball 882 C H Roth 882, Philip Chapin Jones, 1036, Charles F. Norton, 1122, E. T. Selig, 1122, Clarence L. Collens, II, 1123.
——Ratings, 40-degree and 50-degree, some economic phases of. By Clarence L. Collens, 2nd, 1115.
——Rubber industry, fitting the electric motor to the machine in the (D), 1183.
——Single-phase and three-phase alternating-current commutator, with series and shunt characteristics. By S. P. Smith (D) 517
——Spinning and twister frames, individual motor drive for. By George Wrigley (D), 48.
——Squirrel-cage induction. By J. T. Takeuchi (D), 593.
——Starters. By J. Anderson (D), 1038

*Indicates illustrated articles

Motors, electric (Cont.):
——Synchronous induction type. By Laurence H. A. Law (D), 342.
——Textile factory installation. By J. T. Randles (D), 93.
Moultrop, Irving Edwin, *1206.
Mueller, George H., 253.
Muilergren, Arthur L., 853.
Munger, Ernest L., 304.
Municipal ownership:
——Massachusetts utilities oppose bills that facilitate, 444.
——Publicity, constructive, helps defeat, *338.
Murchie, W. E., 1093.
Murray, John J., 104.
Murray, Thomas Edward, *516.
Murray, William Spencer, *1156.
Muscle Shoals (see Hydroelectric development).
Muth, A. J., 1093.

N

Nally, Edward, Julian, *466.
Naphtaly, L. S., 603.
National Association of Electrical Contractors and Dealers:
——Constitution, to take up proposed amendments to, 395.
——Constitution changed, 548.
——Costs and accounting takes up, 39.
——Massachusetts State Branch, annual convention, 145.
National Association of Railway and Utility Commissioners to meet in Detroit, 1136.
National Council of Lighting Fixture Manufacturers push standardization, 39.
National Electric Light Association:
——Class D members meet, 1090.
——Convention, annual:
  Atlantic City, 95.
  Accountants sessions, report of, *1022.
  Address by Carl D. Jackson; some post-war problems of the utilities, *1003.
  Address by Guy E. Tripp; The manufacturer, jobber and contractor-dealer, 1007.
  Aspects of the (editorial), 915.
  Business development of electrical—a symposium, 1005.
  "Canned speeches" at our conventions, the curse of. By "Kassandra," 888.
  Commercial sessions, report of, *1017.
  Committee appointments announced, 347.
  Editorial, 867.
  Electrical apparatus committed, report of, *1028.
  Exhibits, educational, 444.
  General Sessions, report of, *991.
  Hoover to address, 796.
  Large and enthusiastic, forseen by President Bump, *969.
  Parallel sessions, possibility of avoiding, needs reconsideration (editorial), 987.
  Prime movers committee report, *1033, correction by W. J. Canada, 1223.
  Program, tentative draft of, 797.
  Progress, co-operation and optimism mark (editorial), 987.
  Public policy committee report, 1001.
  Public relations sessions, report of, *1025.
  Technical sessions, report of, *1009.
  Transportation arrangements, 745.
  What will you do with it? (editorial), 985.
——Iowa Section's convention, program for, 1191, report, 1287.
——Meter committee to hold open meeting at Springfield, Ill., 249.
——"More business—better business" campaign, 49, 95, 445, 646, 848, editorials, 115, 417, 1055.
——Nebraska Section convention, 972.
——North Central Electric Association convention, 1239, report, 1287.
——Pacific Coast Electrical Association convention, report of, 1190, 1136.
——President Bump's optimistic forecast, 97.
——President Smith impressed with association work in the west, 1286.
——Reorganization plans, makes great progress in, 36.
——Section chairmen new, *1087.
——Southern electrical men and N. E. L. A. bureaus confer at New Orleans, 147.
National Electrical Code:
——Branch circuit rules, public hearing on underwriters', 600.
——Fire Protection Association to extend, 39.
——Radio equipment, proposed revision of rules on (D), 1233.
——Radio regulations modified, 898.
——600-watt rule public hearings on being held by N. F. P. A. committee, 847.
——Underwriters to facilitate investigation of new electrical products, 745.
——Western Inspectors recommend few changes in, 300.
National Electrical Safety Code:
——Editorial, 67.
——Overhead wire crossing specification, conference held on, 497.
——Sleet storm study gives no basis for changes in, 100.
National Fire Protection Association (see National Electrical Code).
New Jersey:
——Engineering firm launched with contracts valued at $7,500,000, p. 246.
——Governor, candidate for, proclaims utility plank, 1289.
——Public Service Corporation's [illegible] electric service expansion, 598.
New Jersey (Cont.):
——Public Service Electric Co.:
  Construction program, plans heavy, 849.
  Distribution system being converted to three-phase, four-wire, 499.
New Orleans:
——Negotiations, 50.
——Agreement reached by company and city officials, 798.
Newton (Iowa) municipal plant sold to utility company, 396.
New York City:
——Alternating-current development in, traced by F. W. Smith, 598.
——Edison Company's second annual electric vehicle show held, *699.
——Forty years of electric service in, to celebrate, 550.
——Municipal needs, recommends New York to build power plant to supply, 498.
——New York Electrical Society, four hundredth meeting of, 898.
——Signs, electric, barred from Fifth Avenue, 550.
——United Electric Light & Power Co., Hell Gate—a station of many features, *820.
——Utility companies show gains, 197, comment, 167.
New York State Committee on public utility information formed, 1236.
New York State water power act amended, 644, editorial, 667.
Nineteen twenty-one; a year of records, *6.
Non-employment (see Labor).
Norman, Earl E., 902.
Northwest Electric Light & Power Association's annual convention, report, 1188.
Norton, Prof. C. L., *1194.
Norway, use of metric system would help American engineering practice in. By Chr. Grassdal, 285.

O

Ohio:
——Electric Light Association program for Cedar Point convention, 972, 1290.
——Inductive interference, report avoids detailed rules on, 395.
——Overhead rules, adopts new, 696.
——Public Service Company purchases Mansfield and Ashland utilities, 500.
Oil (see also Fuel):
——Dielectric strength of, five hundred tests on the. By J. L. R. Hayden and W. N. Eddy, 382.
——Fuel, effects of sulphur in. By Allen F. Brewer (D), 193.
——Insulating, research on. By E. B. Wedmore (D), 93.
——Power production, for. By T. H. Dobson (D), 492.
——Qualities desirable for transformers and circuit breakers. By C. J. Rodman, *1271, comment, 1257.
——Sparkover voltages through. By W. S. Flight (D), 1133.
——Transformer, determination of water in. By J. E. Shrader, *174, comment, 169.
——Transformer, detecting moisture in. By L. H. Hardin, 734.
——Transformer, under low temperatures. By G. Brühlmann (D), 642.
——Transformers and oil switches, influence of low temperatures on mineral oils in (D), *893.
——Well, motor-driven, reduces monthly power cost from $1,800 to $253. By W. G. Taylor, *1226.
Oklahoma:
——Commission to adopt electric service rules, 396, 599.
——Utilities Association Convention, 50, 448, 547. Public relations discussed by, 547.
Olds, Charles Luther, 404.
Oregon, new city line extension rules for, 396.
Ore-locating device developed in Arizona, electrical. By G. M. Butler, 185.
O'Reilly, Andrew J., *103.
Osgood, Farley, *347.
Osgood, Harry W., 902.
Oshhima, Mitsuichi, 1046.
Ovens, electric:
——Baking bread, economies of, for. By Wirt Scott, *878.
——Challenge fuel-fired type (editorial), 368.
——Paint on light metal ware dried satisfactorily by. By J. W. Carpenter, *1076.
——Vulcanizing rubber, cost of, reduced by electric oven. By James W. Carpenter, 585.
Overton, S. B., 1047.

P

Pace, T. J., *1244.
Pacific Coast Electrical Association (see under N. E. L. A.).
Pacific Gas & Electric Company, vice presidents elected, four more, 298.
Parker, E. P., 976.
Parker, George F., *554.
Parsons, D. E., *853.
Patent convention, German:
——Protest raised by revival, 644.
——Not to be revived, 695.
——State department inclined to revive, 849.
——State department revives, 970.
Patent Office:
——American Engineering Council takes up conditions, 52.
——Paralysis: What it costs (editorial), 215.
——Bill near final stage, 295.
——Bill now awaits signature of president, 345.
——Pending bills, American Engineering Council denounces, 895.
Patents (see General Electric Co. and Lamps).
Patterson, W. H., *404.
Pauly, K. A., 976, *1094.
Pearson, C. H., 604.
Peaslee, W. D. A., 1142.
Peirson, C. H., 1142.
Pender, Dr. Harold, *303.
Pennock, W. F., 604.
Pennsylvania's industrial load, comment by C. S. Cook, 583.
Pettengill, Jr., H. J., 1046, 1142.
Phasing out with lamps. By R. McKinney, *388.
Philadelphia Electric Co.:
——Another 30,000 kw. for, to take care of anticipated business, 749.
——Bonds yielding 5.53 per cent, offers $7,500,000 in, 1085.
——Rates reduced, 700.
Pipe, ground, installed by use of piledriven. By George M. Miller, *385.
Pipe-thawing apparatus that limits current, portable, *586.
Plaisted, W. M., 1142.
Prichett, G. P., 1294.
Platinum in electrical apparatus, substitutes for, 530.
Plimpton, B. A., 1094, 1195.
Plows and plowing, electrical. By A. Delamarre D), 243, 1184.
Poles:
——Derrick pulls from 75 to 100 poles a day. By George M. Miller, *289.
——Joint-pole lines, maintaining, on "fifty-fifty" basis. By Fred H. Smith, *954, comment, 1059.
——Joint, use for over 5,000 volts, Connecticut commission to approve, 547.
——Labor-saving for wood yard. By R. A. Hammack, *87.
——Sockets to prevent butt rottings, concrete, *276.
——Specifications, changes necessary in. By P. O. Reyneau, 186.
——Steel plates protect, 635.
——Top dimensions of wooden, mean nothing (editorial), 1159.
Porcelain, electrical, research. By M. H. Hunt (D), 966.
Portland (Me.) company rules to end direct-current service, 499.
Power conference, world, 795.
Power factor:
——Correction and its relation to plant operation. By P. Vanderwaart (D), 48.
——Essen meeting of the V. D. E. in. By Matthias (D), 393, 442.
——Improvement. By M. Harlé (D), 892.
——Kva. basis favored for demand billing. By J. E. Doran, J. B. Hodtum and R. C. Fryer, 877, comment, 869.
——Metering, comparison of, favors kva. demand. By J. E. Doran, J. B. Hodtum and R. C. Fryer, *1216, comment, 1208.
Power plants (see Generating Stations).
Pfeif, G. H., 563.
Praitsching, Charles P., 204.
Pratt, J. M., 903.
Precipitation, electrical:
——Fume ion formation in. By Yasutiro Niwa (D), 443.
——Progress in, recent. By Evald Anderson (D), 394.
Price, Charles W., 203.
Price, F. W., 204.
Prince, Frederick W., *304, 854.
Proctor, John R., 975.
Production of electrical equipment and supplies, 1919, 1920 and 1921, page 40.
Prout, George R., 754.
Public relations:
——Advertising, building, on the foundation of a common interest, *1164.
——Boston Edison telling its story to the public, *1178.
——Central-station output a barometer of local industry. By G. E. Miller, *936, comment, 919.
——Clarinda, Iowa, demonstration of central-station service, *739.
——"Collier's" measures country's growth by progress of utilities, 339.
——Consideration of human element essential to best (editorial), 1058.
——Criticism of their company, preparing employees to meet unfair, 538.
——Customer contracts reduced to figures. By E. L. Milliken, *621, comment, 618.
——Customer relationship, improving. By Emmet N. Britton, 429.
——Customer, what a new, thinks the first day. By H. A. Lemmon, 127.
——Dayton company's service, showing what's back of, *439.
——"Family spirit" in the public utility. By H. A. Lemmon, 671.
——"Get together" meetings gain public support for utility, 192.
——House warming party for a new turbine, *539.
——Hydroelectric development value featured in company's advertising, *1129.
——Local interdependence of all electrical men. By William H. Atkins, 959.
——Louisville Gas & Electric entertains local electric club, *840.
——Meter, contest teaches public how to read electric, *141.
——New York state committee on public utility information formed, 1236.
——Pacific Gas & Electric makes itself a personality by advertising, *789.
——Pacific Power & Light builds good will with educational film, *1228.
——Public policy campaign based on local history, *689.
——Satisfied curiosity begets confidence (editorial), 1057.
——Secrecy, the curse of (editorial), 715.
——Selling the people our great public works (editorial), 718.

*Indicates illustrated articles

Public relations (Cont.)
——Service interruptions as an object lesson for customers, *738.
——Talking direct to the public. By W. P. Schwabe, *338.
——Testimonial to utility service, a real, 189.
——The way of understanding (editorial), 1155.
——Utility barometer curve sent to all business men. By E. P. Peck, *938, comment, 919.
——Utility service defined, 91.
Putnam, J. F., 803.
Pumps and pumping:
——Intake screen which can be raised for cleaning. By J. S. H. Wurtele, *238.
——Lubricating auxiliary pump automatic, for safe turbine operation. By J. F. Usener, *837.
——Oil well operations, electrical power the best for, 198.
Purchasing agents' organization proposed utility, 898.

Q

Quinn, K. T., 704.

R

Radio (see also Institute of Radio Engineers):
——Aerial resistances, investigation of transmitting. By T. L. Eckersley (D), 243.
——Amplification of weak alternating currents. By H. Barkhausen (D), 343, 966, 1133.
——Another notable development in (editorial), 1209.
——Antenna efficiency, improving. By M. B. West (D), 1084.
——Antenna generation, wave-length relations for progressive. By A. Powers (D), 194.
——Antennas, airships. By Algeri Marino (D), 1184.
——Antennas, ground resistance of. By A. Meissner (D), 143.
——Armstrong feed-back circuit patent upheld, 648.
——Aviation, service in. By P. Brenot (O), 1084.
——Bill introduced in house, 1235.
——Broadcasting over electric service circuits demonstrated, 645.
——Broadcasting over the wires (editorial), 765.
——Business of, the (editorial), 565.
——Calling apparatus. By L. Chauveau (D), 543.
——Carrfer current for interstation communication, 185.
——Carrier-current relay perfected, 1238, 1289.
——Central station company, possibilities in radio for the. By J. C. Martin, *673, comment, 667.
——Chicago to require permits for installations, 1240, comment, 1207.
——Compass, essentials of the. By Lieut. John E. Williams (D), 643.
——Conference recommendations for federal control, 897.
——Danger from amateur outfits, 1090.
——Demonstration of recent communication achievements, semi-popular, 199.
——Direction finder and its application to navigation. By F. A. Kolster and F. W. Dunmore (D), 343.
——Directional transmission of electromagnetic waves for navigational purposes. By J. Erskine-Murray and J. Robinson (D), 794.
——Earth's atmosphere, transmission of signals beyond the. By J. B. Whitehead, 186.
——Educational influence of (editorial), 868.
——Fad, what will be the outcome of the? (editorial), 717.
——Fire insurance and radio equipment, 1043.
——French fishing flat service on (D), 493.
——Generator of high-frequency current for measurement purposes, simple (D), 1133.
——Government wants curb on amateur radio telephony, 295.
——Great Britain's imperial wireless chain, (editorial), 618.
——Lamp socket can now replace antenna and battery, *1166, comment, 1158.
——Laws, President asks for $50,000 more for enforcement of, *497.
——Longer-distance communication, Is more power the only solution of? (editorial), 168.
——Manufacturing control, would investigate, 698.
——Marconi shows results with short waves in experiments, 1285.
——Mars, feasibility of communication to, questioned. By Charles Rettu, 85.
——N. E. C. regulations modified, 898.
——N. E. C. rules on equipment, proposed revision of (D), 1233.
——1921—a year of achievement in. By David Sarnoff, *29.
——Paris International Conference on, discussions of. By G. Vallauri (D), 844.
——Radiotelegraphy:
  Future of. By J. G. Quimby (D), 594.
  Great Britain commission's report on the "imperial wireless chain" (D), 594.
  High-speed. By A. C. T. Cusins (D), 493.
  Printing telegraph by radio. By R. A. Heissing (D), 293.
——Radio telephony:
  Avalon—Los Angeles toll circuit. By Clement, Ryan and Martin (D), 93.
  Government control, recommendations for, 545.
  Hoover calls conference to aid control of, 347.
Radio (see also Institute of Radio Engineers (Cont.):
  Influence of, the far-reaching (editorial), 119.
  Modulation control. By H. Yagi (D), 394.
  Operating asset, the radio telephone as an (editorial), 817.
  Shore-to-ship two-way conversation, demonstration of, 195.
  Telephone company to lease broadcasting service, 350.
  Tube operation of modulator. By E. S. Purington (D), 194.
  "Wired wireless" for creating good will, Squier on, 1071.
——Rectifier design, low voltage. By R. D. Duncan (D), 1038.
——Regulation conference opens in Washington, 446.
——Relay recorder for remote control by. By F. W. Dunmore (D), *1038.
——Reliability of, shown by broadcasting experience. By J. C. Martin, *927.
——Resistance centralization. By Edward Bennett and L. J. Peters (D), 643.
——Ships Paris and Lafayette, equipment of (D), 143.
——Show draws crowds, 498.
——Signals, visual and photographic device for recording. By Chas. A. Hoxie (D), 95.
——Station at Saigon, Indo China, high power (D), 1133.
——Super-regenerative circuit, amplification of 300,000 claimed for new, 1188.
——Terms and service to determine radio outlet discussed, 1137.
——Thermionic triode as rectifier. By E. B. Moullin and L. B. Turner (D), 1184.
——Time and position ascertained by, 83.
——Toulon and Tahiti, transmission of wireless signals between. By M. Guierre (D), 143.
——Transmission over long distances. By G. Malgorn (D), 1284.
——Triode, the grid potential of a, and its measurements. By T. Ono (D), 893.
——Tufts College has wireless college faculty, *1290.
——Vacuum tube, definition of the output of a. By G. Beauvais (D), 1233.
——Vacuum tube, disintegration of walls of, caused by positive ions. By H. P. Waran (D), 293.
——Vacuum tube, low-voltage rectifier design when employing the three-electrode. By R. D. Duncan (D), 693.
——Vacuum tube sender at Königswüsterhausen. By H. Thurn (D), 93.
——Waves from tube senders, shape and phase of. By E. Alberti and G. Zickner (D), 844.
Raber, W. F., 1093.
Railways, electric:
——British final report on electrification (D), 242.
——Cars for Chicago, two new type safety. By Charles Gordon (D), 193.
——Chilean problem and its solution. By David C. Hershberger (D), 343.
——Chilean railroad electrification (D), 142, 442.
——Chilean State, electrification of. By D. C. Hershberger (D), 1133.
——Cincinnati traction power system, modernizing (D), 142.
——Direct-current distribution, economies of. By L. P. Crecelius and V. B. Phillips (D), *1284.
——Disturbances, electric railway, and detection of passing electric trains by galvanometer. By E. S. Bieler (D), 743.
——Electrification developments (D), 47.
——Electrification, light railway equipment as a step toward (editorial), 669.
——Electrification of main-line railroads. By S. T. Dodd (D), 965.
——French place $8,000,000 in electrification contract, 1086.
——Gasoline-electric sets. By L. Pahin (D), 394.
——Geneva, new street cars for. By L. Pahin (D), 142.
——Heavy electric traction summary and forecast of (D), 394.
——Heavy traffic lines, electric traction on. By George Gibbs (D), 342.
——Illinois Central to electrify terminal at cost of $80,000,000, 897.
——Illinois Traction System, graphic records improve line maintenance (D), 292.
——Industrial plant, electrification of. By D. M. Petty (D), 1183.
——Italian electrification a record one in Europe, 745.
——Italian experience in electrification (editorial), 718.
——Italian single-phase road in the Brembana Valley. By C. Brodbeck (D), 1037.
——Italy: Mont Cenis road. By G. Hulschiner (D), 92.
——Klarälfvens road electrification. By E. Wist (D), 593.
——Lancaster-Morecambe-Heysham (D), 892.
——Locomotive design, recent progress in electric (D), 293.
——Locomotive drives, electric (D), 142.
——Locomotives, control equipment of Paulista. By P. W. Forsberg (D), 593.
——Locomotives, direct-current, regeneration, characteristic curves of. By C. A. Atwell (D), *692.
——Locomotives for Chilean State, passenger (D), 542.
——Locomotives, hydraulic transmission for electric. By Wittfeld (D), 492.
——Locomotives, selecting designs for electric. By A. W. Gibbs (D), 194.
Railways, electric (Cont.):
——Mexico, electrification in, 1085.
——Mittenwald road, overhead construction of the. By H. Westphal (D), 1083.
——Motors, heating of railway type, in service and on test, 381.
——Motors, modern, should supersede older types. By J. M. Hipple (D), 442.
——Motors, regenerative braking and single-phase commutator. By B. Nordfeldt (D), 1083.
——Motors, roller bearings for traction. By H. Mecke (D), 1183.
——Paulista direct-current 3,000-volt locomotives. By John A. Clarke, Jr. (D), 142.
——Rectifier for Swiss street railway, mercury arc (D), 642.
——Rotary converters with special reference to railway electrification. By F. P. Whitaker (D), 1037.
——St. Gotthard electrification (D), 492, 543.
——St. Gotthard road electrification. By K. Sachs (D), 843.
——Steel plant railroad electrification. By R. B. Gerhardt (D), 143.
——Terminal operation of an electrified. By L. E. Lynde (D), 1284.
——Third rail favored by Northwestern Pacific (D), 193.
——Third rail systems of the United States (D), 47.
——Transformation of three-phase current into direct current. By Fr. Kade and H. Kramer (D), 793.
Railroads:
——Economic function of the, the. By Herbert Hoover, 524, comment, 518.
——Shops, electric motor drive in. By Bertram S. Pero (D), 1133.
Rainsford, Ralph, *1046.
Randall, Harry, 1244.
Rankin, Henry P., 903.
Rates (see also Commission regulation and rulings and Court decisions):
——Applications, municipalities to have longer notice of rate increase, 901.
——Base in depopulated community, 552.
——Betterment and new business expenditure in relation to, 1092.
——Bill to enjoin rates fixed by municipality must allege them unreasonable, 102.
——Boston-Cleveland comparisons difficult, says Wallis, 145.
——California governor urges against increased utility, 350.
——California Railroad Commission orders emergency reductions, 894.
——Commission's, are prima facie lawful, 451.
——Commission's decision in specific use where discrimination was charged did not involve reasonableness of rate schedule, 502.
——Commissioners, railway and utility, champion fair rates, 39.
——Company-wide, 451.
——Confiscatory, not justifiable because of post-war readjustments, 702.
——Confusion would exist if commission were abolished, says McCardle, 495.
——Definite and certain, should be, 752.
——Deflation brings a rate problem. By W. W. Freeman, 25.
——Demand, under low load factor, 1242.
——Depreciation, how special conditions affect, 502.
——Discrimination against lighting customers condemned, 251.
——Discrimination between localities, 502.
——Discriminatory, unproductive of revenue, 251.
——Dual utility, fixing rates for, where there are no data to govern allocations, 202.
——Eight per cent return held sufficient, 974.
——Fair return but no more, utility entitled to, 752.
——Franchise value excluded in fixing rates—federal income tax, 1045.
——Franchise value in rate fixing, 402.
——Heating and cooking, 451.
——High, caused by hostile valuation of utilities, 840.
——Increase follows threat to discontinue service, 1141.
——Increase refused by court pending determination of appeal from commission ruling, 752.
——Indianapolis seeks lower, 1134.
——Line losses due to faulty construction should not be reflected in, 202.
——Los Angeles, electric light and power rates equalized in, 1135.
——Mercury suppression of the inverse current in. By C. Jotte (D), 1232.
——Milwaukee, reduction in, 502.
——Mine hoist motors service, 1292.
——Minnesota federal court on basis of valuation, 602.
——Municipal deviations criticised, 102.
——Municipality cannot increase contract rates deemed inadequate, 1092.
——Philadelphia Electric Co. reduces, 700.
——Potomac Company, decrease of 5 per cent. ordered for, 852.
——Pre-war unit of cost prices is unfair rate basis, 657.
——Prices of materials, declining, in their relation to, 502.
——Railroad rate reduction an expedient of doubtful value (editorial), 1107.
——Reduced because of inadequate service, 552.
——Reduced or property maintained, should rates be? (editorial), 267.
——Reproduction costs and the war period, 402.
——Right of the state to fix, the inalienable (editorial), 517.
——Rural, in overbuilt territory dilemma presented by, 702.
——Rural localities separate schedules for, condemned, 552.
——Rural reduction in, 1193.

*Indicates illustrated articles

Rates (see also Commission regulation and rulings and Court decisions (Cont.):
——Schedule effective through error, 1045.
——Service charge commission allows 10 per cent increase in lieu of, 251.
——Service quality as basis for, 402.
——Springfield (Ohio) dispute settled at informal conference, 1085, dispute not settled, after all, 1289.
——Street lighting is entitled to lower rate than other lighting business, 1292.
——Telluride Power Co granted increase 152
——Three different charges in rural service bill forbidden 1045
——Utah case, Supreme Court refuses to review, 799.
——Water rights as an element in valuation, 102.
——Wholesale, city of Redding, Cal. entitled to, 302
Rating, a machine, should express a definite limitation (editorial), 519, comments by Fred M. Kimball, 882, C. H. Roth, 882, Philip Chapin Jones, 1036.
Rating, temperature only one factor limiting. By Justin Lebovici, 733
Reactance coils, result of short-circuit tests on outdoor type. By A. F. Bang, *425, comment, 419.
Reading, R. S., 902, *1142.
Rectifiers:
——Europe used on a large scale in. By K. Bally (D), 1184.
——Mercury-vapor (D), 93.
Reddinger, I. R., 554.
Reed, Harrison P., *1047.
Regulation (see Commission regulation).
Reid, Harry, 902, *1093.
Relays:
——Radio-operated, gets enthusiastic attention at A. I. E. E. meeting, 796.
——Wave form affected by. By V H Todd *434.
Renkin, W. O., *554, 1047.
Research:
——Automatic stations, invites operators' suggestions for improving. By Chester Lichtenberg, 1274.
——Cooperation between universities and utilities. By Harris J. Ryan, 8.
——"Electrical World's" research section starting its sixth year (editorial), 718.
——Electrolysis, under way in the South. By H. S. Warren, 784.
——Impulse voltage on. By S Bekku and O Tanno (D), 1233.
——Men, maintain the supply of trained research (editorial), 1159.
——Physical, a widening interest in (editorial), 868
——"Must be sold!" By C E Skinner 690
——Past and future (editorial), 4.
——Scientific and industrial in progress and completed suggestions for research, 144 344 544 744 1039 1234
Reyneau, P. O., *853.
Rheostats, liquid, the design of. By W. Wilson (D), 794.
Rice, Richard H., *354.
Richards, Walter J., 104.
Richter, P. S., 704.
Robb, Alex. G., 103
Robert E. A. *975.
Roberts, Albert E., 604.
Robinson, Dwight Parker, *2.
Roentgen rays:
——Absorption of narrow beams. By P. W. Burbidge (D) 794
——Bulbs, polarization phenomena in X-ray. By S. Ratner (D), 594.
——Soft X-rays from arcs in gases and vapors, characteristic. By F. L. Mohler and Paul D. Foote (D), 543.
——Steel. X-Ray studies on the crystal structure of. By Arne Westgren and Gosta Phragmen (D), 1233.
Rural electric service:
——Connecticut town guarantees return on rural line extensions, 888.
——Distribution lines, construction considerations, 1276.
——Editorial, 917.
——Long spans for rural lines. By Paul P. Ashworth, 135.
——Problem must not be ignored (editorial), 318.
——Prospect of business from the farm. By G. C. Neff, 27.
——The opportunity. By G. C. Neff 949
——Wisconsin farm-owned lines show a deficit, 790.
Rushmore, David B., 976, *1243.
Russell, Herman, *703.
Russia, electrification of. By P. Gurewitsch (D), 342.

S

Safety (see accident prevention and electrical safety conference).
St. Lawrence River (see under Hydroelectric Development).
Salt River power, sale of, approval by Congressional Committee 1043
Sands, H. T., *1243.
Sanford, George W. 1094.
Saurman, Atlee B., 253.
Scanlon, J. Leo, *754.
Schluederberg, Carl G., *304, 1093.
Schneider, Charles F., 204.
Schuchardt, Rudolph Frederick, *1256.
Schussler, M. H., *604.
Schwabe, Walter P., 54.
Schwarting, W. W., 1142.
Scott, Rumsey W., *403, 553.
Scribner, Charles Ezra, *316.
Seattle (see Washington).
Seaver, Kenneth, 604.
Sengstock, F. F., 754.
Service outages, detailed analysis of, essential to greater reliability (editorial), 989.
Shafer, Don C., *1293.
Shahan, J. H., 1143.
Shaw, Herbert S., 154.
Shepard, Bert H., 604.
Shepard, E. R., 902.
Sheldon, Dr. Samuel, Memorial Fund. By T. C. Martin 384.
Shoemaker, R. W., 975.
Show, electrical:
——Chicago Heights contractors and central station stage successful, *241.
——Philadelphia to have big, 972.
——Providence six-day, draws 12,128 visitors, *639
——Salt Lake City plans, 1137.
——Spokane, Wash., cashing in on, 290.
——What's the matter with. By Earl E. Whitehorne, *728.
Skin effect (see cables).
Skinner C. E. *652
Skinner William E., 204.
Slate dielectric strength of. D. F. Miner (D), 794
Smith, Albert W., *103.
Smith, Frank W., *1293.
Smith, Horace B., 554.
Smith, Philip Seabury, 304.
Snow Norman L. 754.
Society for Electrical Development (see also Fires)
——Clearing house for association meeting dates, establishes, 549.
——Directors, new, elected, 1290.
——1921 review, 38.
——Our cliques in corners (editorial) 665.
——Publication schedule, 700.
Society for the Promotion of Engineering Education, Convention, 1137, 1288.
Sorsby, Paul C., 804.
Sound-proof partitions. By F. R. Watson (D), 1184.
Southard George H., *976.
Southern California Edison Company (see California)
Southern electrical men and N. E. L. A. bureaus confer at New Orleans, 147.
Southwestern convention, information committee formed at, 970.
Spain:
——Buitreras hydro-electric plant (D), 593.
——Seara hydro-electric plant. By J. Reyval (D) 692
Spencer, C. G., 1142.
Spooner, Charles W., *452.
Sprague, Frank J., *1243.
Squire, General George O., on "wired wireless" for creating good will, 1071.
Squire, Francis F., 1094.
Standardization:
——American Engineering Standards Committee elects officers, 448, report shows great progress, 849.
——Government and industry co-operate in, 550.
——Ideal procedure established for creating national standards (editorial), 568.
——Japan and Norway, national standardizing bodies organized in, 879.
——Survey of simplification needs to be conducted by standards committee, 1089.
——Thoughts on some. By E. W. Rice, Jr., 479.
Stannard, Clare N., *803.
Starkey, W. C., 104, *253.
Starr R. C., 403.
Statistics:
——Additions to systems during 1922 will total $324,016,000, p. *925, comment, 917.
——Barometer curve sent to all business men, Utica. By E. P. Peck, *938, comment, 919
——Business conditions in the electrical industry, on the upgrade. By R. M. Davis, *939.
——Census of electrical engineers and electricians 898
——Central station energy output and revenue: November, 1921, *230; December, *430; January, *630; February, *880; March, *1119.
——Central station output a barometer of local industry. By G. E. Miller, *936, comment, 919.
——Dwellings in the U. S. a survey of rural and urban, *688.
——Energy consumption by various types of consumers, 1116.
——Five systems with an output over 1,000,000 kw.-hr., 827, correction, 1114.
——Generators in central stations, rating of, totals 14,466,915 kw., *679, comment, 669
——Hydro-electric developments involve an expenditure of $150,000,000, p. *951.
——Indiana industries 60 per cent electrified. By Robert M. Davis, *321.
——Industrial power requirements, census data on 1919, p. 848.
——Manufactures, census of electrical, for 1919 analyzed, 776.
——Massachusetts, textile mills lead in industrial energy consumption in. By Robert M. Davis, *1267, comment, 1259.
——Output and revenue of central station companies for 1921, *21.
——Pennsylvania, industrial load in. Comment by C. S. Cook, 583.
——Production of electrical equipment and supplies during years 1919, 1920 and 1921, p. 40.
——Residential customers during 1921, more than 1,000,000 now *74 comment, 69.
——Residential lighting and industrial power customers will spend $1,454,000,000 for material and apparatus by 1927, p. *10
Steam generator, electric:
——Canadian paper company uses, *520.
——Of 25,000-kw. rating installed, 1090.
Steel (see mills, steel).
Steger, L. C., 404.
Sterne, William C., *975.
Stevens, H. R., 853.
Stinson, H. H., 1195.
Stitzer, A. B., *1195.
Stokers with 645 sq. ft. of grate area for Paris plant. By O. C. Sheldon, 533.
Stolley, F. W., 804.
Stovel, R. W., *54.
Straw, J. B., 54.
Street, Lockwood N., Prof., 853.
Street, Oscar Dickinson, *66.
Strothman, L. F., 1195.
Switzer, Edgar, 1294.
Strouse, William F., 1093.
Substations:
——Automatic:
Coal mine (D), 142.
Converter, Canadian (D), 92.
District advantage in distribution represented by. By Chester Lichtenberg, 683.
——Design, probabilities must be weighed in (editorial), 419.
——Outdoor, substantial, for light load centers. By S. F. Pearson, *1075.
——Outdoor, unusual bus. structure utilized for industrial. By T. H. Arnold, *287.
——Outdoor switching station double-deck, in Japan, *220.
——Pale-top, serves city distribution. By E. F. Pearson, *736.
——Radio Corporation of America Rocky Point station of. By M. M. Samuels, *680.
——Semi-automatic, serves coal mine load, *327.
——Transformer, flexible oil and water system for. By Walter H. Millan, *287.
Sullivan, Charles M., 604.
Sunny, B. F., *553.
Superpower:
——Atlantic Coast, survey advisory board soon to meet again, 345.
——Editorial, 67.
——Plants justify themselves in coal emergency, 645.
Swallow, Joseph G., 1046.
Sweden, Arctic Circle, generating electricity within the, 125.
Sweden, electrical development in. By Edy Velander, 1223
Sweezey, Robert O., 1046.
Switchboards, truck-type, supplanting permanent structures in new generating stations and substations, *570.
Switches:
——Disconnecting simpler, practice desired. By J. Allen Johnson, *125.
——Disconnecting, the effect of high currents on. By H. C. Louis and C. T. Sinclair (D), 1233.
——Oil, annunciator panel indicates which oil switch opens. By H. S. Rich, 337.
——Oil, emergency. By Manuel Rodriguez, 190.
——Rotary, operates satisfactorily on 17,000-volt line. By Paul P. Ashworth, *1277.
——Safety switch congress held at Pittsburgh, first, 298.
——Tie, defective, gives peculiar trouble on 66,000-volt line. By L. A. Fitts, 836.
——Time, compensates for varying time of dusk. By R. W. Cramer, 185.
Switzerland:
——Developments in, recent. By Stanley Parker Smith (D), 194.
——Interconnection to be made compulsory in, 199.
Swope, Gerard, *216.
Synchronous machines, asynchronous start of. By A. Böhn (D), 1182.
Synchroscope connections should be checked before using. By E. C. Soares, 484.

T

Tacoma (see Washington)
Talmage, Charles H., *704.
Tampa to put light and power wires underground, 696.
Tariff:
——Bill, 145.
——Laboratory glassware will not be placed on the free list, 1187.
——Lamp, proposed, brings lively Senate debate, 1135.
——Senate reports out elastic tariff with foreign valuation, 749.
——Valuation, American:
Chamber of Commerce members split even on 196
Senate opposed to, 845
Taxes:
——Electric utilities paid $5,800,000 federal taxes in 1919, p. 500.
——Franchise, abolition of, in New York is urged, 195.
——Government control means higher (editorial) 1257
——War tax burden to be balanced (editorial), 1157.
Taylor, S. H., 854.
Taylor, Thomas H., 854.
Telegraphy:
——Printing, applied to factories, banks, railroads, etc. By A. H. Reiber, 380.
——Printing systems applied to message traffic handling. By A. H. Reiber (D), 443.
——Submarine cable, practice. By T. Willard Milnor, *380.
——Submarine cable, transmission characteristics of. By John R. Carson and J. J. Gilbert (D), 48
Telephony:
——Automatic exchanges, economy of small. By M. Langer (D), *966.

*Indicates illustrated articles

Telephony (Cont.)
——Automatic exchanges obviating difficulties in use of Strowger. By C. McHenry (D), 394.
——Automatic systems, auxiliary features in. By W. Aitken (D), 93.
——Demonstration of recent communication achievements, semi popular, 199.
——Harmonics, filtering out of power circuits. By E. P. Peck, 285.
——Line work in the United States. By E. S. Byng (D), 543.
——Machine switching, transition from manual to, in large cities, *170.
——Receiver, mechanical action of sound produced by a. By K. Kurokawa (D), 493.
——Receiver with increased sound intensity. By G. Seibt (D), 794.
——Repeater, practical application of the. By H. S. Osborne (D), 1284.
——Rheinland telephone cable. By F. A. Buchholz (D), 743.
——Submerged cable, longest and most deeply. By W. H. Martin, G. A. Anderegg and B. W. Kendall, 380.
——Transmission through submarine cables. By A. Rosen (D), 243.
——Wired lines, eliminating hum on. By G. A. Iler, 433.
Tennessee power interests, merger of large, proposed, 749.
Termites invade California and destroy poles, crossarms and pins, *683, comment by B. A. Behrend, 1173.
Tests and testing:
——Board, compact, makes tests easy and economical. By J. G. Moojen, *1176.
——Distribution-transformer with ammeter satisfactory. By A. B. Cayo, *139.
Texas floods, interconnection proves value in, 897.
Thermionic emission, contact difference of potential and. By O. W. Richardson and F. S. Robertson (D), 1038.
Thompson, G. G., 104.
Thompson, H. M., 104.
Thompson, J. C., 452.
Thompson, Otis L., 1294.
Tideman, Henry, 803.
Tinker, Elisha A., 854.
Tolman, Dr. Richard C., 1244.
Torchio, Philip, *266.
Towers for river span of 1,390-ft. built from poles. By R. J. Andrus, *485.
Traction (see Railways).
Tractors (see Vehicles, electric).
Trade associations:
——Federal commission to regulate, would have, 795, comment, 767.
——Open-price association case, effort being made to reopen, 695.
——Ruling, informal, on what they may legally do, 349.
——Senate committee to hold hearings on, regulation, 845.
——The hobbles of fear are off (editorial), 365.
Trade and market conditions, domestic (see also Manufacturing and distributing).
——Basic industries, conditions in, 705.
——Bank clearings, 1296.
——Batteries, dry-cell, 755.
——Batteries, storage. By H. B. Gay, 43, also 605.
——Building (see Construction).
——Business, general conditions. By V. C. Bruce Wetmore, 42, also 155, 398, 1095, 1246.
——Cables, 42.
——Carbon products, 755.
——Collections and credits, 155, 355, 705, 1095, 1196, 1246.
——Conductor, armored, 555.
——Conduit, 155, 606, 805, 1196.
——Construction, 105, 356, 556, 755, 977, 1246.
——Control devices, 505, 705.
——Copper, 1296.
——Cost of living, 1196, 1246, 1296.
——Failures, business, 1196, *1295.
——Fans, 356, 856, 1246.
——Federal Trade Commission fire, "Pittsburgh Plus" under, 255.
——Flatirons, 606, 905.
——Flatirons, German, on sale here found defective, 756.
——Freight, 106, 1246, 1295.
——Fuses, 305.
——Heaters, 505.
——Heating devices (see also Hollow-ware), 41, 855.
——Hollow-ware, 105, 1295.
——Instruments, 806.
——Insulation, 855.
——Insulators, 205, 605, 905.
——Jobber, blow at, in Mennen decree of trade commission, 654.
——Jobbers, 1144.
——Jobbing, St. Louis, *205.
——Jobbing, southwestern. By J. L. Buchanan, 43.
——Lamps, 106, 655.
——Lamps, incandescent, business investigated by Lockwood committee, 97.
——Lighting, industrial, 805.
——Lighting, street, 806.
——Liquidate old accounts, strenuous efforts to, 454.
——Manufacturers', electrical, 1919 taxes amount to $19,306,429, p. 454.
——Motors. By W. A. Layman, 97, also 506, 904, 1095.
——Motors, fractional-horsepower, 904.
——New York City has shortest factory week in United States, 1295.
——1921: Electrical industry weathers hard year and now shows recovery, 55.
——Outlet boxes, 405.
——Pacific Coast business. By T. E. Bibbins, 42.
——Pins, lowest, 305.
——Platinum, 156.
——Poles, 205, 605, 977.
——Porcelain, electrical, 1048.
Trade and market conditions, domestic (see also Manufacturing and distributing) (Cont.)
——Radio telephone receiving sets, 254, 605, 856, 1048.
——Refractories, 1048.
——Refrigerating machinery, electric, 355.
——Resale situation, Beech Nut decision creates further confusion in, 105.
——Rocky Mountain business. By J. A. Kahn, 45.
——Sheet, electrical, 255, 977.
——Southeastern business. By Wm. Farr, 45.
——Southern business. By W. R. Herstein, 44.
——Stokers, 556, 755.
——Switchboards, 505.
——Switchgear, 105.
——Switches, safety, 306.
——Tax bill, 106.
——Towers, steel, 855.
——Trade commission attacks Douglas Fir Company alleging trade restraint, 1096.
——Transformers. By M. O. Troy, 45.
——Turbines, hydraulic. By Arnold Pfau, 41.
——Turbines, steam. By E. H. Smith, 41.
——Vacuum cleaner, 105.
——Vehicles, electric passenger, 254.
——Washing machines. By Enoch B. Seitz, 44, also 855.
——Wire, 42, 655, 1145.
——Wiring devices. By Frank V. Burton, 43, also 406, 756, 1296.
——Wiring material, 355, 706.
Trade and market conditions, Foreign:
——Brazil, 206.
——Canada's lamp imports, non-English-speaking countries sent 70 per cent of, 1295.
——Canadian lamp committee finds 40-watt size most widely used, *1245.
——Chile, Westinghouse Electric & Mfg. Co. starts 32 cars of apparatus to, 1246.
——China, strong German competition in, 506.
——European conditions that affect American electrical exporters. By Joseph McElroy, 3rd, and P. S. Smith, *1264, comment, 1257.
——Exports, electrical: December, 206, January, 555, February, 654, March, 904, April, 1144.
——Export business, the way it must be won. By E. W. Droosten, *791.
——Export trade a question of foreign exchange and hard work. By Joseph McElroy, 3rd, *391.
——Farm-lighting plants, 505.
——German deliveries uncertain, 356.
——German electrical exports, 306, 706, 783.
——German lamp bulb prices remarkably low, 405.
——Great Britain appliance market, how to exploit, 355.
——Great Britain, clotheswashers not yet popular in, 556.
——Great Britain; growing demand for American electrical appliances, 255.
——Great Britain shows interest in electrical apartments, 406.
——Imports, electrical, March, 805, April, 1096.
——Japanese electrical exports in 1918 and 1919, p. 254.
——Japanese 1918 and 1919 electrical imports largely from America, 305.
——Latin America and in Spain, market prospects for electric apparatus in. By Philip S. Smith, *724, comment, 717.
——Lighting articles duty causes protest by importers' association, 1196.
——1921 electrical exports, detailed figures for, 454.
——South America, outlook for wiring supplies in Spain and. By Philip Smith and A. H. Keleher, *831, comment, 818.
——Spain and South America, outlook for wiring supplies in. By Philip Smith and A. H. Keleher, *831, comment, 818.
——Spanish market, Germany outshining United States in, 156.
——Warning to exporters, a. By J. Klein, 491.
Trade relations (see also Public Relations):
——Central stations and contractor-dealers should pull together. By H. D. Stokes, 1178.
——Harmony, an experiment in building local. By A. M. Wilson, 1079.
Transformers:
——Auto—, reduce electric range service cost. By W. C. Heston, 487.
——Bank connections, two methods of checking. By Eustace C. Soares, *334, correction by Edward A. Gibbs, *1173.
——Copper fuses used for. By G. M. Hardy, *886.
——Current, investigations of. By H. W. Price and C. Kent Duff (D), 1084.
——Current, temperature and mechanical stresses in. By J. B. Gibbs and L. Dorfman, *221, comment, 219.
——Current—, use and construction of. By V. Candie (D), 594.
——Delta-connected, two voltages obtained from single bank of. By E. C. Soares, *1075.
——Distribution, operating on a temperature basis. By L. L. Elden, *626, comments, 619, 1109.
——Distribution, stored outdoor. By E. P. Smith, *187.
——Economic, the problem of the most. By J. Hak (D), 542.
——Furnace, mounted on truck to save running heavy loads. By Alfred L. Williams, *684.
——Electric Power Club preferred standards of, ratings, 1236.
——Inspection, reducing cost of (editorial), 469.
——Insulation breakdown, testing transformers in service for, 190.
——Magnetic flux distribution in. By Karl B. McEachron (D), 1283.
——Million-volt testing. By J. F. Peters (D), 1083.
Transformers (Cont.)
——Mounting lighting, in a corner saves space, *135.
——Moving heavy, geared truck permits, 588.
——Oil piping system, flexible hose used for, 687.
——Oil qualities desirable for. By C. J. Rodman, *1271, comment, 1257.
——Open-delta operation, economy of. By Merrill De Merit, *771, comment, 769.
——Pole top, new. By E. Lapp (D), 965.
——Power, care and operation of. By J. G. Corrin (D), 292.
——Propagation of traveling waves in. By H. Massing (D), 793.
——Repair work, factory methods applied to. By G. E. Decker, *121, comment, 119.
——Rotary trouble, reconnection for half voltage causes. By R. L. Rowlin, *334.
——Special, reconnected with increased capacity. By Alfred L. Williams, *1175.
——Standardized installations cost $125. By P. M. Hatch, *786.
——Temperature control of, needs further investigation (editorial), 1259.
——Thirty year old still in service, *132, correction. By V. Z. DeFerranti, 784.
——Three-phase from two phase in emergency, obtaining. By A. W. Lee, *286.
——Ventilation, forced, increases capacity 25 per cent, *190.
——Windings, prevention of transient voltage in. By J. Murray Weed, 378.
Transmission:
——Aerial span of 2,300 ft. in satisfactory service for nine years. By L. J. Moore, *535.
——Alternators, reaction of high-capacity lines upon. By J. Labouret (D), 242.
——Calculations, an example of transmission-line. By R. D. Evans and H. K. Sels (D), 442.
——Characteristics of circuits, electrical. By W. Nesbit (D), 92.
——Circuits, electrical characteristics of. By William Nesbit (D), XVII, 193.
——Conductors, single, in iron pipe found objectionable. By R. H. N. Lockyer, 187.
——Cost of 33,000-volt line is $1,757 per mile. By C. W. Otis, 1277.
——Costs of 22,000-volt and 13,000-volt lines, 88.
——Feeder capacity saving from increased. By. E. D. Knight, 186.
——Grounding chains burned at links, but carried short-circuit current. By Nelson Jones, 834.
——Grounds on, and the principle of superposition. By H. Ho (D), 1283.
——Higher voltage, in the west. By S. Barfoed, 31.
——Ice loadings on wires caused by sleet storm, abnormal. By S. P. Melville, *335.
——Industrial plants, power transmission in. By Kenneth M. Raynor (D), 492.
——Interconnection:
Advantages of, striking (editorial), 867.
Alternating-current power stations, of. By L. Romero and J. B. Palmer (D), 892.
Evolution of interconnected power lines and effect on utility regulation. By M. H. Aylesworth, 325, comment, 318.
Financial, engineering and commercial aspects of. By Samuel C. Moore, 191.
Great Britain, progress in, 572.
Massachusetts, important, expected in, 1289.
Michigan a leader in interconnection of hydro and steam plants. By Harry J. Burton and William W. Tefft, *328, comment, 318.
Michigan, 31 hydro and steam plants joined by 140 kv. lines in. By Harry J. Burton and William W. Tefft, *770.
Municipal plants seek advantage of, 444.
Small systems, of (editorial), 919.
Texas, advocated for, 1086.
Texas floods, proves value in, 897.
——Line hardware, high voltage. By Ch. Lavanchy (D), *48.
——Neutral, common grounded, for alternating- and direct-current systems, 788.
——100,000-volt lines through streets of Berlin, *120.
——Oregon-Arizona line, closing of last link in, 196.
——Outdoor versus indoor installations (editorial), 668.
——Overhead grounded wire, economic value of. By E. E. F. Creighton, *378.
——Overhead lines for medium voltage. By E. Guignard (D), 542.
——Overvoltage problem, present status of the. By J. Biermanns (D), 1182.
——Sleet, melting by short-circuiting transmission lines, 136.
——Steel-aluminum conductors for overhead lines. By G. Hiller (D), 393.
——30 degree turn, simple construction for, *685.
——Tower serves also as substation frame, *136.
——280,000 volts on Big Creek line, field tests of. By R. J. C. Wood, *277, comment, 268, correction, 882.
——Voltage regulation of long lines. By John J. H. Douglas, 831.
Treacy, John J., 353.
Trees, average cost of trimming or removing, is $1.84 each. By C. N. Harman, 1124.
Tripp, Guy E., 563.
Tri-State Water & Light Association of the Carolinas and Georgia, 648.
Trucks (see Vehicles, electric.)

*Indicates illustrated articles

Trumbull, Hugh, 853.
Tucker, Herbert M., 1244
Tulis, E. A., 754.
Turbine governors, adjustment of, 785.
Turbine, gas, commercialization of, would revolutionize power plants (editorial), 819
Turbines, hydraulic:
——Large installations. By W. Hahn (D), 1283.
——Reaction By D J McCormack (D), 242.
——Walchensee (Bavaria) plant, of the. By G Troeltsch (D), 92.
Turbine, mercury, Hartford has first commercial installation of 1186.
Turbines, steam:
——Blading, proportioning. By Harold M. Martin (D), 242, 692.
——Governor, pneumatic. By D. L. Barbour (D), 142.
——Interborough Rapid Transit Company's three-cylinder, 60,000 kw., fluctuating load carried with water rate of only 11 lb per kw hr. by, *420.
——Major troubles diminished, *77.
——Possibilities of the. By P. F. Coffin (D), 442.
——Size factor in (D), 1182.
——Water rate of 11 lb per kilowatt-hour developed by 60,000-kw. turbine, *486.

U

Underground:
——Circuits over railroad run in conduit under bridge sidewalk. By W. C. Blackwood, *534
——Current drainage, odd case of. By Carl Hering, *335. Comment by G. H. McKelway and reply by Carl Hering, 1274
——Development, indicating map used to show stage of 238
——80,000-volt cable being installed in Italy. By Philip Torchio, 76, comment, 68.
Unemployment (see labor.)
Utah manufacturers oppose adoption of lighting code at present time, 446.

V

Vacuum tubes (see Radio).
Valves, motor-operated steam:
——Closed under severe conditions, 249.
——Suggestions desired for test on, specific. By T. W. Stinson, 333.
——Tests of, emergency closing. By T. W. Stinson, *386.
Valves, triode, dynamic methods of determining constants of. By H. Yagi (D), 543.
Vandel, C. E., 1143
Vansize, W. B., 1195.
Van Tassel, George D. B., 304
Vaughan, Frank P., 1293.
Vehicles, electric:
——Chicago billboards to boost, *91.
——Electric transportation equipment equivalent to 500 men, *576.
——Express service, big order given for electric trucks for, 398.
——Factory transportation, analysis and control of By F A Pope (D), 293, 794.
——Freight transfer service and electric tractors (D), 143.
——Municipal purposes, for. By F. Ayton (D), 48.
——New Englanders get behind movement, *1191.
——Passenger and freight transfer in piers and warehouses By L. S Gatter (D), 965
——Plant production organized around a material-handling plan (D), 543.
——Operation cheaper than gasoline truck, 89.
——Show in New York City in April attracts many exhibitors, 550.
——Trucks, electric, for delivery use, economy of *529
——Trucks, electric, most desirable for ice-cream deliveries, 538
——Trucks for cargo handling. By G H Rae (D), 844.
Vehicles, electric (Cont.):
——Trucks, recent developments in accumulator. By Raymond J. Mitchell (D), 243.
——Why the vehicle waits (editorial), 1255.
Veit, C. B., 604.
Venable, Frank, 453.
Venezuela as field for electrical development. By Harry Chapin Plummer, 84.
Ventilating, electric. By W. T. Reace and G. C. Breidert (D), 793.
Vernon, H. A., 804.
Vernor, W. M., 453.
Vincent, Jr. W. G., *403.
Virginia, licensing of all electrical workers and utilities proposed in, 246.
Voltages on a three-wire direct-current system, regulating. By R. D. Archibald (D), 1232.

W

Wages (see Labor).
Waidner, Dr. Charles W., 554.
Wakefield, Mass., efficient operation of little avail in depreciated plant, 497, may sell municipal plant, 648.
Wakeman, James M., 1293.
Wales, George R., 854.
Waller, E. P., *1143.
Waller, Richard, 976
Wanneman, Charles R., *203.
Ward, G. G., 1294.
Washington state:
——Industrial lighting code proposed in, 971.
——Seattle and Tacoma city plants, connection of, proposed, 647.
——Seattle-Tacoma project for interchange of hydro-electricity, 1137.
——Seattle, terminal freight handled electrically at *320
——Water Power Company buys Intermountain Power Company, 1237.
Washington, George L., *604.
Wasser, O. E., 1046.
Waste, anti-, posters at Hartford, *487.
Water power (see also Hydroelectric development and Federal Power Commission):
——Austrian development of, 480.
——British Columbia (D), 142.
——Canada hydro-electric progress in, during 1921, p. 876.
——Canada, resources of. By J. T. Johnston (D), 1284.
——Development of small (editorial), 988.
——Dutch East Indies, hydro-electric possibilities in the (D), 1183.
——Figures on available, some startling (editorial), 417.
——Georgia operator scores state operation, 746.
——Great Britain resources committee report (D), 243.
——Italy, J. E., Aldred negotiates purchase of water powers in north, 1041.
——Maine fourth in developed, 274.
——Maine, opposition to state development of, growing, 745.
——New York state act amended, 644.
——New York state's rights in forest preserve, 100.
——New York water-power law, Governor Miller advocates amendment of, 49.
——Supreme court, wiping out state lines in water-power claims, sets up priority, 1237.
——United States, developed and potential water powers of the, *531, correction by Thorndike Saville, 883.
——Water Power League of America passes out of existence, 296, comment, 317.
——World-wide development. By A. H. Gibson (D), 143.
Waterwheel manufacturers merge, 596
Webster J. C., 1142.
Welch, Travis, 1094.
Welding (see also American Welding Society):
——Arc, increasing speed of. By H. R. Pennington (D), 443.
——Arc, metallic welding of manganese steel (D), 143.
——Automatic. By L. J. Steele and H Martin (D), 143.
——Automatic, "Cyc-Arc" process of By L. J. Steele and H. Martin (D), 594
——Glasses yellow or amber, best when welding By H. L. Umland, 1172.
Welding (see also American Welding Society) (Cont.):
——Locomotive boiler (D), 743.
——Manganese steel. By H. R. Pennington (D), 394.
——Motor generators, reduces cost of repairing, *885
——Safety rules for. By D. N. Louis, 485.
——Standards for testing welds, 1175.
——Steel construction, applied to. By A. T. Wall (D), 892.
——Wire specifications issued, 1278.
Western Association of Electrical Inspectors recommend few changes in National Electrical Code, 300.
Western New England Association of Electrical Inspectors discuss fuse ratings, 298.
Westinghouse, George, *228.
Westinghouse Electric & Mfg. Co. sales for the year of a hundred million, reports, 1088.
West Penn Power Company again expanding generating capacity, 397.
Wharton, Clifton, 976.
Whitefield, W. L., 803.
Whitney, Albert G., 453.
Whitsit, Lyle A., 703.
Widau, W. E., 1047.
Wiggin, Charles, 653.
Wilcox, F. E., 1143.
William, Horrace M., 754.
Williams, R. K., 1047.
Williams, S. B., 1194.
Winches, selecting gearing for. By J. A. Jackson (D), 1038.
Winding equipment, reconstruction of French. By John F. Perry (D), 194.
Windings, preventing transient voltage in. By J. Murray Weed (D), 442.
Wing, David 1293
Wire (see also Connectors):
——Copper-cadmium, for electrical transmission. By W. C. Smith (D), 92.
——Copper-cadmium, for electrical transmission. By W. C. Smith, *223.
——Copper, extreme sensitiveness of the action of reducing atmospheres upon heated. By T. S. Fuller (D), 643.
——Iron, versus copper as an electrical conductor By W E Rice 331, comment by F. M. Gillespie, 883.
——Overhead grounded, questions on the economic value of. By E. E. F. Creighton (D), 292.
——Cooling of, natural convective. By A. H. Davis (D), 693.
——Overhead crossing, conference called on uniform specifications, 244.
Wiring:
——Fireproofing liquid, station wiring adequately protected by. By S. C. Lindsay, *835.
——Offices and public buildings, making electricity more accessible in (D), 742.
——Residence, experience, 931.
Wisconsin:
——Electrical Association convention, 496.
——Storm, visited by severe sleet, 445.
——Utilities annual meeting plans, 96.
——Utilities Association formed, 647.
Wishon, A. E., 103.
Wolfe, N. A., 354.
Wood, Francis G., 1094.
Worcester, Edward, 154.

X

X-rays (see Roentgen rays).

Y

Young, Jr., Albert J., *204
Young Owen D., 1106, 1244.

Z

Zahr, V. A., 504.
Zimmerman H. W., *652.
Zinc, effects of inpurities on electrolytic. By G. D. Scholl (D), 1038.
Zinc, hydrogen overvoltage and current density in the electrodeposition of. By V. C. Tainton (D), 1184.
Zinsmeyer, E., 1143.

AUTHOR INDEX

ADDINSELL, H. M. How should the public utilities be financed, 941.
Andree, J. W. Operating interconnected hydro plants for best system economy *933
——Repair condenser circulating water pipe with concrete *1174
Andrus, R. J. Towers for 1,390-ft. river span built from poles *185
Apfel, P. F. An all-electric home, 235.
Aristides. Jobbers must do their part in co-operation with manufacturers, 584.
Arnold, T. H. Unusual bus structure utilized for industrial substation, *287.
Ashworth, Paul P. Long spans for rural lines, 135
——Rotary which operates satisfactorily on [illegible] *1277
Atherton C. A. Facts that determine sign legibility *[illegible]
Atkins William H. [illegible] interdependence of gas and electrical [illegible] 959
——Putting system operation on a higher plane *1219 comment 1208.
Aylesworth, M. H. Evolution of interconnected power lines and [illegible] on utility regulation, 325, comment, 318.
BANG, A. F. Result of short-circuit tests on outdoor type reactance coils, *425, comment, 419.
Barbera, A. A. Bolt eye and wiped joint facilitate the pulling of cables, *634
Barfoed, S. Higher voltage transmission in west, 31.
Barnes, Cyrus. Central-station executives should visit appliance factories, *789
Barrett Robert E Cost of automatic hydro-electric plant, 333
Barstow W. S. Sound financing the aim of utilities 7
Barton T. F. Suggests brush change and avoidance of the presence of oil, 385.
Bastian H. S. Generating power from waste, *373, comment, 369.
——Successful handling and storing of hogged fuel *1077
Bauhan, Alex. E. Systematic inspection scheme for preventing breakdown, *943, comment, 918.
Baum F. G. The true inwardness of Pacific Coast engineering, 584.
Beardsley, C. R. Closed-circuit ventilating system for cooling turbo-generator, *735.
Behrend, B. A. Destruction of wooden poles by insects, 1173.
Bell, H. H. Improved lighting system to be installed on Lincoln Highway, *731.
Bell, Louis. Concerning the light of other days, 46.
——Quick success must not be expected in electrical industry, 483.
——Rear-line circuits as a solution of surburban distribution, 633.
Bennett, C. E. Same wet and dry sparkover obtained with compensated impulse gap, *1065 comment, 1109, comment by Author, 1223.
Bernadin, F. M. Cash discount as a factor in distribution, 333.
Berresford, A. W. The electrical manufacturing industry, 428, comment, 418.
Bibbins, T. E. Conditions favor better Pacific Coast business, 42.
——The need of educating the public on quality wiring, 791.
Bickford, W. I. Some reasons for the excessive cost of distributing electrical supplies, 392.

*Indicates illustrated articles

Blackwood, W. C. Circuits over railroad run in conduit under bridge sidewalk. *534
Blakeslee, D. W. Method of obtaining most economical size of conductor. *1124
Bonsall, R. F. Baltimore system of leaving meters alive. *178
Britton, Emmet N. Improving customer relationship. 129
Broome, Frank H. Preparation necessary for tests on steam equipment. 236
Brown, M. M. Covering of cement used to protect conduit in coal bunker. 336
——Suggestions on rebabbitting bearings. 434
Bryant, W. C. Let the manufacturer, jobber and dealer stick to his trade. *340
Buchanan, J. L. Southwestern jobber expects improved demand. 43
Burton, Frank V. Analysis of 1922 wiring-device sales outlook. 43
Burton, H. J. Experience with carbon tetrachloride fire extinguishers. 189
——Precautions must be taken when using fire extinguishers. 535.
——The deadly kite. 46.
Burton, Harry J. and William W. Tefft. Michigan a leader in interconnection of hydro and steam plants. *328, comment. 318
——Thirty-one hydro and steam plants joined by 140-kv. lines in Michigan. *770
Bussman, H. T. The fuse problem common to all who make or sell appliances. 740.
Butler, G. M. Electrical ore-locating device developed in Arizona. 185.

CALDERWOOD, H. A. Preparing engineering students for the industry. 1074
Canada, W. J. Cost of operating diesel engines. 1223
Carpenter, James W. Adopting electric heat for baking japan on automobile fenders. 138.
——Electric oven reduces the cost of vulcanizing rubber. 585.
——Electric ovens dry paint on light metal ware satisfactorily. *1076.
Cayo, A. B. Distribution-transformer tests with ammeter are satisfactory. *139.
Channing, E. C. Peculiar behavior of rotary converters. 289, 837.
Chase, Frank W. The "electric fire" reporters make a double score. 733.
Clark, Le Roy. Why should we chase prices down the spiral? *1081.
Clarke, D. D. Phase rotation on two lines determined by static voltmeter. *337.
Collens, Clarence L., II. Economies as well as engineering considered. 1123
——Some economic phases of 40-degree and 50-degree ratings. 1115.
Cook, C. S. Industrial plant voltages in Pennsylvania. 583.
Cramer, R. W. Time switch compensates for varying time of dusk. 185.
Crouse, J. Robert. Hawthorne as an electrical prophet. 1172.
Cunningham, R. E. Termites invade California and destroy poles, cross arms and pins. *683, comment by B. A. Behrend. 1173.

DANIELS, F. H. Spare parts should be purchased from the original manufacturer. 591
Dauch, Alan S. 17.4 lb. of steel annealed per kilowatt-hour. *579, comment, 569.
Davis, Robert M. Business conditions in the electrical industry on the upgrade. *939.
——Indiana industries 60 per cent electrified. *321.
——Textile mills lead in industrial energy consumption in Massachusetts. *1267, comment. 1259.
Decker, G. E. Factory methods applied to transformer repair work. *121, comment. 119.
De Merit, Merrill. Economy of open-delta operation. *774, comment, 769.
Derry, H. W. By-products saved in lumber plant pay power bills and show a profit. 241.
Dixon, James. Erector's instructions for installing engine-type generators. 187.
——Installing engine-type generators with limited equipment. *437.
Doane, S. E. Review of lighting progress in 1921, p. 9.
Doran, J. E., J. B. Hodtum and R. C. Fryer. Kva. bases favored for demand billing. 877, comment, 869.
——Comparison of power factor metering favors kva. demand. *1216, comment, 1208.
Dorfman, L. (See J. B. Gibbs.)
Douglas, John F. H. Voltage regulation of long lines. 834.
Dows, Chester L. Non-ventilated units for lighting show increase in use. 387.
Droosten, E. W. The way that export business must be won. *791
Dwight, H. B. Bessel function for calculating skin effect. *964
Dyckerhoff, A. European practices tend toward greater economy. *421, comment, 469.

EDWARDS, H. S. Arrangement of meter terminals and links that facilitates testing. *636
Elden, L. L. Operating distribution transformers on a temperature basis. *626, comments, 619, 1109

FARR, WILLIAM. Outlook in Southeast interesting as well as excellent. 45
Feiker, F. M. What the Department of Commerce is doing for industry. 71, comment. 67
Ferguson, Samuel. Central station wage problem. 26
Ferree, E. C. Is high-tension outdoor metering always desirable? 737.
Ficklen, W. F. Against government interference. 783.
Fink, Colin G. Invention of drawn tungsten wire. 384.
Fiske, Haley. Utility securities as investments for life insurance companies. 1117.
Fitts, L. A. Defective tie switch gives peculiar trouble on 66,000-volt line. 836
Forsythe, W. E. Brightness of light sounds. 235
Fox, Gordon. Factors affecting installation of electric motors for hoistings. *171, comment, 168, correction, 584.
Freeman, W. W. Prices, turnover and expansion. 371.
——Process of deflation brings a rate problem. 25.
Fryer, R. C. (See J. E. Doran.)
Gallaugher, F. V. The right measure of "going value." 1223.

GAY, H. B. New and renewal storage battery business promising. 43.
Gerhardt, R. B. Economy of electricity recognized in steel plants. 28.
Gibbs, Edward A. Checking transformer connections. *1172.
——Insuring an exact brush fit. 785.
——Locating proper brush position with a voltmeter. 534.
Gibbs, J. B. and L. Dorfman. Temperature and mechanical stresses in current transformers. *221, comment, 219.
Gibson, W. R. Lead-covered 600,000 circ. mil cable span suspended by messenger. *288.
——Meter records checked by use of tags. *788.
Gilchrist, John F. Making purpose of utility sales clear to public. 24.
Gillespie, F. M. What is one man's meat is another's poison. 883.
Gillooly, Frank. Hasty station operation often results in accidents. *336
Gould, William. Open the central-station doors wider to new business. 960.
Grassoal, Chr. Use of metric system would help American engineering practice in Norway. 785.
Greenwood, C. E. Broadening the appeal of the electric home. 1228.
Gross, I. W. Ease of using illumination charts. *134.

HAGUE, CHARLES E. Load-dispatching system for working correct number of boilers. *88.
Hammack, R. A. Labor-saving pole yard. *87.
——Organization chart that correlates work. 238, correction, 584.
Hardin, L. H. Ready method of detecting moisture in transformer oil. 734.
Harding, C. Francis. School for electric metermen. 134.
Hardinge, Harlowe. Pulverizing Anthracite coal is practical and economical. 433.
Hardy, G. M. Copper fuses used for transformers. *886.
Hardy, N. G. Determining heat content of gases from oil-fired boilers. *137.
Harman, C. N. Average cost of trimming or removing trees is $1.84 each. 1124.
Hartmann, Thomas W. C. Electric drive and push-button control increase plant production. *787.
Harvey, N. J. Further comment on the jobber situation. 384.
Hatch, P. M. Standardized transformer installations cost $125. *786.
Heed, S. D. The story of the Cincinnati house-wiring campaign. 1068.
Henton, S. C. Adapting old types of watt-hour meters to safety entrance boxes. *236.
Hering, Carl. Odd case of underground-current drainage. *335. Comment by G. H. McKelway and reply by Carl Hering. 1274
Herstein, W. R. Outlook depressing in South. 44.
——Pioneering needs a balanced plan to make it pay. 341.
——The impossibility of jobber representation in every town. 842.
Herz, Alfred. Some grounding chains are inadequate. *177, comment, 169.
Heston, W. C. Electric range service cost reduced by auto-transformers. 487.
Higgins, D. D. Unstable operation of paralleled stations. 285
Hodtum, J. B. (See J. E. Doran.)
Hoffmann, Dan C. Current transformer used as phantom load for testing meters. *238.
Hogue, O. R. House-to-house appliance selling. *1128.
Holtz, F. C. Jewel inspection essential for proper meter operation. 1275.
Hoover, Herbert. The economic function of the railroads. 524, comment. 518
Hopper, D. C. Unit costs for estimating line extensions. 188.
Horton, A. J. (See F. L. Spindler.)
Houston, F. M. Central stations should be pacemakers in electrical merchandising. 539
Hughes, George A. Cost, slow turnover and excessive stock duplication. *140

ILER, G. A. Eliminating hum on telephone lines. 133
Insull, Samuel. Economics of the public utility business. 581, comment. 567
Ipsen, C. L. Costs of heat treated parts reduced to minimum by electric furnace. *1125

JACKSON, CARL D. Some postwar utility problems. *1003
Jameson, B. G. Still greater reliability the aim in station design. *32
Johnson, J. Allen. Simpler disconnecting switch practice desired. *125
Johnston, A. L. Safeguarding repair and construction work on electrical circuits. 685.
Jones, Nelson. Grounding chains burned at links, but carried short-circuit current. 834.
Jones, Philip Chapin. Forty-degree versus fifty-degree rating from an industrial engineers' viewpoint. 1036
Jones, T. I. How to balance reduced industrial demand. 26

KAHN, J. A. Hope for new year in Rocky Mountain business. 45
Karapetoff, Vladimir. Average value of an unsymmetrical alternating-current curve. *234.
Kassandra. Running a meeting-electrical or otherwise. 389
——The curse of "canned speeches" at our conventions. 888.
Keith, J. J. The relation of trade discount, turnover and profit. 1130.
Keleher, A. H. (See Philip Smith.)
Ketch, James M. Adapting standard reflectors and guards to new type of mill lamp. *1077.
Kimball, Fred M. Thinks viewpoint of editorial refreshing. 882.
King, H. M. Water-barrel lightning arresters give satisfactory service. *586.
Klein, Julius. A warning to exporters. 491.
Knight, E. D. Saving from increased feeder capacity. 186.

LANE, A. R. How insects attack cables in Canal Zone. *134
Lanphier, R. C. Developing the foreign market for electrical specialties. *540.
Lebovici, Justin. Temperature only one factor limiting rating. 733.
Lee, A. W. Obtaining three-phase from two-phase in emergency. *286.
Lee, Carl. Demand factor of coal mining motor loads. *233.
Lee, Louis R. Some economic engineering problems to think about. 957, comment. 918.
Lemmon, H. A. "Family spirit" in the public utility. 671.
——What a new customer thinks the first day. 127.
Lichtenberg, Chester. The automatic station represents distinct advance in distribution. 683.
——Invites operators' suggestions for improving automatic stations. 1274.
Lindsay, S. C. Station wiring adequately protected by fireproofing liquid. *835.
Little, W. Paxton. Accounting for construction projects. *1211, comment. 1209.
Litscher, Christian J. The need for organization in the radio business. 841.
Lockyer, R. H. N. Single conductors in iron pipe found objectionable. 187.
Loew, E. A. Limits of electric house heating. *623, comment. 619.
Loomie, L. S. Effect of cross-section on impedance of steel conductors. *884.
Louis, D. N. Safety rules for electric welding. 485.
Low, Willard W. Manufacturers should limit the number of representatives in territories. 491.
Lucke, Charles Edward. The safety, suitability and soundness of domestic appliances. 890.
Luke, G. E. Temperature rise of electric machines on intermittent duty. *1069, comment. 1059.

MANUFACTURER, A. Direct sales to dealer and good servicing the key to large appliance business. 641
Martin, J. C. Possibilities in radio for the central station company. *673, comment. 667.
——Reliability of radio shown by broadcasting experience. *997
Martin, T. C. Sheldon Memorial Fund. 384.
McCann, W. R. Improved design of heavy-duty 6,600-volt double bus. *1275.
McElroy, Joseph, 3rd. Export trade a question of foreign exchange and hard work. *391
McElroy, Joseph, 3rd and P. S. Smith. Conditions in Europe that affect American electrical exporters. *1264, comment. 1257.
McKelway, G. H. An odd case of underground current drainage. 1274.
McKinney, Ralph. Phasing out with lamps. *288
Melville, S. P. Abnormal ice loadings on transmission wires caused by sleet storm. *335.
Merrill, J. L. Slide connector table for correcting power factors of motors. 637
Middlemiss, George H. Water-tube type of arrester compares favorably with others. *838.

*Indicates illustrated articles

Millan, Walter H. Flexible oil and water system for transformer substation. *287.

Miller, G. E. Central-station output a barometer of local industry, *936, comment, 919

Miller, George M. Ground pipe installed by use of pile driver, *385

——Pole derrick pulls from 75 to 100 poles a day *289.

Miller, John H. Care of electrical instruments, 86

Milliken, E. L. Reducing customer contacts to figures *621 comment, 618.

Moojen, J. G. Compact test board makes tests easy and economical, *1176.

Moore, D. McFarlan Production of cold-light sources not over yet, 1223

Moore, L. J. Aerial span of 2,300 ft. in satisfactory service for nine years, *535.

Moore Samuel C. Financial, engineering and commercial aspects of interconnection, 191.

NEFF, G. C. Prospect of business from the farm 27

——The rural service apportunity 949.

North J. E. How to organize and conduct a "Home Electric" *475.

Norton, Charles F. 40-degree and 50-degree motor ratings, 1122.

OTIS, C. W. Cost of 33,000-volt transmission line is $1,757 per mile, 1277.

PAGE, ROY. Records of material in stock should be simple, *1170.

Paul, George F. Nails in soles of electric workers' shoes are suicidal, *135.

Pearson, E. F. Pole guards bar mischievous boys, *838.

——Pole-top substation that serves city distribution, *736.

——Substantial outdoor construction for light load centers, *1075.

Peck, E. P. Filtering harmonics out of power circuits, 285.

——Utica barometer curve sent to all business men *938 comment 919.

Peck, H. W. Chart for studying accuracy of large number of meters 337.

Perry, Allen M. Achievements in electrical equipment, *12.

Perry, E. H. Revolving chart cabinet for records, *387.

Petermam, L. C. Secondary construction of proved value, *1167, comment, 1159.

Pfau, Arnold Underlying factors favor hydraulic turbine business 41.

Pine, P. P. Warships use central-station service in San Diego 390.

Plummer, Harry Chapin. Venezuela as field for electrical development, 84.

Ponti, G. G. Italy's hydro-electric troubles are over, 964.

Powell, A. L. A field for greater co-operation between architect and engineer *180, comment, 169.

Powell E. B. Pulverized coal as power-plant fuel past trial stage, 273

Price, Frank S. Stabilizing the radio equipment market *1130

REID C. R. Finding way to start standby generators for power-factor correction, 686

——Starting generators for operation as synchoronous condensers 885.

Rettie, Charles. Feasibility of radio communication to Mars questioned, 85.

Reyneau, P. O. Changes necessary in pole specifications 186

Rice, E. W., Jr. Some thoughts on standardization 479

Rice W. E. Iron wire versus copper as an electrical conductor, 331.

Rich H. S. Annunciator panel indicates which oil switch opens, 337.

Ripley, C. M. Interpreting the corporation to the workers *1281.

Robertson, W. E. The influense of the Underwriters inspection on quality, *640.

Robinson, Lloyd N. Rudiments of hyperbolic functions should be discussed repeatedly 85

Rodman, C. J. Oil qualities desirable for transformers and circuit breakers, *1271, comment, 1257.

Rodriguez, Manuel. Unconventional but effective, 190.

Roth, C. H. Proper rating of motors rather a commercial than a engineering problem, 882.

Rowlin, R. L. Reconnection for half voltage causes rotary trouble, *334.

Rush, H. S. Standard transformer boosts series circuit voltage, *385.

Ryan, Harris J. Research co-operation between universities and utilities, 8.

SAMUELS, M. M. Safe, simple and compact construction, *680.

Sargent, Howard R. Waste elimination possible in electric wiring devices, *1180.

Sarnoff, David. Last year one of achievement in radio communication, *29.

Saville, Thorndike. North Carolina the fifth in developed water power, 883.

Scheffler, Frederick A. Powdered fuel in power plants, 1073.

Schmidt, Axel. German electrical exports, 783

Schwabe, W. P. On talking direct to the public, *338.

Scott, Wirt. Economies of electric ovens for baking bread, *878.

Selig, E. T. Give the consumer some consideration, 1122.

Semler, C. M. A problem confronting manufacturers of transmission-line materials, 341.

Sheldon, O. C. Stokers with 645 sq.ft. of grate area for Paris plant, 533.

Short, P. B. Furnace reactance requirements need consideration, *81, comment, 68.

Shrader, J. E. Determination of water in transformer oil, *174, comment, 169.

Seitz, Enoch B. Continued improvement in washing-machine sales expected, 44.

Sindeband, M. S. Carrier current for interstation communication, 185.

Sirmit, John A. Semi-outdoor hydro-electric plant with backwater suppressor, *1161, comment, 1158.

Skinner, C. E. Research must be "sold" 690

Smalley, M. F. Outdoor meter installations facilitated by standardizing construction, *536

Smith, E. P. Distribution transformers stored outdoors, *187.

Smith, Fred H. Maintaining joint-pole lines on "fifty-fifty" basis, *954.

Smith, Karl F. Definite temperature necessary in babbitt pouring, 886.

Smith Philip S. (See also Joseph McElroy, 3rd.) Market prospects for electric apparatus in Latin America and in Spain, *724, comment, 717.

Smith, Philip and A. H. Keleher. Outlook for wiring supplies in Spain and South America, *831, comment, 818.

Smith, W. C. Suitability of copper-cadmium wire for electrical transmission, *223.

Sniffin, E. H. Conditions more favorable for steam-turbine business, 41.

Soares, Eustace C. Simple insulation-testing apparatus with 6,000-volt range *288

——Synchroscope connections should be checked before using *484

——Testing installed generators to determine temperature ratings 388.

——Two methods of checking transformer bank-connections *334 correction by Edward A. Gibbs, *1173.

——Two voltages obtained from single bank of delta-connected transformers, *1075.

Spangler, F. L. and A. J. Horton. Fixed-resistor battery-charging method receiving more attention, *282.

Staley, M. L. Mental inertia must be overcome to establish metric system, 633.

Stickney, G. H. Demand for engines with commercial or executive ability, 533.

Stinson, T. W. Emergency closing tests of motor-operated valves, *386.

——Specific suggestions desired 333

Stokes, H. D. Central stations and contractor-dealers should pull together, 1178.

Storrow, J. W., Jr. Importance of familiarity with apparatus, 964.

Stratton, H. F. Overhead as a test of management, 1231.

Straugh, A. Utility view of commercial and industrial electric heating, 84

Street, O. D. The case for the electrical jobber, 271, comment, 269.

Strittmatter, R. J. The only way to sell appliances, *1230.

Suerth, Joseph. New circuit breakers replacing fuses reduce maintenance, *484.

TAYLOR, W. G. Motor-driven oil well reduces monthly power cost from $1,800 to $253, p. *1226.

Tefft, William W. (See Harry J. Burton.)

Thomas, H. R. Paralleling current transformer leads facilitates demand metering, *1227.

——Transportation and handling of standard meters, *1278.

Thomson, H. L. Scheduling departure of meters by portable truck saves time, 887.

Thomson, W. E. Excess air causes serious losses in boiler plants, *887.

——Proper care of boilers prevents water going into steam lines, *1224.

Tidd, George N. Utility outlook brightest in industry's history, 24.

Todd, V. H. Relays affected by wave form, *434.

Torchio, Philip. 80,000-volt cable being installed in Italy, 76, comment 68.

Tripp, Guy E. The manufacturer, jobber and contractor-dealer, *1007.

Troy, M. O. Better transformer sales expected in 1922, p. 45.

——Mass production important factor in future transformer prices, 1082.

Turpin, M. C. What will happen when the nickel-chromium patents expire? *490.

UNLAND, H. L. Yellow or amber glasses best when welding 1172

Usener, J. F. Automatic lubricating auxiliary pump for safe turbine operation, *837

VELANDER, EDY. Swedish engineers' opinion on lightning protection, 1036.

——Electrical development in Sweden, 1223.

——Tree stumps hogged for fuel, 333.

WAGNER, C. F. Current distribution in multi-conductor single-phase buses, *526, comment, 519.

Wagner, Herbert A. Engineering enrollment in harmony with economic conditions, 583.

Wakeman, H. R. Cost of outdoor metering equipment, 783.

Wardell, Fred. An answer to the question, "Who will sell electrical appliances?" *690.

Warren, H. S. Electrolysis research underway in the south, 784.

Weeks, H. E. Local selling of holding company stock, *521.

Westbrook, F. A. Cables for mining-locomotive gathering reels and cutting machines, 436.

——Park cable laid across marshland in shallow trench at low cost, *1174.

——Submarine cable laid across river by steam winch, *634.

Wetmore, V. C. Bruce. Hard work the key to business in 1922, p. 42.

Whitehead, J. B. No ground for fear, 483.

——Transmission of radio signals beyond the earth's atmosphere, 186.

Whitehorne, Earl E. A study of jobbers' sales and costs, 577, comment, 568.

——Business development—what it means to the central station, *921.

——The problems of the manufacturer and the jobber, 19.

——The use and future of the electrically-equipped furniture, *224.

——What's the matter with electric shows? *728.

Whiting, Percy H. How to put on a stock campaign, *779, comment, 769.

Williams, Alfred L. Furnace transformer mounted on truck to save running heavy leads, *684.

——Special transformers reconnected with increased capacity, *1175.

Williams, J. E. Coal pile fires and how to prevent them *1127.

Wilson, A. M. An experiment in building local harmony, 1079.

Wood, R. J. C. Field tests at 280,000 volts on Big Creek transmission line, *277, comment, 268, correction, 882.

Wurtele, J. S. H. Pump intake screen which can be raised for cleaning, *238.

*Indicates illustrated articles

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This Day of Promise

NO YEAR has ever dawned upon the world perhaps as like to that which followed on the birth of Christ as this new year we have before us now. With all the change that time has wrought, there is a striking parallel.

The generation that listened then with awe to those great tales of the bright star that stood above the manger of the babe was weary of unending war and sick of kings. The Roman Empire had taxed and ruled people to exhaustion. Hope had gone out of the hearts of humble folk and they prayed for a savior who could lead them out of bondage. They sought a temporal king and not the great creator of ideals who came. But it was the minds of men that needed the emancipation, more than their bodies, and the ideals of Christianity brought a great impulse to humanity that has carried the whole world out, up and on to where we stand today.

And here again we have a world weary of the agony of war and sick of kings and armies and borne down by the crushing burden of great navies that have sapped the wealth and strength and life of nations, the greatest, freest, most enlightened. And the wreck and devastation of a world war has this time brought about so staggering a demonstration of the curse and folly of it all that in every land with one accord men have stopped short and searched their hearts and minds and asked themselves why the old way need still endure. And they have sent their leaders on to Washington to find if possible an end to it.

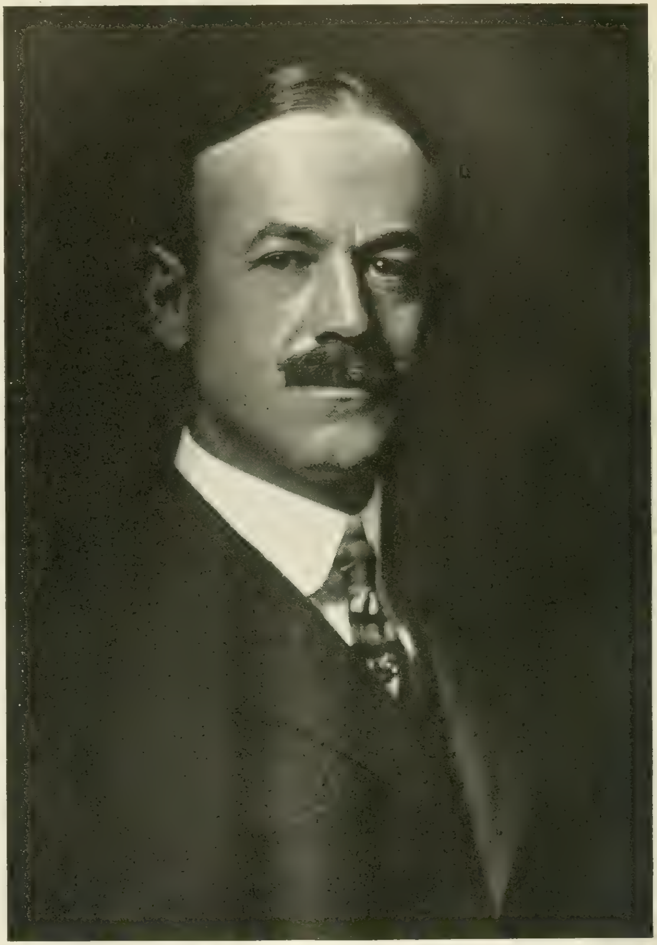
But we are not looking for a savior this time. Humanity no longer prays for a great king to lead it to some other life. Rather we reach and strive to grasp that power which will enable us to organize our own ideals into our living and to achieve salvation from these age-old evils from which we suffer by bringing reason, justice, truth and love out of their hiding places into our useful daily work.

The hope of it is that we possess this power, here and now. If we will but exert the spirit of determination, if we will but manfully maintain belief in our own works, we *can* adjust our governments and industries to our ideals. But the processes of evolution are orderly and slow. The leaders of the new era which we face today will be those men who will give guidance and interpretation as the freer, more courageous thinking of the masses conforms to the new spirit of these better times.

We are a fortunate generation, standing as we do in this great day of promise. We face an era of increasing material prosperity. And the world is setting itself to living its ideals. What a prospect!

Dwight Parker Robinson

Engineer of prominence, administrator of outstanding ability, organizer and president of one of the largest engineering and construction companies in the country.



IT IS generally conceded that the year now opening will bring in its course the beginning of the long-heralded boom in electric light and power plant construction. The water-power act is beginning to function, money is once more coming to a reasonable level, the power load is commencing to creep up, new customers are taking service, and costs of power equipment and building materials are being reduced. All these factors point to increased construction activity during 1922. Among those who will take a prominent part in the business of design and construction is Dwight P. Robinson, organizer and president of Dwight P. Robinson & Company, Inc., engineers and constructors, who possesses to a marked degree that rare combination of sound business judgment and engineering skill, and who has for more than thirty years been engaged in bringing large engineering and construction enterprises to completion with speed and economy.

Mr. Robinson was born in Boston, May 1, 1869. In 1890 he was graduated from Harvard and two years later from the Massachusetts Institute of Technology, where he obtained his electrical engineering education. After graduation he assisted in the mechanical engineering laboratory at the latter institution and in 1893 joined the organization of Stone & Webster. Within a few months he was placed in charge of the Chicago office, and in the following year constructed a power plant at Nashville, Tenn., for the Union Light & Power Company. From 1895 until 1903 he was engaged in operating different light and power properties under Stone & Webster management. The first two years he was general manager of the Cumberland Light & Power Company at Nashville, Tenn., and then for two years he was at Baltimore as general manager of the Edison Electric Illuminating Company. In 1899 he went to the Pacific Coast, where for four years he was with the Seattle Electric Company in charge of the light and power business and the development of the hydro-electric and steam-power supply of Seattle and adjacent cities.

In 1903 Mr. Robinson returned to Boston in charge of all engineering, and when the Stone & Webster Engineering Corporation was formed he was made president in charge of both engineering and construction activities. In 1912 he was admitted to partnership. During the period from 1912 to 1918 he had charge of notable hydro-electric developments at White River (Cal.), White Salmon (Wash.), Big Creek (Cal.), Falls Village (Conn.), Dundee Falls (Me.), Columbus (Ga.), and the reconstruction of the Hauser Lake dam in Montana, and also had charge of building steam stations at Seattle, Minneapolis, Boston (four), Buffalo, Bridgeport, Lowell, Houghton (Mich.), Savannah, Jacksonville, Tampa, Pensacola, Columbus, Dallas, Fort Worth, El Paso, Houston, Port Arthur, Pittsburgh, Seward (Pa.), Pittsfield, New Bedford and Bridgewater.

In 1918 Mr. Robinson gathered about him a staff of old associates and organized the firm of Dwight P. Robinson & Company, Inc., to carry on an engineering and construction business specializing in the design and construction of power stations and industrial plants. Among the first contracts of this company was one for the design and construction of the large Colfax power station for the Duquesne Light Company, where generating units of 60,000 kw. each were installed. The ultimate plant, which is designed to contain six such units, will be among the largest steam plants in the country. This plant was described in detail in the ELECTRICAL WORLD for April 12 and 16, 1921.

The company rapidly expanded, many contracts of various kinds were obtained, and the organization grew to large proportions. In 1920 Dwight P. Robinson & Company, Inc., absorbed Westinghouse, Church, Kerr & Company, Inc., by consolidation, resulting in one of the largest organizations of its kind in the world.

Editorial Comment

Electrical World, January 7, 1922

Volume 79 Number 1

Revival of the Industry During the New Year

THOSE who delight in post mortems may exercise their faculties in reflection upon the year that has passed. In virtually every business it was a lean period, marked by liquidation and with little in the way of notable scientific achievement to commend it. Historically it may loom great because of the efforts in the sphere of political action to secure essential and beneficial economic changes. But until the present world-wide discontent over social and economic conditions is also liquidated a return to prosperity and "normalcy" can scarcely be expected. The abundance of riches which we so suddenly acquired was due almost entirely to unprecedented exports to Europe. The conditions there are now more or less chaotic and in a state of flux. Petty wars rage. Non-employment and want abound. Statesmen busy themselves over questions of reparations and defensive alignments rather than in finding how to stem the financial crisis which threatens to overwhelm them. If we are to enjoy prosperity and world-wide peace, there must be stabilization in Europe. The Cannes conference on economics may help to hasten such a consummation. Certainly the Washington conference on limitation of armaments has served to reduce jealousies and fears, and it is within the range of reason to expect that money once expended for non-productive armaments when released for productive use will stimulate the revival of sound business conditions. At any rate, that is the fervent hope of all peoples and in this hope we place our confidence.

Recognized Economic Position of Electric Utilities

FOR the first time in its history the electric light and power industry has experienced the rigors of a severe industrial depression. In previous years hard times were hardly noticeable. The utilities were improving their systems and expanding so rapidly that until 1921 their history was one long succession of triumphs and achievements. At times so great were the demands for service that the utilities could not keep up with them. Last year, however, the central-station companies of the country ran into a major business depression and suffered a setback. Amazing it seems after the excellent record of over twenty years' standing in which the central-station output of energy doubled every five years; and yet it indicates not saturation—far from it—but the extent to which the electric utilities have established themselves as sources of power supply for the industrial world. While the economic position of the utilities is thus recognized, a stage has now been reached where it is essential to the industry's well-being that the electric light and power companies re-establish their commercial departments and put them actively at work canvassing for new business. A change for the better is impossible without some change in spirit and an immediate return to productive work. There must also be revived and applied the will to serve, for here and there may be heard menacing murmurings of state ownership. Except in very rare cases, this indicates a weakness in the defensive armor of the central stations, and if they are overcome they have but themselves to blame. They cannot afford to lose public support and good will, for aversion when it comes will find its own outlet for far-reaching change.

Broader National Viewpoint on Power Production Necessary

WHILE the trend of development continues along economic lines toward huge generating stations and wider and wider interconnection of systems, the time is ripe for a broader national viewpoint on power production and equipment and on their adequate and proper financing. We need leaders competent to take a long view and to think of what will probably happen because of what always has happened in like circumstances. The future power supply of the country must be dealt with on a stupendous scale, and future engineering must be as daring in conception as it is bold in execution. Standardization must also become more than a sentiment, it must be a reality. Experience and inventive genius henceforth must also travel more in harness, and to that end there should be the closest and frankest co-operation between the manufacturer and the central-station company. What form future engineering and commercial developments will take it is not hard to predict. It is the hope of every thoughtful engineer and executive that we shall soon have an industry stronger financially and economically, united in effort and purpose and determined to utilize to the utmost all of its combined skill and initiative. It is largely for the executive to determine whether future needs shall be built on the constantly shifting sands of expediency or on the solid rock of experience. If continued progress is to be ours, there must be within the electrical industry greater unity of purpose and action.

Promising Outlook for Improvement and Business Revival

THE bells that ring in 1922 should usher in a business revival that will develop gradually as the year progresses. Basic financial conditions are better than they were, and there is much solid ground now for optimism. The progress will be moderate, however, but steady. On this there appears to be very general agreement. In some aspects of trade further adjustments are looked for, making a brisk revival out of the question. Manufacturers and jobbers of electrical supplies may therefore take heart and be satisfied to plod along steadily and resolutely, confident that no general collapse of price is to be feared and that hard work will bring its reward.

Research—Past and Future

FOR progress in new developments due to electrical engineering research during the year just ended the palm is easily taken by the telephone, telegraph and radio fields. The bountiful yield of improved equipments and new methods from the adaptation to these services of the hot-cathode tube, together with the ready generation and control of high-frequency currents, is still in full flower. In the wire field multiplexing for both telegraph and telephone has been extended through the increased availability of high frequency and the development of suitable filters and kindred apparatus. By means of vacuum-tube relays and amplifiers and the facilities they offer for interchange with radio transmission both telegraphy and telephony have not only greatly extended their range but have increased notably in both flexibility and resource to meet special needs.

In the radio field recent attention has been attracted strongly to the increasing use of broadcasting telephone service. Simple and inexpensive equipment is on the market in great quantity and is being rapidly absorbed owing to the excellent broadcasting service from several stations installed at various points in Eastern states.

The improvement and construction of high-frequency alternating-current generators and their adaptation to long-distance radio goes on apace, and it is reported that a considerable number of these generators rated at 200 kw. are now in service. Noteworthy results in long-distance transmission are already reported from the beginnings of the larger international station now only partly installed on Long Island. Continuous-wave methods are replacing with good results, because of improvements in vacuum-tube generators and auxiliary equipment, the spark methods more commonly used on ships. The year has seen a number of new forms of vacuum tubes for use as detectors, relays, amplifiers and generators. One of the most conspicuous of these introduces the magnetic field as the controlling agent of the volume of electronic discharge, permitting the electrical separation of the receiving and relayed circuits.

While in the field of power transmission no revolutionary new methods have appeared as the result of research, nevertheless most important advances due to the active study of the possibilities of so-called superpower systems have been made. The suggestion of such a system for the Atlantic Coast has taken tangible shape through the report of the United States Geological Survey. Discussion on the Pacific Coast has dealt more particularly with the actual problems of transmission at 220 kv., proposed as a standard voltage.

Important progress has been made in several other directions. The question of high-voltage circuit breakers, their rating and performance, has received illuminating discussion, and it is known that an extensive series of comparative experimental studies has been made by joint co-operation of several important manufacturing companies. While the results of these experiments are not yet revealed, it is certain that they mean improvement and progress. High-voltage insulators are under constant investigation. The construction of transformers for extremely high voltages places a new instrument in the hands of those working for the improvement of insulators. The problem of built-up insulation, both for machines and for cables, has also had much light shed upon it during the year. This is one of the most difficult and obscure of all electrical engineering problems. The results attained are a clearer knowledge of the nature of the troubles which arise and of the directions in which the materials entering into the insulation must be improved.

Looking forward, the next year is certain to find further advance in all of the directions mentioned. We may expect a continuous extension of the new facilities in the radio field, a wider installation of automatic telephones and the development of printing telegraph methods. Already there are suggestions that the vacuum tube will advance into the power field. It will probably first appear as a rectifier. In the transmission field improvements in high-tension insulators may be expected with increased attention to the problem of lightning protection. Substantial results may also be expected from the several active research committees of the National Research Council, among which may be mentioned those on electric arc welding, resistance welding, electric insulation and core losses.

Trends in Our Trade and the Laws Which Bring Them

BUSINESS conditions generally throughout the world are in an active state of flux, and the electrical trade cannot escape the influence of the times. There are many changes in the making. For not only are men being called upon to readjust distorted economic relationships thrown out of balance by the war, but the very spirit and purpose of business and trade housecleaning and "straightening up" have focused close attention on many older situations where help has long been needed, although in the pleasures of prosperity the need has been disregarded.

One of the basic questions which call for thinking is the matter of the distribution of the two kinds of electrical goods—the staple wiring materials and the appliance specialties. At present jobbers are handling both, some giving their major energy and enterprise to one line, some to the other. Yet these two branches of the electrical trade are so different that it is inevitable that some wholesalers and some retailers are by temperament and inclination best equipped for specialty merchandising and some for the old-line business. And it will carry further than that. For the contractor will soon come into a larger opportunity in the wiring business. More houses must be wired and he must do it and the work of wiring must not be diverted by absorption in the details of appliance selling. This fact is going to influence a natural selection and perhaps a separation of these two classes of materials and work. And if it is necessary and desirable, it should be speeded and directed by a general policy of the industry that will guide each organization into the work that it is suited for.

Electrical men are also broadly recognizing more than ever before the importance of records and figures. We must all get further into costs as the basis of a more effective and protective regulation of credits and profits. Too much prosperity has been sacrificed in the electrical industry of recent years by misdirected selling. It is all right to talk of costs, however, and to reason in the abstract on the great need of knowing more of what it costs to manufacture, to distribute and to sell, but there is only one sure way to bring it all about. When the seller refuses to give credit to any man who cannot demonstrate to him by clear and proper records that he is not only solvent, but succeeding, a knowledge of costs will become automatic. And our business will be lifted out of the plane of competition for orders, too often at the lowest possible price, and established on the sensible basis where the seller is engaged in building up the largest possible clientele of prosperous customers who prefer to pay full price for quality and service.

Every man who functions in a trade must render some essential service if he is to be entitled to receive a profit. If he is permitted to add this profit to the cost of the goods, it must be because he actually does something to promote the fabrication or the distribution of those goods more economically than if it were done some other way. The trade owes him nothing except for service. He has no claim for consideration save as he pays his cost in a material benefit. Thus, for instance, the practice of making small factory shipments ordered through jobbers is extravagant and bad business. Fundamentally the jobber must function as a warehouser or he should not function at all.

These problems—and the question, for instance, of who is to be the ultimate outlet for electrical appliances, the electrical or the non-electrical merchant—are not to be settled by opinions. They will be settled by the facts. They are orderly developments in the growth of a young industry which will evolve in strict accordance with old economic laws. It need not be a mystery to electrical men what is to come. It need not bring expensive disappointments or upset painfully wrought plans. The laws which trade evolution follows may be studied, and the precedents of similar experience in other industries are easily to be found. Much can, and we feel certain will, be done this year in this way.

The New Year One of Opportunity for the Manufacturer

ONCE more the electrical industry is to know the joy of building. For a score and a half or more years the manufacturers, the utilities and the trade had put their shoulders to the wheel and by hard work and unflagging enthusiasm had brought the industry up to the point where in 1914 the manufactured output was valued at $335,170,000, of which $19,963,115 was exported, and the light and power companies sold 16,782,000,000 kilowatt-hours. And then the war came along. First the Russian and then the English and French munitions contracts, and finally in 1917 the war requirements of the United States, lifted the electrical industry like many others out of its peaceful stride, and without any effort on its own part the industry found itself years ahead of what it might have reasonably looked for had the world remained at peace.

As was naturally to be expected, a violent reaction followed such a tempestuous activity. Does it mean that we must wait for the number of years that the impetus of war pushed the industry ahead of its normal growth to come and go before we can once more go forward?

If electrical men are content to sit back and bewail and bemoan as so many have the past year—particularly manufacturers and jobbers—then we shall wait. On the other hand, if all have learned that it is only on some great occasion like a war that business floats in on a platter, then we shall go ahead at once.

For five years now there has been almost no real development work. Some larger units have come forth, but little real contribution to electrical devices and equipment. Here is the opportunity. Now is the time. The salvation of the industry must lie in work, and one of the best forms that we know of is constructive work. We urge the manufacturers to get busy and bring out new devices and improve their lines.

At the same time we urge that existing lines be standardized as to size, type and parts. There was a lot of this work done under war necessity. Since then there has been much talk but little accomplishment. If standards can be agreed on and effected in a few weeks during the war, then we must confess that we do not understand why so much time should be consumed now in coming to a sensible agreement.

When one looks at the hodgepodge of motor sizes and types, at the multiplicity of insulator patterns all in style, at the quantities of different supply parts a factory that happens to have motors of different manufacture must have on hand, at the years (it almost seems as though it was from the beginning of creation) of endless discussion on standard heating-appliance plugs and connectors, at the countless number of wiring supply devices, at the special this and the special that, the odd this and the odd that—when one considers all this all that he can really think is, what an awful waste!

Talking about waste leads us to another thought—knowledge of costs. If any manufacturer thinks that he can go through the competition ahead without knowing his costs, he is sadly mistaken. The Electrical Manufacturers' Council has developed an excellent cost-accounting system. We recommend its more general use.

More refinements are necessary in selling, and one of the most important is that of market analysis. Studies are being made by the larger manufacturers of all published statistics and sales reports to determine the extent and tendency of the market; to determine whether they are holding their own, going ahead or falling behind, and why; to determine which market or territory is likely to be most fruitful for immediate future development, and so forth. The smaller manufacturer should emulate his larger brother.

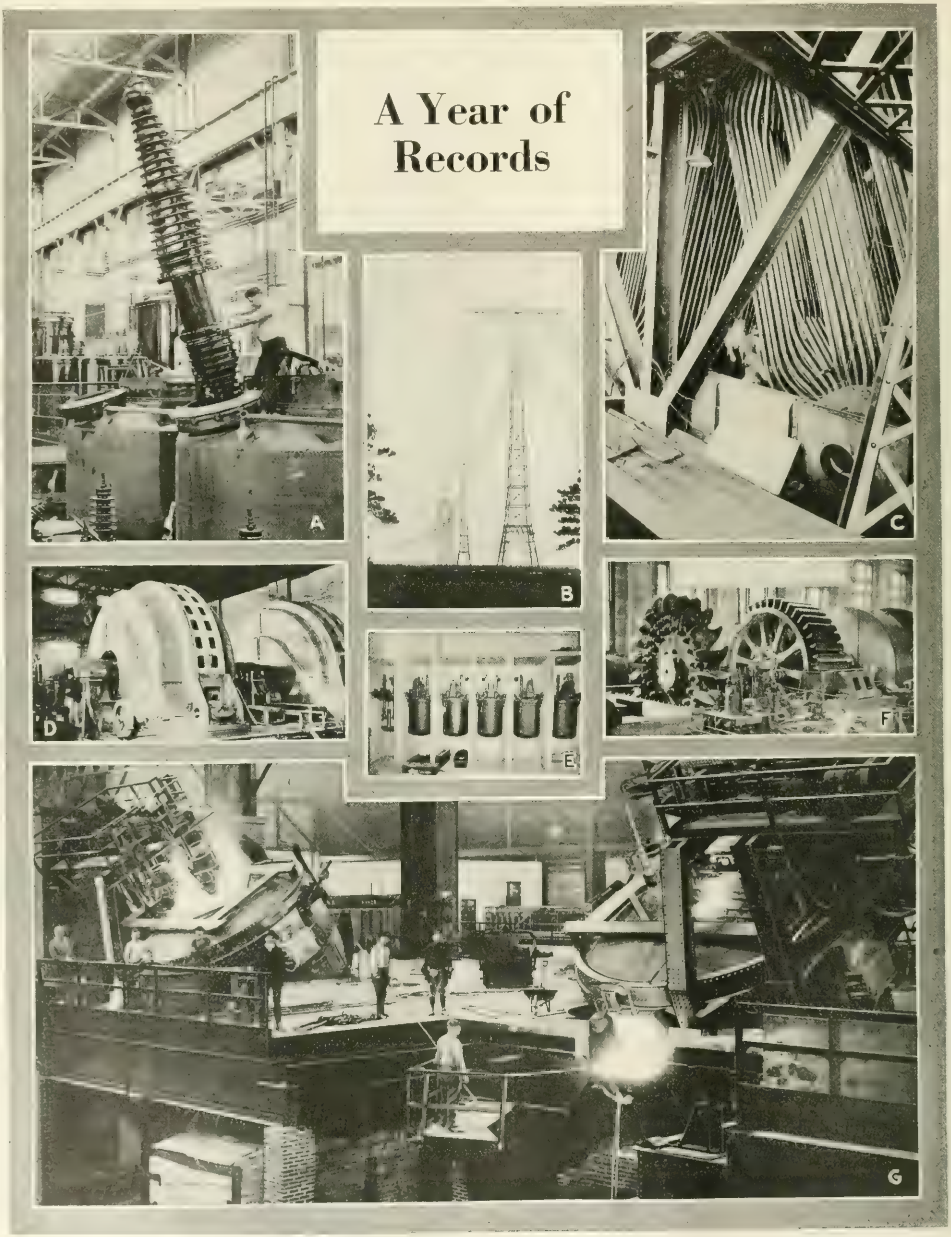
To do this studying, however, there should be more statistics available. For some reason which we have never been able to understand, the electrical manufacturer as a class is "statistics shy." This will probably wear off after a while, but in the meantime the smaller manufacturers are keeping themselves in the dark, to the advantage of the larger ones who are able to afford the money to dig out the facts.

There is also an export market to be developed. We have the surplus manufacturing capacity and the surplus money; Europe has the desire to buy but no money. The larger manufacturers can take some of these accounts and because of extensive financial background can carry them. We suggest to the smaller manufacturers that they obtain their share of this market by forming some kind of an export financing organization with sufficient credit rating to enable the participants to carry long-time accounts comfortably.

The electrical industry can look back with considerable pride upon the reasonable price advances that it made while others were profiteering. This, however, is no excuse for not liquidating prices as quickly as conditions warrant. Electrical manufacturers must make every effort possible to reduce costs.

We see the manufacturing group entering the new year in a spirit of determination and we are glad. Too much should not be expected at once. Constant plugging intelligently directed, however, will win the day. The new year is here, so, in the immortal words of the doughboy, "Let's go!"

A Year of Records



DEVELOPMENTS of the past year, while few, were for the most part superlative in character, the biggest this, the longest that and the largest something else. These illustrations are not all-inclusive, but indicate the bigness of 1921 achievements.

A—The 220,000-volt oil circuit breakers for the Southern California Edison Company have the largest terminal bushings ever supplied. B—Portion of the world's largest radio station at Rocky Point, Long Island. C—2,647-hp. boiler at the River Rouge plant of the Ford Motor Company. D—10,000-hp. frequency-changer set of the Consumers' Power Company. E—Circuit breakers for the Hell Gate plant of the United Electric Light & Power Company have the unprecedented rupturing capacity of 66,000 amp. at 13,200 volts. F—30,000-hp. impulse wheels at the Caribou station of the Great Western Power Company. G—40-ton furnaces of the Naval Ordnance Department, excelled in size only by the 60-ton furnaces being installed for the Ford Motor Company.

Sound Financing the Aim of Utilities

Continuous and Economical Financing Will Determine the Growth of Companies Fair Return Upon Investment Must Be Defined Bonded Debt Should Be Reduced to Half the Property Value

By W. S. BARSTOW
President W. S. Barstow & Company, New York

DURING 1922, and probably for a good many years after, the problems of the electric light and power utilities will to a large extent be financial ones. For those companies which have cleaned house, rearranged financial structures on a modern basis and freed themselves from the remnants of high finance, the problems will be greatly simplified. These problems, however, will never disappear as long as the law of supply and demand applies to money as it does to every other commodity. While, with an ever-progressing art, the methods of building up new physical properties will vary from time to time, the possibility of the continuous and economical financing of such properties will determine the extent of the growth of the industry.

There has been no time during the past thirty-five years when the demand for power has been so great as it will be in the very near future. To meet this the requirements of capital will be correspondingly great. This capital cannot be drawn from any special hidden source, but must be obtained in competition with industries of every description throughout the world. Such heavy financial requirements cannot be met unless public service commissions and utilities enter into a frank and honest understanding of the situation. It has no doubt up to the present time been necessary in many cases for commissions to pursue destructive tactics in order to compel the rearranging of financial structures created by methods of the past. But now that this has been accomplished in the majority of cases the public utilities are upon a more solid foundation than any other industry.

The time is approaching when with demonstrated efficiency of honest finance and management on the part of the utility, the future expansion will be largely in the hands of the lawmaker, who must handle the matter in a broad way and not in the manner dictated by present legal restrictions existing in many of the Eastern states.

If there was ever a time in the history of public utilities when optimism should exist, that time is now. The engineer whose attention in the past has been directed solely to the requirements of the physical structure is now with the exactness, honesty and broad vision of his profession devoting special thought to the financial part of the undertaking, so that the expansion for which he has so carefully planned may be realized.

GROWTH DEPENDS UPON CREDIT

The existence and growth of any utility depend not so much upon its physical property and its ability to furnish efficient service as upon its credit, without which it cannot even continue, much less extend, its operations. On this credit depends the entire future of power supply. Unfortunately very few commissions realize that the majority of their decisions do not tend to improve credit, so as properly to invite economical expansion, but, on the contrary, often restrict it so as to make such expansion impossible.

To allow a "fair return upon investment" sounds well, but means little, until a definition of "fair return" is reached. The growth of a utility is in a sense beyond its control, governed as it is by the development of the art in the hands of the public. A fair return is a fair return only when it can contribute to such growth by attracting from other fields added capital to the enterprise. It has been assumed, too readily perhaps, that a rate of return can be fixed definitely and that the law of supply and demand for money can be regulated by a single governing body. This theory alone is responsible for much of the high cost of financing. Almost all public service commissions have as part of their organization an efficient engineering staff, which spends weeks and months of effort in fixing valuations and rates and in settling details of operation, but generally to no purpose, as the desired result of placing the utility in a position for economical financing is rarely attained through these efforts.

CUSTOMER OWNERSHIP WILL INCREASE

It is this promiscuous fixing of rates of return on investment, without regard to financial conditions, that has tended to force utilities to increase their bonded debts to the breaking point, in an effort to preserve the properties, the rate so fixed often being suitable to the requirements of the lender but far below the needs of the owner. When commissions give as much time, thought and attention to the study of financial conditions as they now devote to engineering details, decisions will no doubt be more constructive. The extension of ownership of public utilities in local communities has done and will do much toward realization that rates which might satisfy the lender will not always meet the requirements of the owner or invite the increase of his interest in the enterprise.

The country-wide impetus that the local ownership plan has acquired will increase during the coming and successive years, until the local investor who is also the consumer, rather than the commission, will ultimately determine the proper rate of return. There have been in the past two distinct groups—the consumer and the investor—each demanding an advantage over the other, although each was a vital factor in the enterprise. With these groups united as they are in customer ownership, policies can be established which will result in fairness to both and which will permit not only the existence but the expansion of the industry. Future years may also develop along practical lines some well-defined plan to penalize the unprogressive utility, which has been known to enlist the aid of the commission in maintaining an obsolete plant giving inadequate service at the cost of the public.

But with the extension of local ownership only a fractional amount of the capital necessary for new extensions is provided, and it is in the obtaining of the larger portion that problems will arise. Commissions generally must realize that rates of return to be "fair" must result in improving the credit of the utility so as to attract the investment—not the loan—of new capital to it from other fields.

FINANCIAL STRUCTURE MUST BE KEPT BALANCED

In the meantime those directing the utilities must beware lest the lower cost of money, accompanied as it will be by many inducements to borrow as in the past, again render the financial structure unstable and cause much of the history of the past to be repeated. Permanent, economical financing is that secured through the owner and not through the lender, and this should be realized at every stage of the development. Many utilities cannot accomplish the change from bonded debt to ownership at once, but every effort should be made to reduce the former as nearly as possible to one-half the value of the property. This is an all-important factor in credit.

Opinions have recently been expressed as to the extent that bonds at a lower interest rate will be issued to refund the higher rate bonds now outstanding. Transactions of this kind will, of course, depend upon the decline of interest rates to a point which would warrant such refunding, and this, with European conditions as they are at present, is problematical. The present business depression, which may continue for a period, contributes to the decline because it relieves the money market of a large demand for new capital. The amount of refunding of bonds at a high interest rate, however, promises to be comparatively small. Whatever is undertaken in this direction will be accomplished gradually over a considerable period of time and, of course, being simply a substitution, will not diminish to any extent the amount of capital available for expansion of property.

As market conditions for the sale of stocks improve, and in fact when any opportunity is offered, every effort should be made to retire bonds bearing high interest by this means. Such financing is a permanent paying off of debt, which is not the case when the debt is refunded or the time of payment simply postponed.

PROVISIONS FOR FUTURE FINANCING

That the future public utility financial situation is brightening rapidly can be seen by the events of the past year. The adoption of non-par-stock laws in the majority of states has now made possible for the first time the proper extension of the ownership of the properties. Much has been done to contribute to economy through the definite establishing of the series mortgage, providing for constant expansion of that part of the financial structure in accordance with changes from time to time in the cost of money, just as provision for expansion is made when building a new power plant.

The appreciation by the commission and the management that if the service to the public is to be protected adequate reserves must be set up to this end has restored an important stabilizing factor. The electric power industry has long since broken the confines of state boundaries, and its expansion has become of national importance in economically developing industrial life. This must result in much more rapid demands for expansion than in the past, and economical and ready financing is the foundation for such expansion.

Research Co-operation Between Universities and Utilities

BY HARRIS J. RYAN
Professor of Electrical Engineering.
Leland Stanford, Jr., University

CO-OPERATION in research between universities and utilities had a small beginning a generation ago. The last five years have witnessed a rapid increase. Difficulties and problems encountered on the road to progress by men in the utilities must always be the concern of corresponding men in the universities. Able faculty men know that in all probability the cause of the non-solution of a practical problem is some lack of knowledge of the corresponding underlying principles involved.

In recent times these matters have been mutually understood within the utilities and the universities for the decided benefit of both. Faculty men are welcomed by utility men as comrades in effort for the benefit of all. This association is costing each group much valuable time. Nevertheless, the results obtained are abundantly worth it. The men have come to know one another better. The utility man has found where to look for possible help when trouble is encountered that he is unable to overcome, and the university man has learned to whom to go for information as to the lack of knowledge of fundamentals for which he may be responsible or in regard to which he can offer effective aid.

UNIVERSITY HELP MORE APPRECIATED

Owing to frequent misunderstandings, first results have often been disappointing, particularly in the newer branches of engineering. The faculty men in many instances have lacked first-hand knowledge and experience in engineering. Pioneer graduates were small in numbers and generally unwelcome as engineers in the industries until they had "found themselves" somehow through the "school of hard knocks."

The preparedness days and participation in the great war brought the two groups together in a strong mutual understanding and determination to work for victory. Since the close of the war they have continued their united effort in "reconstruction," taking up the problems that had to be set aside for the time being and solving the problems that have been defined by the vision of a more effective use of the nation's resources. Such vision took form in the national mind as a requisite for the maintenance of a sturdy, wholesome peace.

Corporations engaged in factory production are in a position to promulgate valuable researches in all matters wherein reimbursement can be accomplished by charges made upon resulting factory products. Rarely is this correspondingly the case for the utilities. Generally speaking, a difficulty overcome by one has been overcome for all without compensation for the one and without cost to the others.

Thus there exists a wide "no man's land," littered with difficulties in the way to progress that must be taken up gratuitously by the utilities. They are finding that they can do this best by securing the co-operation of all who will be benefited.

Research co-operation between universities and utilities rests upon the firm foundation of mutual interest. It cannot properly have a commercial foundation. In research the utility and the university contribute men and equipment according to convenience. The utility generally can afford and actually does meet the tangible expenses encountered. Researches that cannot be undertaken satisfactorily upon this basis are not considered suitable for co-operation. It is thus that research co-operation between universities and utilities has come to stay.

Review of Lighting Progress in 1921

BY S. E. DOANE
Chief Engineer National Lamp Works of General Electric Company

ONE appreciates, when reviewing the accomplishments of the year in any line, the appeal which the report of phenomenal developments or epoch-making achievements has to the reader. Such reports, however, are only possible occasionally. Their lack denotes no lack of progress.

The year has brought to the central-station companies a new appreciation of the lighting load. Had not the standard of illumination become better and the consequent lighting load increased, many companies would have found a hard situation to face in this present prolonged business slump.

NEW STORE EQUIPMENT

Illuminating engineering practice throughout the year has seen few changes in standards in any one of the general fields. Though the installing of new or revamped lighting in industrial plants was retarded, a number of plants have given thoughtful attention to their lighting designs. In the commercial lighting field, although expenditure for new equipment has been slow, the lighting requirements do not follow business conditions nearly so closely as in the industrial, and more sales effort has been directed toward this field during the past year. New units have been developed for store and office applications, the tendency being toward the use of totally inclosing units of either the direct or semi-indirect type, dustproof, and so constructed that the maintenance expense is minimized. New show-window lighting equipment has been developed within the year with which it is now possible to secure both color and spotlight effects.

Noteworthy advances have been recorded in sign lighting. The year has seen the introduction of new 25-watt and 50-watt vacuum-type sign lamps designed to bridge the gap between the old style low-wattage lamp and the high-wattage daylight and clear gas-filled lamps.

The problem of satisfactorily solving the automobile head-lighting problem and the increasing density of automobile traffic with its attendant toll of accidents have made the consideration of highway lighting imperative. Installations of a special highway lighting unit are being made in different localities.

Street-lighting practice has undergone no radical changes during the year. The result of one survey indicates that about 18 per cent of traffic accidents is due to poor illumination. As these considerations become established the demand will be for higher values of street illumination. Larger lamps are already listed, including the 15,000-lumen (1,500-cp.) and the 25,000-lumen (2,500-cp.) lamps. The rating of street series lamps has been changed from a candlepower to a lumen basis. The present system of nominal rating gives the candlepower as one-tenth of the lumen output. This nominal rating of candlepower will be dropped as soon as practicable.

Residence lighting in the past was left to develop much as it would of its own accord, owing to the imperative demands of other fields for directive effort. The home owner is dependent upon the fixture dealer, who heretofore has often considered pleasing design rather than the desirable illumination as the chief aim. Talk of "lighting effects" is becoming more general, and the tendency is toward more intelligent design to satisfy both the fixture manufacturer and the lighting engineer. A more directive effort is being made to obtain the proper application and use of lamps so that unwise combinations of lamp and fixture will before long be eliminated.

PROGRESS IN PURE SCIENCE

In the realm of pure science painstaking determinations of color, temperature and brightness relations of various illuminants have been reported. Work relative to illumination intensities and their relations to the working eye and upon speed of vision and other related factors has added guideposts to the path of illuminating engineering practice.

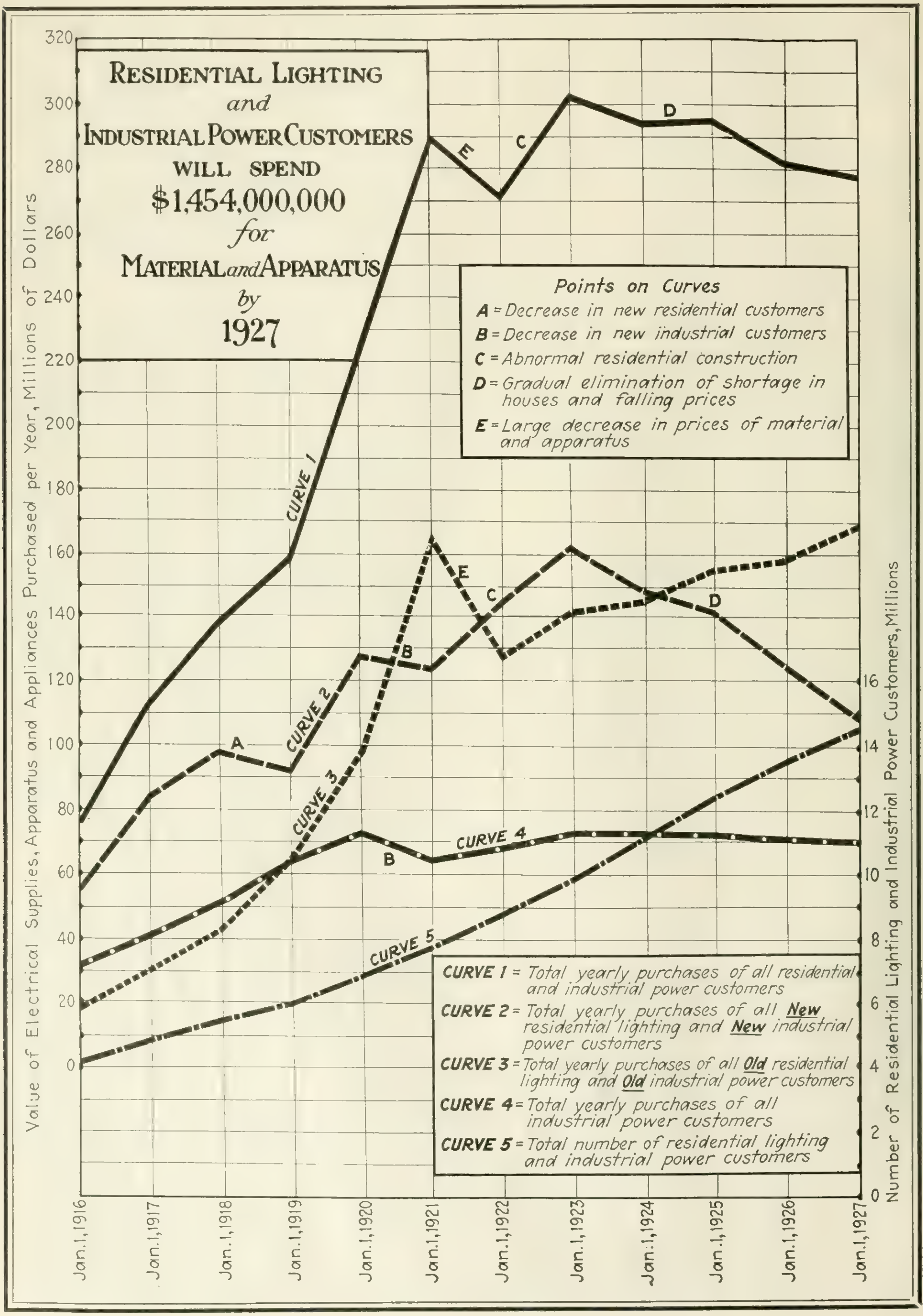
On Jan. 1, 1921, the photometry and testing of incandescent lamps was put on a new basis. Heretofore the efficiency of lamps was designated by watts per candle, which varied in magnitude with the inefficiency rather than with the efficiency. The new standard of lumens per watt is a direct measure of efficiency and conforms with the lumen ratings which have been published for several years. The institution of the lumen method of photometering has necessitated changing from the established method of rating vacuum lamps in terms of horizontal candlepower to a spherical basis, and a change of all large lamps to a lumen output basis. This change does not include miniature lamps.

A new method of evaluating lamp quality has been effected which is obviously fairer than the old method of establishing the useful life to the period where the candlepower depreciated to 80 per cent of the original. The new method considers three factors, namely, the whole life, the mean lumen output and the mean efficiency or mean lumens per watt.

LIGHT, NOT LAMPS, MUST BE SOLD

In the coming year one of the most important duties of the lighting industry will be to bring jobbers, contractor-dealers and central-station companies more closely together and bring home to them that electrical goods must be sold to the customer in terms of so much light and not as so many sockets, so much wire, so many lamps and so on. In the year just past a large number of lighting demonstrations, which are the best means of emphasizing the fact that it is light that is sold, have been installed in many cities, and this work will go on with increasing vigor. Wherever these demonstrations have been organized there has been an increase in the standard of lighting, expressed in terms of foot-candles, and a resultant increase in lighting load for central-station companies.

The important research work planned for 1922 has to do with determining even more accurately than now the number of foot-candles of light necessary for the best possible efficiency under various conditions. Tests of the relation of light to vision will continue, and it is hoped to discover additional material which will result in exact rules for good lighting.


RESIDENTIAL LIGHTING
and
INDUSTRIAL POWER CUSTOMERS
WILL SPEND
$1,454,000,000
for
MATERIAL and APPARATUS
by
1927
Points on Curves
A = Decrease in new residential customers
B = Decrease in new industrial customers
C = Abnormal residential construction
D = Gradual elimination of shortage in houses and falling prices
E = Large decrease in prices of material and apparatus
CURVE 1 = Total yearly purchases of all residential and industrial power customers
CURVE 2 = Total yearly purchases of all New residential lighting and New industrial power customers
CURVE 3 = Total yearly purchases of all Old residential lighting and Old industrial power customers
CURVE 4 = Total yearly purchases of all industrial power customers
CURVE 5 = Total number of residential lighting and industrial power customers
CURVE 1
CURVE 2
CURVE 3
CURVE 4
CURVE 5
A
B
B
C
C
D
D
E
E
Value of Electrical Supplies, Apparatus and Appliances Purchased per Year, Millions of Dollars
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Number of Residential Lighting and Industrial Power Customers, Millions
16
14
12
10
8
6
4
2
0
Jan.1,1916
Jan.1,1917
Jan.1,1918
Jan.1,1919
Jan.1,1920
Jan.1,1921
Jan.1,1922
Jan.1,1923
Jan.1,1924
Jan.1,1925
Jan.1,1926
Jan.1,1927

Value of Domestic Lighting and Power Customers as Purchasers of Electrical Supplies and Apparatus*

Residential Lighting Customers in United States, Jan. 1, 1915, to Jan. 1, 1922.

Year	Total Customers At End of Year	Increase During Year
1915	4,006,300	571,400
1916	4,626,400	620,100
1917	5,241,000	614,600
1918	5,744,800	503,800
1919	6,517,600	772,800
1920	7,465,900	948,300
1921	8,467,600	1,001,700

The number of residential lighting customers is based on surveys made by the ELECTRICAL WORLD in 1920 and 1921 in which complete reports were received from electric light and power companies representing about 65 per cent of the total installed generator rating of the country. The last two months of 1921 were estimated by the companies reporting.

Estimated Residential Customers in United States, Jan. 1, 1922, to Jan. 1, 1927.

Year	Total Customers At End of Year	Increase During Year	
		New Dwellings Wired	Old Dwellings Wired
1922	9,498,600	531,000	700,000
1923	10,677,600	479,000	700,000
1924	11,856,600	479,000	700,000
1925	12,915,600	359,000	700,000
1926	13,854,600	239,000	700,000

A recent survey by the *Building Age* indicates that the equivalent of 1,328,629 new houses is needed at once. It is assumed that this house shortage will be eliminated by 1927, in accordance with the following construction schedule: 30 per cent during 1922, 25 per cent during 1923, 25 per cent during 1924, 15 per cent during 1925, and 5 per cent during 1926. The census indicates that an average of 270,000 new dwellings are built per year to take care of increased population. On account of restricted immigration it is assumed that 200,000 houses per year will be constructed from 1921 to 1927. This figure must be added to the house shortage. It is assumed that 90 per cent of these new houses will be wired for electrical energy. The ELECTRICAL WORLD survey indicated that of the 1,001,700 new residential lighting customers during 1921, 700,000, or 70 per cent, could be classed as "old dwellings wired." It is assumed that 700,000 old dwellings will be wired each year from 1921 to 1927.

Estimated Potential Value of an Average Residential Lighting Customer as a Purchaser of Electrical Supplies and Appliances

Year	New Customer (First Year)		Old Customer (Per Year)
	Wiring and Fixtures	Appliances	
1915	$56.71	$5.74	$3.82
1916	78.37	7.13	4.75
1917	84.73	8.70	5.80
1918	87.75	12.40	8.47
1919	85.85	18.80	12.50
1920	93.00	30.70	20.40
1921	82.00	20.30	13.52
1922	77.00	19.30	13.30
1923	73.00	18.20	12.10
1924	68.30	17.30	11.53
1925	64.90	16.40	10.53
1926	61.60	15.60	10.40

Cost of wiring houses includes retail cost of wiring and fixtures only. Estimates for 1921 were obtained from twenty-five representative light and power companies for both house wiring and appliances and the average of those estimates was taken. House-wiring figures for 1915 to 1920 inclusive were obtained by a careful study of costs of wiring and fixtures, with due regard for weight of various items. Definite appliance figures were obtained for 1915, 1919, 1920 and 1921. Figures for 1916, 1917 and 1918 are estimated from a study of appliance manufactures. It is assumed that old customers will purchase per year appliances valued at two-thirds of the value of appliances purchased by new customers. While it is known that the prices of certain supplies have reached a low level, yet prices of other supplies and appliances will undoubtedly decrease further, and it is assumed, therefore, that subsequent to 1921 prices will fall at the average rate of 5 per cent per year.

Estimated Value of All Residential Lighting Customers as Purchasers of Electrical Supplies and Appliances

Year	New Customers	Old Customers	Total
1915	$35,650,000	$13,120,000	$48,770,000
1916	53,000,000	19,000,000	72,000,000
1917	56,500,000	26,850,000	83,350,000
1918	50,380,000	44,350,000	94,730,000
1919	80,750,000	71,800,000	152,550,000
1920	92,450,000	133,000,000	225,450,000
1921	102,330,000	101,000,000	203,330,000
1922	118,200,000	112,600,000	230,800,000
1923	107,400,000	114,900,000	222,300,000
1924	100,900,000	123,000,000	223,900,000
1925	86,100,000	125,000,000	211,100,000
1926	72,500,000	134,400,000	206,900,000

Potential Value of an Average Industrial Power Customer as a Purchaser of Electrical Supplies and Apparatus

Year	New Customer (First Year)		Old Customer (Per Year) (Per Installed Motor Hp.)
	Wiring, etc. (Per Installed Motor Hp.)	Motors and Apparatus (Per Installed Motor Hp.)	
1915	$ 8.66	$10.60	$1.10
1916	11.90	11.70	1.60
1917	13.00	13.50	2.10
1918	13.20	15.30	2.25
1919	13.40	16.70	2.30
1920	14.20	19.40	2.50
1921	12.50	16.50	2.00
1922	11.85	15.68	1.90
1923	11.26	14.90	1.81
1924	10.68	14.17	1.72
1925	10.13	13.48	1.63
1926	9.63	12.80	1.55

All unit costs for industrial plants are based on installed motor horsepower. Cost of wiring industrial plants includes retail cost of wiring materials and fixtures only. Estimates for 1921 were obtained from twenty representative light and power companies. Wiring figures for 1915 to 1920 were obtained in same manner as for residential lighting customers. Motor and apparatus figures are based on estimates received and cost of motors from 1915 to 1920. It is assumed that in 1921 old customers spent $2 per installed horsepower for supplies and repair materials, and figures prior to 1921 are based on price of fuses and wire.

Estimated Value of All Industrial Power Customers as Purchasers of Electrical Supplies and Apparatus

Year	New Customers	Old Customers	Total
1915	$20,200,000	$6,710,000	$26,910,000
1916	30,200,000	11,440,000	41,640,000
1917	38,200,000	17,700,000	55,900,000
1918	42,100,000	22,200,000	64,300,000
1919	47,400,000	26,500,000	73,900,000
1920	32,800,000	32,300,000	65,100,000
1921	41,000,000	27,800,000	68,800,000
1922	43,800,000	29,180,000	72,980,000
1923	42,250,000	30,680,000	72,930,000
1924	40,200,000	31,920,000	72,120,000
1925	38,120,000	32,850,000	70,970,000
1926	36,250,000	33,800,000	70,050,000

Summary of Value of All Residential Lighting and Industrial Power Customers as Purchasers of Supplies, Appliances and Apparatus from 1921 to 1927

Year	New Customers	Old Customers	Total
1922	$162,000,000	$141,780,000	$303,780,000
1923	149,650,000	145,580,000	295,230,000
1924	141,100,000	154,920,000	296,020,000
1925	124,220,000	157,850,000	282,070,000
1926	108,750,000	168,200,000	276,950,000

Total 1921 to 1927....................$1,454,050,000

*Figures do not include wiring and appliances for stores, hotels, theatres, halls, etc.

Achievements in Electrical Equipment

Past Year Witnessed Important Accomplishments in Design and Application—Records in Waterwheels, Oil Switches and Transformers—Redesign of Boilers—Extension of Automatic Control and Electric Heat Applications

By ALLEN M. PERRY
Engineering Editor ELECTRICAL WORLD

WHEN the business conditions of the past twelve months are borne in mind, the year is noteworthy as a period of marked development in electrical and closely allied equipment. A large number of manufacturers have reported new products or important improvements in existing equipment, but some are not yet ready to announce them publicly. There have also been diversified applications of existing equipment to new or relatively untouched fields. All of this indicates that electrical manufacturers have not been oblivious to the needs of the industry, nor have they been affected by the reluctance to carry on development work which characterized many other industries in 1921.

NEW RECORDS IN WATERWHEELS

As might be expected because of the increased interest in water-power development, high-tension transmission and continuity of service, the equipment which has been developed has been chiefly for these purposes. However, it has not been confined to these fields.

In the hydro-electric field the principal progress has been in the development of larger-size prime movers, higher-head reaction turbines, double-runner impulse wheels, high-speed propeller-type runners for low and medium heads, draft-head regainers, and a consideration of inverted turbine mountings with upward discharge. Prominent among reaction turbines are the 55,000-hp. wheels for the Hydro-Electric Power Commission of Ontario and the 40,000-hp. units for the Mount Shasta Power Corporation. The former, which are designed to operate under a head of 305 ft., were officially started on Dec. 28 last. The Mount Shasta wheels are designed to operate under 421-ft. head and are the largest high-head reaction turbines built so far. The two vertical-shaft 22,500-hp. Francis type turbines put in operation during the year at Kern River No. 3 by the Southern California Edison Company operate under an effective head of 806 ft., the highest attempted so far with this type of wheel. However, plans are now under way to install a still larger turbine for still higher head at Big Creek No. 3, rated at 35,000 hp. and 825-ft. head. By 1924 the Portland Railway & Light Company expects to have an 860-ft. head reaction wheel installed at its Oak Grove plant, the unit to be rated at 27,500 hp.

Two of the largest impulse-wheel-driven units in the world, rated at 30,000 hp. each and operated under 1,008 ft., were installed in the new Caribou station of the Great Western Power Company during the past year. These units consist of two overhung wheels mounted on each side of the generator. In the coming spring it is expected to install two 44,000-hp. impulse wheels operating under 2,495 ft. head in the Balch power house of the San Joaquin Light & Power Corporation, thus establishing a new record.

While a high-speed propeller-type runner for low and medium heads was available in 1920, another was developed during the past year. Owing to the relatively large diameters of these runners the outflow velocity is not excessive, and for that reason the runners can be applied not only to low heads but also to medium heads in the neighborhood of 60 ft. to 70 ft. without resulting in excessive draft head. As the head is increased the discharge velocity from the runner increases so that eventually these runners would have to be located at the tailwater level, or even below, to prevent excessive draft head. To avoid the inaccessibility and the costly excavation required for such construction, it has been suggested by one company that the turbine be inverted so that the water will discharge upward.

Advances have also been made in the past year in the design of draft tubes, for regaining the energy of discharge. Still another important development is the conduit spillway, one type being developed by the Alabama Power Company and the other by the Consumers' Power Company of Michigan.

REDESIGN OF BOILERS AND IMPROVEMENTS IN ECONOMIZERS

One of the most important changes in boilers has been the redesign of the Stirling type, which has made their manufacture a better shop proposition and adapted them to higher ratings without priming. The chief changes have been to raise the front and rear drums to the same elevation as the center drums and the transfer of the steam nozzle from the center to the rear drum. Furnace construction has also been improved by the development of a new bonding tile which prevents inward bulging of the furnace walls. The design of large coal-fired cross-drum boilers has been carried to the point where operating data have been obtained which will establish the general relations between heating surfaces, furnace volume and rate of fuel combustion giving maximum steam output with minimum slagging difficulties and deterioration of furnace brickwork. These relations and similar information about heavily loaded cross-drum boilers used with other fuels have been employed in designing large high-pressure boilers.

The designs of steel economizers have been improved so as to utilize the counterflow principle to better advantage. In one new type the tubes are connected to horizontal headers, the tubes leaving one header being pitched to enter the next higher header on the opposite side. Another type of economizer has also been designed to be installed as an integral part of each boiler. The pressure parts of this economizer are all steel, the feature being an exterior of cast-iron rings similar to those in a well-known type of superheater.

A very interesting development in superheaters is their adaptation to mounting in the combustion chamber, where they are exposed to the radiant heat of the furnace. This arrangement assures high superheat without change in the construction or baffling of the boiler, facilitates cleaning and inspection and imposes the minimum draft losses and pressure drop.

The largest multiple-retort underfeed stoker which has been developed has been installed during the past year at the Colfax plant of the Duquesne Light Company. In the field of powdered-coal combustion it is interesting to call attention to the recent installation at the River Rouge plant of the Ford Motor Company, where provision is made for burning gaseous, liquid or solid fuels in the same furnace, either simultaneously or separately. Blast-furnace gas is used as a basic fuel. When the supply is inadequate the fluctuations are made up with powdered fuel, tar being used occasionally.

Attention has been given to the electrical operation of high-pressure steam valves, one manufacturer having expended considerable money and time in determining the adaptability of various valves to such operation. To obtain more extensive data the prime movers committee of the National Electric Light Association is planning to conduct some extensive tests at the Essex plant of the Public Service Company of New Jersey.

Although there has been no increase in the size of steam turbines, it is interesting to point out that a second 70,000-kva. cross-compound turbine has been installed at the Colfax station of the Duquesne Light Company. Single-shaft turbines of 43,750-kva. (35,000 kw.) rating have also been installed during the past year, notably in the new Hell Gate station of the United Electric Light & Power Company, although there is no apparent tendency to go to higher ratings in such units.

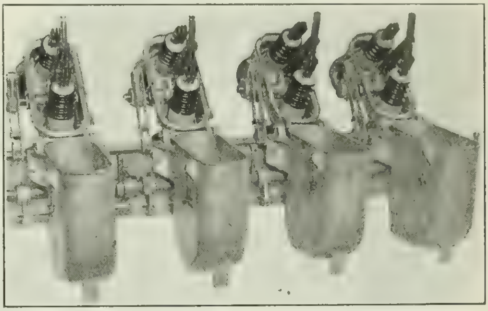
No marked development in turbine-driven generators has been reported, although there have been some advances in hydro-electric units. For instance three 45,000-kva. waterwheel generators have been installed for the Chippawa development of the Hydro-Electric Power Commission of Ontario and two 35,000-kva. generators for the Mount Shasta Power Corporation. The latter are rated at 11,000 volts, 60 cycles, 257 r.p.m., and have the distinction of being the largest 60-cycle waterwheel-driven generators that have yet been built.

Oil Switches of Unusual Voltage and Current Ratings

The building of generating stations of large capacity in the East and Middle West and the preparation for 220,000-volt transmission on the Pacific Coast have called for some marked developments in oil switches of unusual current and voltage-rupturing ability. For the Hell Gate station of the United Electric Light & Power Company oil circuit breakers have been built having a rupturing capacity of 66,000 amp. at 13,200 volts, this being the largest rupturing capacity for which switching equipment has so far been provided. In this station and the Calumet station of the Commonwealth Edison Company all phases are segregated to prevent the possibility of phase-to-phase short circuit. In the latter the switching equipment is mounted in tiers, the parts belonging to separate phases being in separate tiers. The lowermost equipment comprises the oil circuit-breakers, the middle section the disconnecting switches, and the top the main operating mechanism. Proper sequence in opening and closing is obtained by means of interlocks. In the Hell Gate station the arrangement is a little different. While the phases are still separated, the circuit breakers and corresponding interlocked disconnecting switches are on opposite sides of a wall, with the operating mechanisms on a floor above.

Excellent opportunity for the display of ingenuity has been afforded in the design of oil circuit breakers for the supervoltage lines on the Coast, among which are those of the Southern California Edison Company, the Pacific Gas & Electric Company and the Great Western Power Company. One manufacturer reports that the oil circuit breakers were built on standard lines, the only difference being in the general dimensions made necessary by the high voltage. The height of the 165,000-volt breakers from the bottom of the tank to the top of the bushings is 16 ft., the total length of the three units is 32 ft., and the weight of the complete apparatus is approximately 25 tons. The total weight of one make of 220,000-volt breakers with oil will be 202,000 lb.

Developments in breakers of smaller rupturing capacity have been made by another manufacturer, who reports four new types of breakers, including one having a maximum rupturing capacity of 12,000 amp. per phase at 15,000 volts and another intended for the control and protection of small motors up to and including 5 hp., 550 volts. The units are very compact, the first, according to the manufacturer, being small enough to fit into almost any cell formerly occupied by an oil circuit breaker having an interrupting capacity between 1,200 amp. and 2,000 amp. at 15,000. A feature which this manufacturer is embodying in new oil circuit breakers is the double tank with resilient support to absorb mechanical shock incident to rupturing of heavy short circuits. The secondary tank serves the purpose of a retainer for the hot oil which is spilled during short circuit and for the cooling of gases usually emitted under such conditions.

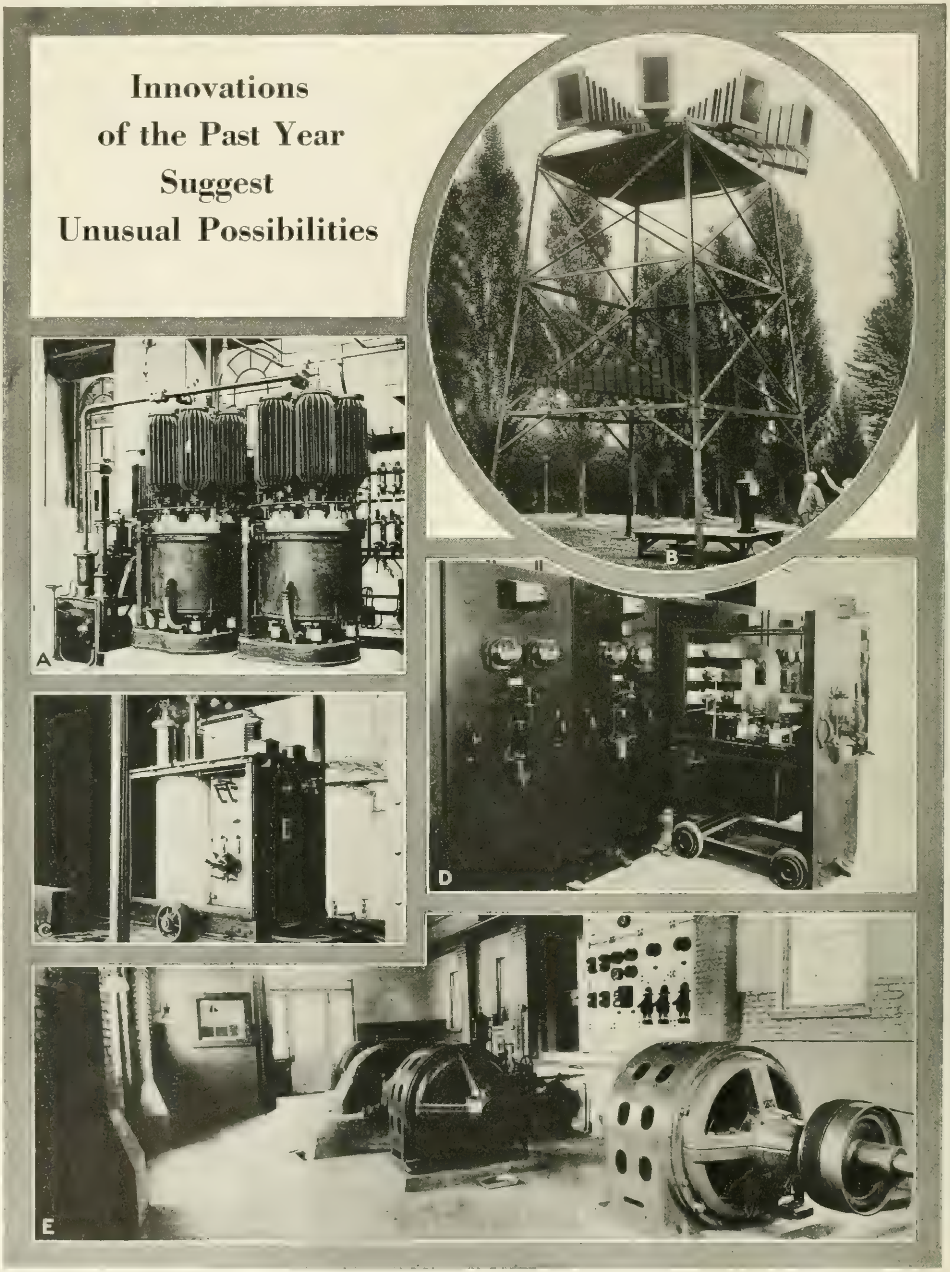


COMBINATION END BELL AND DISCONNECTING SWITCH

Although the truck-type switchboard has been used for several years in industrial plants and for primary service to large consumers, it is in the last year chiefly that it has been applied inside the electric service company's generating stations and substations. Notable among the installations are those of the United Electric Light & Power Company and the Hartford Electric Light Company. In these installations considerable benefit accrues through the compactness, reduced hazard to life, ease of inspection and reduced cost of installation. A distinctly new type of high-tension air-break switch has been placed on the market which, it is claimed, will break any possible ice formation and will not stick because of dust or corrosion.

During the past year one company has made available what is known as a mercury-type overload relay, as well as a phase-failure and phase-reversal device. Another company has developed apparatus for indicating phase sequence, which will be useful in metering and in power

Innovations of the Past Year Suggest Unusual Possibilities



ACHIEVEMENTS of 1921 have not been confined to establishing records in size and rating. Some have been along relatively new lines. A—Steel-clad mercury arc rectifier rated at 500 kw. B—Loud-speaking telephone capable of addressing entire population of United States if closely assembled. C—Kenotron for burning out cable faults, just one of its possible power applications. D—Truck-type switchboard being applied inside electric service companies' stations. E—Attendantless induction generator station.

circuit testings. The mercury-type overload relay consists of a heating coil surrounding a tube of mercury. The main line current is carried through the heating coil, and in case of overload sufficient heat is generated to cause the mercury to boil and open the circuit controlled. The phase-failure and phase-reversal device is somewhat similar in construction to the induction-type meter, but is so constructed that an interaction between fluxes and current of two magnets produces torque.

IMPROVEMENTS IN BUS INSULATORS AND DISCONNECTING SWITCHES

Several developments have been made in bus insulators and disconnecting switches, one company reporting that it has developed busbar and wire supports with universal interchangeable fittings. These units are furnished in three standard voltages—7,500, 15,000 and 25,000 volts. A single-post type of insulator that will withstand a cantilever test of 10,000 lb. was also designed to meet the exacting requirements of the 500,000-hp. station of the Hydro-Electric Commission of Ontario. Still another manufacturing company reports that it has designed extra-heavy unit-type busbar supports for stations of large capacity. Single insulators with a cantilever strength of 8,000 lb. are available, and three-unit supports with a cantilever strength of 20,000 lb. have been designed.

New types of locks for disconnecting switches have been designed on the basis of data obtained from tests made in a large power station in the East. Locks for strain-type disconnecting switches have been brought out which will allow the suspension insulators to vary 3 in. or more and still have a positive lock. This is extremely important where the insulators supporting the switch are subjected to extremes of temperature. For operation on circuits energized at 80,000 volts and above this company has also developed extremely rigid disconnecting switches by ruling one or more grooves along the switch blades, except at the extreme end where the blades make contact with the switch clips. In addition, it has developed two new lines of disconnecting switches which can be operated in three-phase units and locked either in an open or closed position. Furthermore, the switches are so flexible in mounting that they may be supported in the horizontal or a 45-deg. inclined position with overhead or underslung mounting.

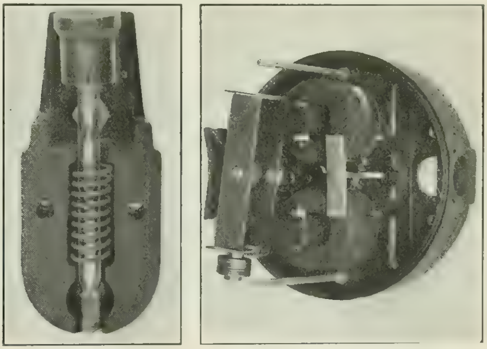
To operate any of the switches mentioned above the company has developed a motor-operated mechanism which can be controlled from the operator's office, where indications will be given of the position of the switch. In addition, the switch has the necessary safety lock to prevent accidental opening.

New types of top-connected end bells have been designed for installation outdoors with provision for easily connecting the leads to the bell without running the risk of water leaking into the bell and cable proper. As an addition to this line of apparatus, combination end-bell and disconnecting switches with the switches mounted integral with the end bell have been devised.

The latest type of lightning arrester brought to the attention of electric service companies is the flash-rod lightning arrester, which involves a porcelain tube covered with granular material that serves as a multigap of large capacity. The manufacturers claim that it has the same discharge capacity as the electrolytic lightning arrester and greater discharge capacity than the low equivalent or multi-gap arrester.

Transformer designs have kept pace with the increase in transmission voltages, units rated at 16,670 kva. and 220,000 volts having been developed for the Pacific Gas & Electric Company, and units rated at 8,333 kva. and 220,000 volts for the Southern California Edison Company. In addition, 23,600-kva. transformers have been installed for the Duquesne Light Company. The 16,667-kva. units are the largest high-voltage, single-phase transformers of the core type which have ever been constructed. Both these and the 8,333-kva. units, although designed by separate manufacturers, have cross-connected windings, with the line terminal in the middle of the coil stacks. This construction gives ample creepage distance to ground along the supporting and insulating cylinder and makes a saving in the height of the core. The methods of ventilating these transformers are also interesting, provisions being made for circulation of the oil through the cores. Another feature of these high-tension transformers is the method of insulating the windings. Means for externally changing tap connections inside transformers have been an additional improvement.

For lower-voltage circuits one manufacturing company reports that it has adopted a double magnetic circuit with elliptical coils for single-phase and three-phase units, this and other features giving greatly improved characteristics for distribution work. The entire winding, including high-tension and low-tension coils, is an integral structure, the contiguous part being cemented together to prevent disintegration of the insulation. In the three-phase units the use of the double magnetic circuit requires the use of five-legged cores, two being auxiliary legs having no windings. This company has also developed a rugged weatherproof positive-acting service for indicating overload. This can be placed in the cover or the side of the transformer. It gives its signal by the relative displacement of two indicating fingers so that the previous condition of the transformer may be detected from the ground. Several other overload indicators have also been developed.



MERCURY TYPE OVERLOAD RELAY AND PHASE-FAILURE OR PHASE REVERSAL RELAY

Few manufacturers are willing to announce the methods which they have followed for adapting insulators to supervoltage lines, but in general the methods involve the use of combined arcing and grading rings. These devices materially improve the voltage distribution of the insulator ring as well as protect it from damage by arcs in case of arc-over. A new manufacturer in the insulator field has developed some insulators on the basis that a definite relation should exist between the dimensions of various insulators for different voltages.

The extension of high-voltage transmission, accompanied by the necessity for improved voltage regulation, has resulted in the extended application of synchronous condensers of considerable size, among which may be mentioned the 20,000-kva. units for the Pacific Gas & Electric Company.

AUTOMATIC STATION AND SUBSTATION CONTROL

While automatic control has been employed for several years in the railway field, it is only recently that it has been extended to generating stations, Edison service feeders, alternating-current feeders and industrial plant service. Among the automatic generating stations which have been installed during the past year may be mentioned that on the Deerfield River at Searsburg, Vt., and that of the Blue River Power Company at Seward, Neb. The Deerfield control provides for starting and stopping of the units by time switches and is designed to make the best use of a somewhat intermittent water supply. The plant at Seward, Neb., is also automatic. The Kansas City automatic Edison substations comprise the largest system of automatic stations for this service in the world. The entire system of the city will be controlled from a series of five automatic substations fed through radial network feeders. The Drifton (Pa.) automatic substation of the Lehigh Valley Coal Company is a recent example of the application of automatic control to industrial service, although it has also been applied to steel mills and industrial plants.

PROPELLER TYPE WATERWHEELS FOR LOW OR MEDIUM HEADS

PROGRESS IN LIGHTING

The year has been marked by several installations of modern lighting systems, the tendency being away from multiple-unit standards except in "white-way" districts where more than one unit per standard may be desired. While the gas-filled lamp has been installed extensively, the luminous-arc lamp is not disappearing by any means and is being installed where extremely high intensity coupled with low intrinsic brilliancy is desired. A recent example of luminous-arc lamp installation is that at Salt Lake City. The use of a globeless gas-filled lamp is also a development of the past year, a notable installation being at Rochester, N. Y. The reflecting surface is such that all the light is sent down on the street, and glare is avoided. A new type of highway light consisting of a double nest of parabolic reflectors was also installed during the past year on the Albany-Schenectady road with very satisfactory results.

Among other developments in the lighting field have been the standardization of mill-type vacuum incandescent lamps with coiled tungsten filaments and lamps of similar construction in blue-glass bulbs for sign lighting service, the adoption of a new form of specification for large incandescent lamps by the Bureau of Standards, the introduction of at least three new types of dust-proof semi-indirect lighting units for offices and commercial lighting, and the connection of street-lighting systems to residential lighting secondaries. The design of quartz-type mercury-vapor units for direct current has been improved and an alternating-current burner has been developed. Considerable advance has also occurred in higher-powered search-lamp design.

Scientific investigations have been made to determine more exactly the difference in speed with which the eye can function under high and low levels of illumination and under lighting of different spectral quality. Tests reported this year indicate that an increase in output of approximately 10 per cent can be obtained by an additional cost for lighting of 1 per cent of the payroll. Systems providing 10, 15 and 20 foot-candles of general illumination are no longer unusual. Some engineers are now advocating a minimum allowance of two watts per square foot in wiring factory buildings to provide ample lighting capacity, whereas a few years ago only one-quarter or one-half of this would have been considered sufficient. An investigation of night traffic accidents in thirty-two cities indicated that 17.6 per cent could be attributed to insufficient street lighting. The crime rate in a district in which "white-way" lighting was installed decreased 8 per cent after installation during a period in which the number of crimes in the remainder of the city increased 54 per cent. The characteristics of road illumination produced by automobile headlamps were determined as a basis for establishing standards of practice and to assist in the perfection of automobile lighting systems.

ELECTRIC HEAT APPLICATIONS EXTENDING

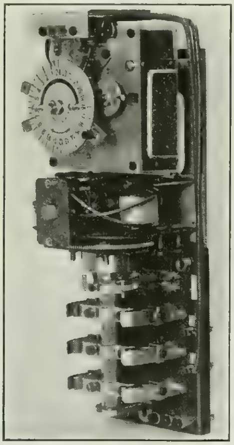
In the field of electric heat application not only has new apparatus been developed but the field for existing devices has been greatly enlarged. For example, a new brass furnace rated at 1,500 lb. was brought out which works on the muffled-arc principle. The largest furnace by far to be considered up to the present time is a 60-ton furnace rated at 9,000 kva. which is being constructed for the Ford Motor Company for melting cold scrap or refining hot metal only.

Electric heat has been applied to nearly every process from baking of japan on shoe eyelets to the heat-treating of the largest ingots and heavy forgings. The past year marks the installation of electrical equipment for heating the air of the entire plant of the Canadian Cotton Company, Milltown, N. S., and for baking bread in Risher Brothers Bakery, Cleveland, where 40,000 loaves have to be turned out every day. The largest electrically heated car-type furnace yet installed is that of the Sociedad Española de Construccion Naval, with a rating of 60 tons and 720 kw. This was made by an American firm at Madrid, Spain, and measures approximately 10 ft. x 20 ft. x 6 ft. Among other developments in the heat application field are the development of an improved riveter, the demonstration of the feasibility of arc-welding alloy steel and the effectiveness of percussive welding. With the idea of making the automatic welding head available for work that was impracticable hitherto, a device known as the semi-automatic welding head has been developed.

In the motor field, much has also been done in the design and application of motors to industrial purposes not extensively electrified hitherto. For instance, in the steel industry a new frequency-converter type of alternating-current, adjustable-speed roll has been installed for the Scullin Steel Company. An interesting application has been made of individual motor drive for operating run-out tables at the Sharon Steel Hoop Company, Sharon, Pa. A motor-driven reel for cold-roll strip has been installed at the Superior Steel Company, Carnegie, Pa. Two electric reversing blooming-mill drives have been installed at the Bethlehem Steel Company's plant at Harrisburg, Pa., and at the plant of the Atlanta Steel Company, Atlanta, Ga. A reversing-mill installation remarkable for its size—namely, 8,000 hp.—was made during the year for the Lackawanna rail mill. This horsepower capacity is said to be highest for any electric reversing drive in the world. What is claimed to be the first adjustable-speed alternating-current drive for plate-glass grinders has been installed by the Allegheny Plate Glass Company. In the textile industry individual motor drive has been applied successfully for the first time to the revolving flat cotton cards at the Mason Tire & Rubber Company's plant, Kent, Ohio, and a notable rubber-mill application has also been made at the New Cumberland (Md.) plant of the Kelly-Springfield Tire Company.

The application of built-in high-speed induction motors to various woodworking machines, grinders and planers has also been a noteworthy development of 1921.

The application of built-in motors has been made possible largely by the development of an induction frequency-changer set which generates frequencies as high as 300 cycles. The new planer drive was developed to overcome the troubles caused by planers overtraveling. Boring of oil wells by means of rotary drilling jigs is another application which has been perfected in the course of the year. A new type of vertical motor has been designed for silk spinners, and successful installations have been made at various plants, including the Standard Silk Company of Phillipsburg, N. J. During the past year the largest lift and turnover type of car dumper in the world has been installed at the docks of the Western Maryland Railroad in Baltimore. A new development in mine locomotives has been the tandem locomotives built for the Hillman Coal & Coke Company, among others. The complete locomotive can be controlled from either unit, or each unit can be operated separately. For use in industrial plants a valuable development has been the introduction of an automatic starter for synchronous motors by which they may be started as easily as induction motors.


ELECTRICALLY WOUND AND SPRING OPERATED TIME SWITCH

To managers of industrial plants which are using a large number of fuses each year it will be interesting to know that a low-price safety-type automatic circuit breaker for direct-current and alternating-current circuits has been developed which serves the dual purpose of line switch and fuse. It cannot be closed under overload and is instantaneous in action, although time-lag relays and low-voltage relays can be applied. It is being made in ratings from 2 amp. to 60 amp. with 50 per cent overload capacity.

During the year a pulp grinder regulator has been developed which will automatically maintain a constant load on large motors driving pulp grinders. Two new varieties of control apparatus and individual contactors have been brought out, one being known as the voltage-drop system of control for direct-current motors, and the other being a bent-frame type of series contactor. The voltage-drop control system, which controls the accelerating contactors, is operated by the voltage drop across the motor-starting resistor, so that it also serves as a current-limit control.

TIME SWITCH AND BATTERY IMPROVEMENT

One of the most interesting developments in the field of time-switch control is the introduction of an electrically wound device, capable of performing up to four operations, adjustments being provided for temperature, change in lengths of months, etc. This device is made for currents up to 300 amp. and voltages up to 6,600. In the lower voltages it has a quick make-and-break drum contactor and in the larger capacities it involves an oil switch. The actuating spring as well as the clock spring are wound by a small synchronous motor, overwinding of the springs being prevented by an ingenious mechanical arrangement.

One change made by a battery manufacturer should considerably reduce the liability of internal short circuits. This is an arrangement whereby the negative and positive plates are supported by separate ribs.

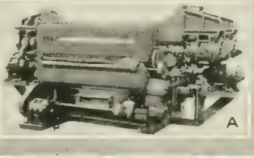
In the wire field probably the most interesting development reported is an all-rubber insulated and covered cable that will not kink or abrade, cannot be easily cut or otherwise damaged and will lie smooth when laid on the floor. As a means of facilitating the use of electricity in the home the new outlet which is being made by at least eleven manufacturers should be of considerable value. With this device enough outlets can be provided for all possible uses, without the necessity of fixtures for all of them. Connections can be made by simply plugging in new types of plugs, also made by these manufacturers, so that fixtures may be readily changeable or detachable.

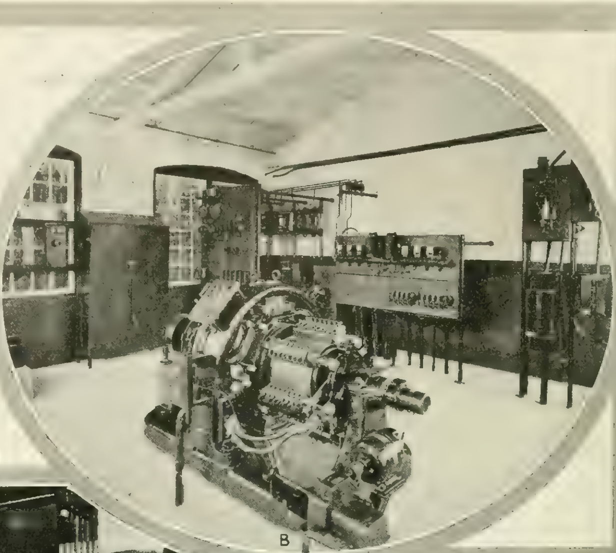
LIGHT DELIVERY VEHICLE DEVELOPMENT

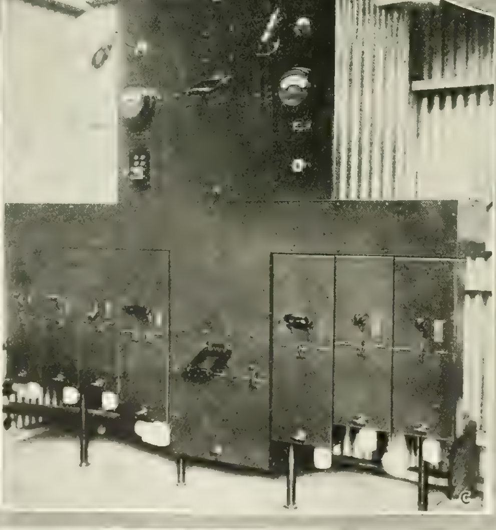
In the electric vehicle field one well-known manufacturer announces that he has nearly completed the design of an entirely new chassis for light delivery which should fill a demand for a moderate-price electric vehicle at low operating cost. Among interesting instruments which have been developed during the past year are an earth-current meter, a high-resistance fault localizer, a portable flux meter and a temperature control and recorder.

In a brief review of developments in such a large field as the electrical industry it has been possible to touch only on notable achievements. The chronicle cannot be concluded, however, without at least referring to the marked developments in radio equipment and broadcasting, long-distance amateur communication, long-distance loud-speaking telephones, carrier-current communication, cargo ship electrification and achievements in electron tubes, each of which would require a volume for adequate discussion.

Important Applications in the Industrial Field Despite Depression

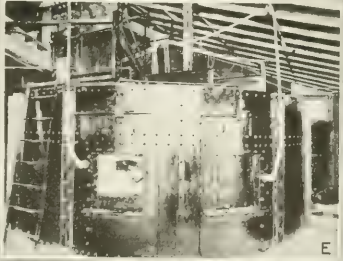






CONSIDERING the numerous applications of electricity to new or relatively untouched industrial fields, the past slump in industrial activity has not been without its compensations. Relieved of the rush of supplying equipment which prevailed during the war, manufacturers have had an opportunity to concentrate more of their attention upon developing equipment.

A few of the developments are indicated: A—Built-in direct-connected motors. B—Automatic coal-mine substation. C—Centralized dead-front industrial switchboard. D—Sectionalized drive for paper mill. E—Rotating-hearth heat-treating furnace. F—Electric shovel.



The Problems of the Manufacturer and the Jobber

The Need for a Practical Unity of Vision and a Common Purpose in the Fashioning of Plans and Policies—Good Work Really the Key to the Great Coming Opportunity

By EARL E. WHITEHORNE
Commercial Editor ELECTRICAL WORLD

IF ALL the electrical manufacturers and jobbers in the United States could be gathered together for a little while in one large room to talk, the discussion would immediately focus on what is going to happen in 1922. And out of the discussion, I believe, would come two bits of thinking—first, a wide mental picture of the conditions in the world today that are affecting this industry of ours, and second, a close-up view of the things that must be done to meet the economic situation as it is with a constructive force that can produce some measure of progress and prosperity. Such a combination of a common vision and a common purpose is, of course, most difficult to achieve among a body of scattered and competing men in any line of work, and yet just now within the electrical industry these conditions are not hard to define, and a considerable degree of unity in plan and policy should be possible.

SOME OF THE QUESTIONS

The electrical manufacturer has many problems confronting him just now and plenty to worry about. Business has been bad and plants have been running under capacity and have been put to it to find the orders to maintain production. Out of this has grown up a bad price-cutting practice that has killed the profit on much of the business that has been done in many lines, and orders have been placed on a hand-to-mouth basis that has rolled up a higher cost and harder problem of production and delivery. These are evils which the manufacturer wants to end. The tariff situation is an uncertain factor. The tax burden is a heavy load of indefinite future. The status of wages is hard to figure on with any confidence. The question of where to raise the money for continued financing is not a simple one to answer. The need for more cost data is imperative.

The electrical jobber is in a no less difficult and an even more precarious position. During the pressure of war times the economic function of the distributer's warehouse was recognized and proclaimed by the government. The jobber rendered a service of essential value, and the whole world of business heard and saw and understood. But later, in the stress of the following depression and in the keenness of the competition for orders, too many of the manufacturers have forgotten that the reason for a jobber is his warehouse and have let down the bars that are supposed to separate the men who qualify as jobbers from those who don't. And the result is a confusion in our distribution, with too many nominal jobbers and too few who with their warehouses continue to perform their economic function. But the splitting up of stocks among too many local houses and the division of the profits into too many fractions passed around have put the electrical jobber into red ink. He cannot make money the way things are. He cannot overcome the small-order trend that is putting up his cost of selling. He cannot get the earnings to enable him to play the part he wants to play in the development of markets for the appliance specialties. He is unhappy.

But behind this and beyond it all are certain fundamental facts that mean more than these things. Our troubles have been borne on the turbulent waves of abnormal times that will in turn resurge to our advantage and reverse much of the situation that we have today. For the war booms and depressions that we have been passing through have distorted the markets and their influences and upset all the natural processes of orderly evolution. An artificial stimulus caused the building of countless new factories and expanded our industrial capacity far beyond all the requirements of normal times. Then the construction of dwelling houses ceased, and following it the erection of all types of business buildings. Building waited for five years or more. Now we face a shortage of more than a million homes needed for housing the people. We have the ready capacity for the manufacture of the goods to build and outfit this big construction program. And everybody is waiting for the word to go.

The word, of course, must come not from one mouth, but from the mouths of millions, and the utterance is growing louder all the time, swelled by the increasing confidence in everybody's mind that we are working out of the economic woods. There are tangible evidences that business is slowly stiffening and gaining strength. As a natural result the householder is already beginning to buy more freely from the retailer, and the retailer will soon commence to send in larger orders to the jobber, and the jobber in turn will purchase more heavily from the manufacturer. Gradually, steadily we will see it come—more confidence, more activity, more business in a natural progression. But it will be based from start to finish on the production of goods that can flow out freely from the factory through the trade and on to the waiting people.

EFFECT ON THE INDUSTRY

All these forced conditions have had a very marked effect on the affairs of the electrical industry. With the cessation of building construction the contractor found his regular traditional wiring business slipping away from him. He looked about him for a way to live and soon saw that war times were fast building up an unprecedented demand for household labor-saving appliances. So almost every contractor has become a contractor-dealer, with much of his interest centered in store problems. But as the music of the hammer and the saw begin to ring louder in the land and houses are seen going up in every hamlet, there will be wiring jobs in plenty clamoring for attention and the contractor will naturally respond and put more of his energy into construction. He will never cease to sell appliances, but his thought, I believe, will center once again more closely on his contracting function. And the work of appliance selling is going to be carried on more largely than ever before by the central-station company. These are trends that are not far ahead, and every manufacturer and jobber must observe and recognize and organize them into the operation of his business if he is to steer true in the tide.

There awaits the manufacturer and jobber of electrical materials a tremendous market that will absorb the utmost that they can produce and distribute, once the building and buying starts. There it lies ahead in plain sight—a million and more new houses to be built, more than five million houses to be wired where central-station lines already are available, more than seven million houses already connected that need more convenience outlets, new fixtures, more equipment, and other kinds of buildings, new and old in like proportion. All this is in the vision that all men in the electrical industry should hold in common and organize around. The market waits on the unfolding of this great program of awakening business and restored individual and industrial activity. The question is, When will it start? What can be done to hurry it along? And that is where we need the common purpose.

The building, fixing and buying program will start when the impulse of American business is put behind the people of America to make them start. We have here a condition where the individual is strong in his confidence and attention. Each man believes that business is better, that good times are almost ahead, that in a very short time it will be wise for him to spend money and do the things he has been waiting for. But in the mass this waiting bulks into inertia that blocks the path to rapid progress and slows the wave of steadily improving business. And the only thing that will remove the obstacle is the power of creative selling.

THE NEEDS WE FACE

The problem of the electrical industry today is very like the problem of all other industries. We face the need for more orders, for more money to finance a larger stock and bigger credits, in short, for a bigger operation that will produce a bigger business and a large measure of prosperity. There is only one way in which this can be done, and that is through good work. The sellers' market has passed on with the boom times and we must change our methods to conform. Goods must be sold today, and it is the manufacturer and the jobber who must grasp the vital responsibility for their resale to the consumer. The market lies in the homes and business places of the people, and the selling of the goods must carry through and make use certain.

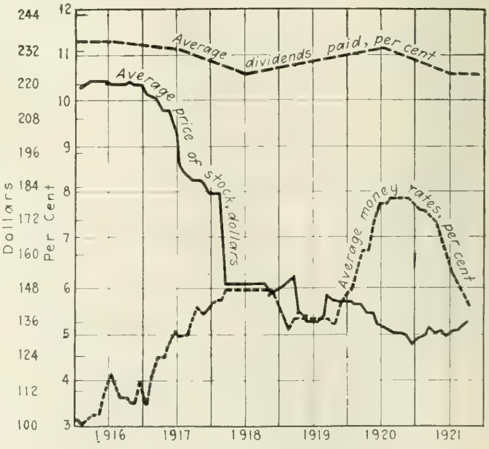
The spirit of the work must be to get the job well done, and whatever is needed to complete the operation must be provided. If more service seems to offer the way, it must be given. If more co-operation would make possible the restoration of trade, it must be made available. The goods must be sold. There is no alternative and no other purpose that can prevail.

The coming of better business to the country will bring great opportunities this year to the electrical manufacturer and jobber. Materials of every kind will be required in increasing volume as the work goes on. It will need every ounce of energy to do this job adequately, serve the market and stimulate the trade. Therefore, every bit of progress that can be made right now toward the better lubrication of our machinery of production and distribution will bring most profitable benefits. And it is worth the while of everybody in any way concerned to undertake the working out of his part in better harmony and co-ordination before the load comes on and it becomes increasingly difficult to make adjustments. So much more can be achieved without the losses caused by friction, duplication and cross purposes. So much more can be produced by more plainly balanced plans. Practical measures of standardization perfected now and sensible arrangements for co-operation worked out in detail and ready for productive use will increase the ratio of return for all this effort that will be applied by many in the coming months.

A common vision and a common purpose may be possible if it is made a simple matter of a mental focus on the work ahead. We need good policies within this industry to make the most of our great coming market, but most of all we need good work—intelligent, consistent and continuous hard work that follows through and makes the job complete. And we must find our business by creating it right where we know it ought to be. After all, this is the most important problem that the manufacturer and jobber face today.

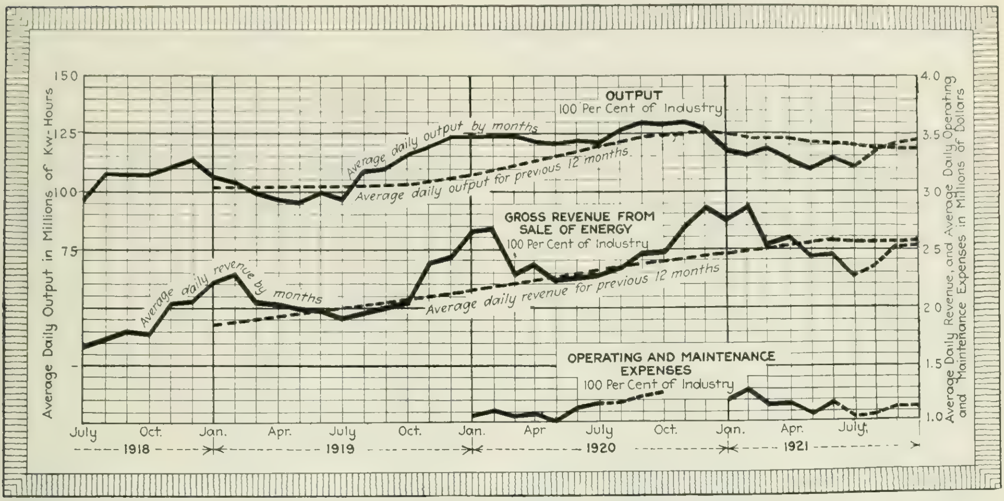
Stability of Utility Securities Shown Graphically

STEADY dividends even during prolonged adverse conditions have demonstrated the quality of public utilities securities. In the accompanying chart, prepared by C. D. Parker & Company, Inc., Boston, nineteen gas and electric light companies' operations were analyzed from January, 1916, to September, 1921. The chart shows that the dividends paid to stockholders during the above period remained remarkably steady; that the high average price of stock was $221 and the low about $129. The nineteen companies supply gas and electricity to virtually every large city in Massachusetts.



RELATION OF QUOTATIONS, DIVIDENDS AND MONEY RATES

Energy Output for 1921 Estimated at 43,100,000,000 Kw.-Hr.



CENTRAL-STATION OUTPUT AND GROSS REVENUE INCREASED DURING OCTOBER

FOR the year just closed the output of the electric generating and distributing companies for which revenue was received was 43,100,000,000 kw.-hr., as nearly as can be estimated from returns received by the ELECTRICAL WORLD for the first ten months of 1921. The output in 1920 was 45,678,000,000 kw.-hr., the decrease during the past year being due to the curtailed industrial energy requirements resulting from the industrial depression. New residential consumers during 1921, however, served to lessen the effect of the general slump in the electrical energy output of the country as a whole. From a financial viewpoint, the year's operations are most encouraging. Returns for the first ten months of 1921 indicate that the gross revenue was $933,950,000. This was a record and was $51,200,000 in excess of that reported in 1920. The operating and maintenance expenses are estimated at $416,922,000, as against $425,775,000 for 1920.

Perhaps the best explanation of an increased revenue during a period of decreased energy consumption is the fact that while the amount of low-revenue energy sold to industrial power customers during 1921 was materially under that of 1920, the high-revenue domestic lighting load was increased during the year by the addition of 1,001,700 new customers of this class. It appears from a recent survey made by the ELECTRICAL WORLD that the amount of energy sold for domestic lighting was increased by 13.4 per cent during 1921 by reason of new customers, and to this must be added the increased consumption of energy by the domestic customers due to the purchase of household appliances during the year. A study of operating expenses and revenue indicates that in the aggregate the ratio between these two items, often referred to as the "operating ratio," decreased during 1921 about 10 per cent below that reported in 1920. However, a survey just completed by the ELECTRICAL WORLD, an analysis of which will be published in an early issue, indicates that

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Instal'ed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
Nov.	71	2,741,705	2,503,402	9.6	66	$54,620	$44,711	22.0
Dec.	71	2,792,554	2,648,746	5.4	66	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	-9.4	70	55,540	48,633	14.3
Mar.	77	2,806,609	2,989,581	-6.1	72	55,513	49,071	13.3
April	78	2,675,949	2,895,067	-7.0	72	55,326	49,064	12.8
May	78	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6
June	78	2,686,479	2,872,900	-6.4	72	52,385	47,977	9.3
July	78	2,706,016	2,949,132	-8.2	72	50,747	49,195	3.4
Aug	78*	2,839,498	3,041,927	-6.7	72*	51,931	50,848	2.1
Sept.	78†	2,844,326	2,937,500	-3.1	72†	54,427	52,955	2.9
Oct.	78‡	2,997,192	3,041,714	-1.4	73‡	57,442	55,631	3.1

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
					1921	1920	1921	1920	1921	1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	53	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	54	18,633	20,964	-11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	55	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	55	19,648	21,287	-7.7	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	56	19,739	22,120	10.8	51.6	60.8	21.3	20.9	45.6	50.8

*Includes estimates for 31 companies, representing 4.5 per cent of the total installed rating of all central stations.

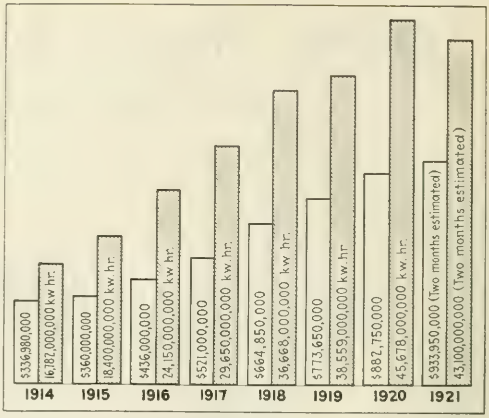
†Includes estimates for 39 companies, representing 3.7 per cent of the total installed rating of all central stations.

‡Includes estimates for 92 companies, representing 17.4 per cent of the total installed rating of all central stations.

the present operating ratio of electric generating companies having steam plants is still about 10 per cent above that of pre-war years.

Reports received by the ELECTRICAL WORLD for the month of October from central generating and distributing companies representing 78 per cent of the installed rating of the country indicates that the average daily electrical energy requirements during that month were the largest since December, 1920. A slight general increase in industrial power used and, of course, the advancing lighting requirements due to the advancing season and the cessation of daylight-saving schedules, added to the consumption of new customers, explains the increase in average daily output of 2,400,000 kw.-hr. over that reported for September.

From an economic viewpoint, the October returns are most encouraging to the electric light and power industry. The returns indicate that, while selling 1.4 per cent less electrical energy in October of this year than in October, 1920, the gross revenue from sale of energy was 3.1 per cent in excess of that received during October of last year. In addition, the operating and maintenance expenses during October were 10.8 per cent below those of October, 1920. The increased revenue may in large measure be accounted for by the fact that more than one million new residential or high-revenue energy consumers were added to the various systems during the twelve-month period. The unusual fuel shortage prevalent throughout the country during the fall of 1920, which resulted in high fuel prices, explains in large part the high operating cost reported for October of last year.



OUTPUT AND GROSS REVENUE OF CENTRAL GENERATING AND DISTRIBUTING COMPANIES 1914 TO 1921 INCLUSIVE

The output of electrical energy during October reflected increased industrial activity above that of September. Department of Labor reports indicate that eleven of the fourteen principal industrial groups showed material gain in activity during October, resulting in increased industrial energy requirements. An increase in energy consumption for lighting purposes was also reported by every section, due to the advancing season and the ending of daylight-saving schedules.

For the first time this year the number of active

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
KW HR. OUTPUT																				
Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	0.3	81	556,561	550,685	1.1
Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	-7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
April	81	196,680	227,008	-13.3	79	963,659	1,052,716	8.4	73	828,457	894,028	7.3	63	132,075	135,421	2.5	88	555,048	586,894	-5.4
May	82	191,141	219,298	-12.8	79	934,973	989,408	5.5	73	819,506	899,657	-8.9	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
June	82	192,007	219,476	-12.5	79	940,443	1,003,727	-6.3	73	806,270	880,934	8.5	63	136,011	129,120	5.3	89	611,128	639,637	-4.5
July	81	187,622	218,995	-14.3	79	934,822	1,026,390	-8.9	73	804,009	884,572	9.1	64	140,795	141,450	-0.6	89	639,768	678,725	-5.7
Aug	81	205,351	224,324	8.5	79	992,681	1,054,124	-5.8	73	848,803	923,210	8.1	64	147,967	154,353	-4.1	89	644,696	685,916	-6.1
Sept.	81	216,708	223,269	2.9	79	1,005,063	1,051,495	4.4	73	851,716	886,300	3.9	64	149,758	151,680	-1.2	89	621,081	624,756	-0.5
Oct	81	243,677	221,929	9.8	79	1,160,178	1,117,590	1.5	73	918,457	927,716	0.9	64	154,792	160,164	3.3	89	580,088	614,315	-5.6
REVENUE																				
		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
Nov.	82	$5,898	$5,017	17.5	65	$20,938	$17,119	22.2	57	$15,158	$12,561	20.8	54	$3,853	$2,910	32.4	79	$8,775	$7,104	23.5
Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16,004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	6,379	6,170	3.5	74	22,180	19,225	15.3	59	16,818	14,436	17.3	62	4,155	3,484	19.3	81	9,323	7,546	23.6
Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
Mar	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
April	81	5,665	5,554	2.0	76	21,504	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	13.6
May	82	5,362	5,342	0.4	76	20,795	17,613	18.0	60	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
June.	82	5,285	5,397	2.4	76	20,058	17,438	15.0	60	14,485	13,519	7.1	63	3,536	3,152	12.2	89	9,021	8,439	6.9
July	81	5,180	5,121	1.1	76	18,798	17,155	9.2	60	14,158	14,689	-3.6	63	3,509	3,145	11.3	89	9,101	8,733	4.3
Aug	81	5,297	5,483	3.3	76	19,050	17,926	6.2	60	14,465	14,594	-0.8	63	3,612	3,536	2.2	89	9,507	9,309	2.1
Sept.	81	5,619	5,857	4.0	76	19,992	18,749	6.6	60	15,326	15,192	0.8	63	3,811	3,673	3.9	89	9,679	9,483	2.0
Oct.	81	6,225	6,072	2.5	76	21,464	20,063	6.9	60	16,130	16,134	0.0	63	3,970	3,892	2.1	89	9,653	9,470	1.9
OPERATING EXPENSES																				
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
Feb	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,963	3.9
Mar	45	1,576	1,651	4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
April.	45	1,418	1,479	-4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,893	2,479	16.8
May	48	1,548	1,577	1.8	56	6,921	6,660	4.0	37	4,274	4,292	0.4	52	1,563	1,486	5.2	81	2,969	2,713	9.5
June	46	1,737	1,862	6.7	56	6,916	6,878	-0.5	39	4,843	5,152	-5.9	60	1,835	1,678	9.4	83	3,565	3,519	1.3
July	47	1,712	2,077	17.6	53	6,772	7,111	4.8	39	4,940	5,800	-14.8	62	1,870	2,039	-8.2	83	3,339	3,937	-15.1
Aug	48	1,861	2,088	-10.8	53	6,871	7,131	-3.6	39	5,028	5,793	-13.2	62	1,892	2,003	-5.5	88	3,648	3,884	-6.0
Sept	49	1,950	2,213	-11.8	54	6,837	7,280	6.0	40	5,354	5,680	5.7	63	1,949	2,184	-10.7	88	3,558	4,030	-11.7
Oct.	48	2,043	2,033	0.5	57	7,144	7,790	-8.3	39	5,012	6,069	-17.4	63	1,974	2,299	-14.1	88	3,566	3,929	-10.2

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants.																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5

spindles in New England textile mills during October exceeded these reported as active during the corresponding period in 1920. The other primary industries of this section were operating at about the same capacity as during September. These slight increases in industrial requirements, augmented by an increased lighting load and new lighting and industrial customers, resulted in an average daily electrical output of 790,000 kw.-hr. in excess of that reported for September.

Steel and iron activity continued to show slow improvement during October, but most other industries in the Middle Atlantic States were operating on a par with September. Increased activity in the South Atlantic States was especially noticeable in the textile industry, almost half a million more spindles being active than during October, 1920. The unusual drought in this section was not broken until the last few days of the month. This condition resulted in largely reduced production of energy by hydro-electric plants and the continued operation of all available steam auxiliary plants. Some industrial plants were forced to curtail operations owing to inability of the power companies to supply adequate service.

Daily Output Higher in Atlantic States

Taking the Atlantic section as a whole, the increase in industrial requirements in conjunction with the increased consumption of electrical energy for lighting and new domestic and industrial customers resulted in an average daily electrical output of 2,600,000 kw.-hr. in excess of that reported from this section during the month of September.

Increased activity was reported by virtually all the principal industries of the North Central States during October, resulting in an increased energy consumption which, combined with the seasonal increase in energy requirements and new customers, was sufficient to raise the average daily energy output of this section by about 1,700,000 kw.-hr.

A large decrease in the irrigation load, while mining and manufacturing operations were about on a par with those of September, resulted in large curtailment in industrial energy requirements in the Mountain and Pacific States during October. As a result of these adverse conditions, and notwithstanding a substantial increase in lighting requirements and new customers, this section reported an average daily output of about 2,200,000 kw.-hr. below that of September.

First Development Under Federal Water-Power Act

THE new 8,000-kva. hydro-electric power plant for Henry Ford & Son on the Hudson River at Green Island, Troy, N. Y., built by Stone & Webster, is pictured below. This is the first development authorized by the Federal Water Power Commission. It will utilize water from an existing government dam built in 1915 and will furnish power required in the manufacture of parts for automobiles and tractors. The approximate cost of the power plant will be $1,750,000.

VIEW SHOWING OPENING FROM FOREBAY TO WATERWHEELS

Utility Management and Finance

THE REAWAKENING of business will bring to the central-station company some interesting problems. Questions of rate reduction, wage adjustments, the quickening rural market, the selling of securities and the spending of the money all will call for new thought and bring with them new opportunity.

Utility Outlook Brightest in Industry's History

By George N. Tidd
Vice-president and General Manager
American Gas & Electric Company, New York

CONSIDERING the general conditions of the public utilities, the year 1922 should see a marked increase in new construction. As many needed improvements have been postponed, the installation of additional equipment will extend throughout the entire system from generating station to distribution lines.

As I look at it, the whole utility situation is very largely a question of banking. At the present time the only drawback to the expansion of the electric light and power companies is the amount of money that can be raised on satisfactory terms. For the past few years the utilities have been confronted with a compounding of high prices for material and equipment and high-priced investment money which they could not stand. While this has retarded the building of new plants and installation of equipment, it has in a measure been a blessing in disguise. Industrial companies are seriously affected by the overhead charges on new plants constructed at a high cost for material with money at a high rate of interest. The utilities which could not then afford to make other than absolutely imperative extensions are now finding themselves in a very comfortable position.

With investment money getting cheaper, the electric light and power companies are able to go ahead with the work of increasing their generating and transmission capacities, which has of necessity been postponed. There are few companies that have an appreciable amount of unsold capacity and many have been unable to supply service to any large new consumers because of power shortage. These companies' plans call for the installation of additional equipment against the resumption of industrial activity, which is very likely to materialize sooner than has been expected and would result in another serious power shortage.

With many companies the power business has just about held its own in spite of the fact that the use of power by some large consumers has fallen off. The increase in commercial and residential load has been tremendous. The result of this condition has been to allow a breathing spell for new construction, and at the same time what business has been lost in low-priced power has been made up in lighting load earning a higher rate per kilowatt-hour.

To my mind, the utilities can profitably spend for new construction all the money they can obtain at a reasonable price, with the assurance that there will be a ready market for the added capacity as rapidly as available.

Viewed from every angle, the electric light and power utilities are right now in a better position than ever before in their history because of several outstanding factors in their favor:

First—They have got in closer touch with the public and have gained the confidence and assistance of their customers. Through the sale of stock locally and the open policy of the companies in laying their cards face up on the table people have come to understand the utility problem.

Second—With adequate rates which are equitable for both the consumer and the company, the utilities for the first time have a chance to set up reserves for depreciation and contingencies. These rates will not be taken away because public utility commissions realize and appreciate the fact that it is to the public's interest for the utilities to prosper.

Third—There is an almost unlimited market for electric power and the day of the small plant is past. Many large consumers are able to buy power for one-half of what it would cost them to make it themselves. There is no question that central-station power is the more economical, and at rates which will return a profit to the company.

Fourth—Most companies have their present equipment in good condition and are ready to go ahead with the installation of more equipment. This can now be done at a comparatively favorable cost for both money and material.

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Making the Purpose of Security Sales Clear to the Public

By John F. Gilchrist
Vice-president Commonwealth Edison Company

THE ease with which new capital is being obtained by those companies which are selling securities to their customers is resulting in some changes in view on the part of managements which tend to hinder the greatest accomplishment. For instance, when plans for these sales were first made, in times that were the hardest possible from the standpoint of raising money by former means, most liberal terms of payment were offered to those who desired to pay on such a basis, and other similar inducements were made. Since it has been found that a large percentage of the money has been paid in cash, and that many of the people approached who wished to make monthly payments have not made a particular point of a greatly extended period, the inclination has been to shorten up terms very decidedly and rather to ignore an important portion of the field.

While it is true that a great deal of money can be obtained on the shorter terms—and this has its desirable features from the standpoint of the treasury—it is a great mistake to lose sight of the fact that the most this abridged plan is accomplishing is the placing of already accumulated investment funds, and that it is doing very little to educate the people in the communities to the idea of putting away in such investments a very small amount every month over an extended period. Companies should, therefore, be urged so to plan their sales as to cover the largest number of possible subscribers, to sell as much as possible for cash, to sell what they can on a slightly less favorable basis with ten or twelve months to pay, and in addition, to attempt also to sell to people who think they have nothing to invest but who might be encouraged to come in on a twenty-four-month or even a forty-eight-month basis.

It may be desirable, at least until it is fairly tried out, to put some limitations around any plan contemplating an extension over a long period, but this can be accomplished in many ways. For instance, it would undoubtedly be practicable to offer to customers the opportunity to subscribe in the names of their minor children between the ages of twelve and twenty-one years, not more than one share to a subscriber, payable as an item of $2 added to the monthly electric bill.

ADVANTAGES OF DEFERRED PAYMENTS

There are many advantages in such a plan. In the first place, children take great pride in such personal property. They would be educated in the matter of buying securities, educated in the matter of saving a regular amount monthly, and, above all, their attention would be turned toward the advantages of public utility securities as an investment.

The managers of companies entering this work are urged to set forth clearly at the beginning all that they wish to accomplish by these plans and then not to let any ephemeral success prevent their getting, in all respects and at all times, the most they can out of them.

In this connection attention is called to the necessity of being most careful to see that only the safest securities are offered for sale to customers. Nothing should ever be sold on which, under any conditions ordinarily conceivable, the periodical income could be suspended. If in this movement any great amount of securities are placed in the hands of small investors which in time of stress will not pay dividends, the injury to the whole field of utility investments will be incalculable.

Another matter to which the utilities should give immediate attention is that of developing a broad secondary market for utility securities. The volume of such securities in the hands of the public is tremendous, and unless the opportunity is provided of selling utility stocks when occasion demands on at least as broad a market as any other securities, utility securities will suffer. There is altogether too great a tendency on the part of even the most far-sighted financiers to assume that all of these securities are being bought for absolutely permanent investment and, when putting out stock in a given issue at a reasonable price, to allow the market to take care of itself. To such an extent is this carried that there is frequently a difference of ten or fifteen points between the price at which the stock is being offered to the public and the price which a holder of the same stock must take when for some reason it is necessary to realize upon it.

These are only a few of the many questions which should be considered most carefully by those responsible for the financing of public utilities and for maintaining the integrity of the securities of the industry.

Process of Deflation Brings a Rate Problem

BY W. W. FREEMAN
President Union Gas & Electric Company, Cincinnati, Ohio

ALONG with the general economic deflation and the continued gradual reduction in the cost of living there will probably develop before this year is done a rate problem. The people of all cities are watching with keen interest the little recurring evidences that the prices of commodities are slowly scaling down. And the public is going to expect reductions in utility rates, for the simple reason that without knowledge of facts men will naturally assume that the electric light and power company should do as other manufacturers are doing and readjust its prices to the changing conditions. They will think this if they are left to reason without facts, but if they have the facts and understand the position of the utility clearly, they will not ask for anything that is unreasonable or unfair.

It is of the utmost importance that the utility go before the public early, in advance of any general popular attention and opinion on this subject, and tell the story. Truth will prevail, and the thing to do is to tell the truth—the whole truth—fully, frankly and in detail. It is a matter of record, though it was almost unknown and has been entirely forgotten by the public, that the central-station companies did no profiteering during the war. The public utilities carried on until higher expense caused by the war had eaten up all profits and begun to jeopardize their actual existence, and then by recourse to the utility commissions they sought relief directly from the people that they might be able to continue serving not only the industries but the homes as well. The result was that the cost of electric service increased something like 17 per cent, which was out of all proportion with the increase in central-station operating costs and the higher costs of other commodities and service that go to make up every family's cost of living.

LAY THE CASE BEFORE THE PEOPLE

Therefore it is right, reasonable and appropriate at this time that the executive of a utility should lay before the entire public the case of that considerable proportion of the people who today are owners of the utility, either by direct purchase of stock or by deposit or investment in bonds or in insurance companies whose funds have been applied in the financing of public service enterprises. These tens of thousands of direct or indirect investors, through the directors and officials who administer these utilities, made a great sacrifice during the war by delaying all appeals for rate increase until the last possible moment and not attempting in any way to join in the popular wave of profiteering. It is only right, therefore, that the small increases which in time they were compelled to secure should not be taken from them until the loss can be in some part repaid through the coming years of reduced expenses.

This is the story that must be told if the people are to understand the situation and appreciate the motives of the utilities in their belief that their rates cannot be reduced to the pre-war scale while costs are still above pre-war expenses and the grievous losses which have been suffered have not yet been made up. And the people will be interested in such a presentation of the case. But the people, I believe, will be interested even more in the other side of our story, which is the message of electric service and its greater value in the home today. Let us also tell the public of the worth of our service at present rates and they will be perfectly satisfied with its costs. In Cincinnati today I believe it would be possible to sell $10,000,000 worth of electrical equipment without connecting another building to our lines. Here is our opportunity, and if we will place ourselves clearly and frankly in the confidence of the people in the coming rate situation and then go forward and do good work in the selling of this idea and ideal of complete electric service in each home, we shall have nothing to fear.

How to Balance the Reduced Industrial Demand

By T. I. Jones
General Sales Agent Brooklyn (N. Y.) Edison Company

As a result of the bad times which happily are now passing there has been a falling off in industrial load in almost every city. The demands of war built up an industrial capacity above normal. Boom times kept factories running past the war, then the reaction came, and throughout the country work fell off and the demand for power dwindled. Now conditions are improving slowly but steadily. The fact remains, however, that there is a hole to be filled by the central-station sales department. The question is: What can be done right now to offset the decreased industrial load and build up the curve where slow times in the factory have affected it?

In Brooklyn we have more than 200,000 customers connected, of whom over 150,000 are residence customers. It is clear, therefore, that the residence predominates as a source of business. Moreover, though they are smaller as units of purchasing power than industrial customers, they are more stable. For people live on through good times and bad. They light their houses, they heat them, they eat, and they enjoy every comfort that they can. And so they cling to the continued use of all the applications of electric service that they are accustomed to, because they save labor, and saving labor, save time and expense. In consequence the residence appliance load offers the central station small units of day-load business that in the aggregate can bulk large and employ a considerable capacity that is idle when the industrial demand falls.

We have, therefore, been making a determined effort to sell appliances to our residence customers and to insure the wiring of as many homes as possible. Because of other needs for capital we have interested many of our local contractors in financing house wiring for themselves so that the jobs can be done now, while the business is needed, and the householder may pay conveniently in deferred payments. The result of this consistent drive to build up more residence load has been most productive. Whereas industrial business and commercial business together have been increasing, month by month, this year less than 10 per cent, our residence load has been steadily climbing in excess of 40 per cent over corresponding months of last year. And this business is fundamental. It is permanent. It is distributed among our predominant class of customers. It will not be subject to business conditions. It is a service which will be used by the people in their ordinary course of living.

Industrial conditions through the country are improving. The railroads are beginning to place orders in a way that clearly indicates a returning confidence. The automobile industry is showing a reaction to somewhat better times. Both these industries are good barometers, and the central-station company can undoubtedly expect to see a gradual improvement in its industrial business. It will not be rapid enough, however, to justify no further thought of ways and means to fill up the hole. Other business must be sought that can be obtained more quickly on the wave of the general expectation of better times and connected to the lines to make immediate demand. It cannot come from commercial customers, because commercial customers are affected in like measure by the general business situation and will come back to vigor with the factories. It is to the residence that we must turn for the quick and permanent and stable business that is needed.

We must sell appliances and we must sell them in a bigger volume than we have been accustomed in the past either to plan or expect. We must work with a broader vision and a greater courage to analyze these homes we serve, calculate what appliances they can properly use, and then go put them on the lines by the power of our selling. On such a quantitative basis there is a market here worth any company's attention—and the quality is also most satisfying.

The Central Station Wage Problem

By Samuel Ferguson
Vice-president Hartford (Conn.) Electric Light Company

At the beginning of this new year it is but natural that the subject of wage reductions should be in the mind of the executive of the central-station company. There is in process a general deflation of commodity prices, and costs are being watched with care. Employee compensation is, of course, an element in utility cost that has a definite bearing on the cost of living. It is well, therefore, that inquiry should be made into this situation. But one does not get far into this question without realizing that sweeping generalizations upon it are entirely unwarranted.

A fair determination of whether employee compensation should be readjusted requires a study of wages paid to individuals performing different classes of service throughout a period of years, plus an analysis of the relation between such wages and the cost of living. During the war period wages and living costs changed greatly, and although both curves ascended, or rather both sets of curves rose, the angles of advance and of subsequent decline did not remain parallel, either for groups of employees or for individuals. In some cases wages advanced too fast and to unwarranted levels; in others living costs increased proportionately beyond the wages established. The real test is the purchasing power of the wages, and an equitable determination must take account of this as applied to the individual or to the class employee who is representative of his team mates in the central-station organization.

In an address before the Chamber of Commerce of the United States in Atlantic City on April 27, 1921, Magnus W. Alexander, managing director National Industrial Conference Board, New York, discussed "Living Costs and Wage Adjustments" from the angle of the purchasing power of the compensation paid to workers. The application of the methods of analysis described by Mr. Alexander in this paper to the study of wages within the central-station industry will show managers of such utilities whether wages should be decreased, increased or allowed to continue unchanged for particular classes of employees or for individuals.

The ratio between the money wage and the cost of living gives the "real" wage received by the employee or group at a particular time, and by plotting these on a time basis the tendency can be shown at a glance for each case studied. At a given date, for instance, the money wage may be represented by the index-number 300, compared with the 1914 wage as 100. The cost of living is represented at that time by an index number of 250, let us say, compared with the 1914 base of 100. The ratio of the two, or 1:2, is a "real" wage index and shows that at the time plotted the "real" wage or actual purchasing power of the worker is 20 per cent above the 1914 level. At a later date (for purposes of illustration) the "money" wage index drops to 180 and the cost of living index to 120. The ratio becomes 1.5, meaning that the purchasing power of the worker on this second date is 50 per cent above the pre-war base. Now, if such an analysis shows that the employee has been gaining at an unreasonably rapid rate upon the cost of living, the predisposition is in favor of a downward adjustment of pay; if, as in some cases an analysis of this kind is almost certain to disclose, his purchasing power has not risen materially above the pre-war base, a readjustment of wages may not be warranted. Should any employee's purchasing-power curve fall below the 100 per cent or pre-war base and not be offset during the period studied by advances on the plus side of the line, the presumption would be that an increase in compensation is in order.

Reasonable employees will see the fairness of this method of analysis if it is worked out for a period of several years during which their wage (and salary) history is plotted in terms of purchasing power or "real" wages.

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The Prospect of Business from the Farm

By G. C. Neff
General Superintendent Wisconsin River Power Company

A REMARKABLE change has taken place during the past year in the viewpoint of central-station-company operators regarding the demand of the farmers for electric service. Where rural service was formerly viewed as a fad due to the war prosperity of the farmer, the demand is now being more clearly recognized as the result of increased economic pressure on the farmer to find ways and means of reducing his production costs. Besides, it affords greater comforts on the farm and gives to the farm home the little things that make the city home so attractive. Gradually the farmer has acquired the sanitary and water-supply conveniences of the city through the development of the apparatus that will bring these things into the farmhouse on a basis that the farmer can afford. The demand of the farmer for the conveniences of electric service is a natural sequence to the other improvements. Along with obtaining the service he has discovered that there are ways and means of utilizing it to cut down the cost of conducting his operations. It is not an uncommon experience to find that electric service makes possible saving the salary and living expense of one man or several, and in many cases a reduction in the cost of keeping horses or in the number of horses required. Operations that have hitherto taken the strength of two or more men have been made possible, through the use of power, with only one man, and sometimes with only the casual attention of one man who is engaged in other tasks at the same time.

Issue Must Be Faced

In effect, the problem of the public utility is to find means for bringing the farm to the city so far as electrical service is concerned. This involves an increase in the rates that have prevailed in city service. This increase is determined by the cost of the lines that are necessary to reach the farm and the fixed and operating charges thereon. There is no need for hesitation on the part of the utility management in asking for the increased rates necessary, since a little careful study will reveal advantages and saving of expense that will clearly justify the cost from the farmer's viewpoint. The problem should be faced as a purely business matter and the individual problem carefully analyzed to bring out all the factors. For the time being there will be many cases in which the distance from sources of supply will be such that the service will not be worth its cost. A careful analysis will enable public utilities to show that this is the case, and frank and honest showing of the facts will be a protection that will be invaluable when the development and practices become reasonably well stabilized.

The time has passed when electric service companies can dodge the issue. It will be far better to face it frankly now than to be forced to face it later with some one unfamiliar with the operation of utilities in a position to force a plan of service that may not be wise. Wisely handled, the situation is in the hands of the central-station industry to direct in a manner that will be of benefit to the industry and of infinitely greater benefit to the consumers. The latter can be protected from the mistakes which are certain to occur if they are forced, through the lack of interest on the part of the central-station companies, to develop their own means for obtaining service. Development of rural service along the lines that rural telephone systems have followed in many states would be a menace that no electric light and power company can afford to incur.

Another factor of extreme importance is the education of the farmer in the use of electric service. No problems are presented on the farm essentially different from those that exist in the city home. The farm itself presents much the same problem that the factory presented to the central-station commercial engineer and the equipment manufacturer fifteen to twenty years ago. Then the factory equipment was designed to fit the abilities of the older forms of power-providing equipment. Since then the whole electrical industry has applied itself to producing equipment that would fit the abilities of the newer source of power supply, so that now the older forms of equipment look extremely crude. The same process of development must be employed with farm equipment, though fortunately the solution of the factory problems has taught a lesson that will shorten the process and eliminate many of the mistakes that would otherwise be inevitable. But the central-station company must interest itself and play a part in the solution of the problem of developing farm equipment because it is one of the most important points of contact between the farmer and electric service.

Engineering Advances Few but Spectacular

THE accomplishments in radio communication have been epoch-making. Unprecedented transmission voltages have been adopted. Marked steps have been taken to assure still further reliability of electric service, and economies of electric operation are becoming recognized as never before.

Economy of Electricity Recognized in Steel Plants

BY R. B. GERHARDT
Superintendent Electric Department,
Bethlehem Steel Corporation

RESTRICTED operations in the steel industry during the past year have seemed to emphasize the important part that electricity plays in effecting economies that are vital toward reducing the cost of manufacture of steel products. The replacing of steam engines by electric reversing-motor equipments on the first finishing stand of the Lackawanna rail mill, on the 44-in. blooming mill of the Bethlehem Steel Company at its Steelton plant, and on the 25-in. blooming mill of the Atlantic Steel Company are definite examples of economies so effected. During the year American manufacturers have built more than thirty-eight electric motors for the larger main-roll drives in steel mills, about eight of which have been shipped to foreign countries. This represents an approximate total of 49,270 hp., ranging in size from 6,300 hp. down to 300 hp. in a single unit.

A problem of great interest now confronting the steel-mill electrical engineer is that of the increasing tendency toward the adoption of 60 cycles as a standard frequency. Most of the large central-station companies of this country have standardized on this frequency, while a greater part of the steel plants are operating at 25 cycles, and to adapt these plants for the use of central-station power or connection to a superpower system will necessitate using large frequency changers. The Tennessee Coal, Iron & Railroad Company has on order a 7,000-kva. frequency changer for this purpose which will be about the largest unit of its kind in steel-mill service. It is doubtful whether the steel mills will consider changing existing equipment from 25 cycles to 60 cycles until this equipment becomes obsolete, but on any extensions of a broad nature the higher frequency may be used advantageously.

OBJECTION TO 60 CYCLES FOR MAIN-ROLL DRIVES

The principal objection to the higher frequency for mill work lies in the fact that for large low-speed motors such as those used on main-roll drives the 60-cycle machine is so large that the cost is considerably out of line and there is also a considerable sacrifice in power factor. To overcome these objections higher-speed motors are suggested, using reduction gearing between motor and mill. However, this adds another piece of apparatus to the drive, which some of the steel men consider a complication. This prejudice may require some time to remove.

On the operation of electrically driven reversing mills a development of considerable importance has been the rearranging and grouping of control, making it possible to handle the mill with two instead of three and four operators in the mill pulpit, at the same time maintaining the same accuracy of control as before without any decrease in production.

The gas engine as a prime mover for producing power in the steel industry continues to occupy a prominent position, as is evidenced by the fact that the Illinois Steel Company is just completing the installation of an additional gas-electric power plant at South Chicago. An achievement worthy of note during the past year was the successful operation of a gas-engine-driven power plant from a single blast furnace by making use of a moderate-sized gas holder with certain automatic regulating features for maintaining an uninterrupted supply of gas to the engines during the casting periods on the furnace. For a plant operating under these conditions as much as 260,000 kw.-hr. has been developed with the gas from one 500-ton blast furnace in twenty-four hours.

AUTOMATIC SUBSTATIONS COMING TO THE FRONT

The automatic and remotely controlled substation is coming to the front in steel-mill work as well as in railway and other lines, and it is expected that future installations will be quite numerous with the growth of the industry. A matter under investigation in this country which has been exploited with some success abroad is the use of large mercury-arc rectifiers in place of rotating machinery for converting alternating to direct current. This piece of apparatus should be especially adapted to this type of substation.

The progress of electrification in the steel mill has been so successful with regard to application in the mills proper that a broader field is now under investigation taking into consideration the electrification of the plant railroad yards, with the idea of eliminating steam locomotives for transportation. Whether or not this will work out best with third-rail operation or by the use of storage-battery locomotives is yet to be determined; in either case considerable economy is possible.

In the electric furnace field an event of considerable importance was the starting of the two 40-ton, three-phase Heroult furnaces at the Government armor plant at Charleston, W. Va. On Feb. 2 last the first heats were tapped. A very high grade of steel has been produced and the whole equipment has functioned very successfully. The induction furnace is being exploited further in this country, and a practical demonstration has been carried on at the Pittsfield works of the General Electric Company, where a 4,000-lb. furnace has been in successful operation for some time past melting down silicon steel scrap on a basic lining. The life of this lining has proved to be very satisfactory.

Improvements in control apparatus now make it possible for the steel mill to obtain magnetic controllers beyond the dreams of the electrical troubleman of several years ago. The life of contacts, arc chutes and wearing parts has been appreciably lengthened, wiring has been considerably simplified, and features have been incorporated making use of improved ideas.

The advent of the new year marks no little progress in the following out of the electrical safety code in the steel plant. It is now a very rare thing to find an uncovered switch or unprotected piece of electrical apparatus. Safety organizations are maintained, and safe practices are being taught unceasingly.

The outlook for the new year from a development standpoint looks good, particularly since an improvement in business conditions is predicted, and there are many steel mills awaiting this improvement to go ahead with electrification.

Last Year One of Achievement in Radio Communication

By David Sarnoff
General Manager Radio Corporation of America

RADIO development during 1921 may be chronicled as a series of commercial achievements. The practical application of the wireless-telephone transmitter as a means of "voice broadcasting" to the home and fireside of news items, music, lectures and so forth is an outstanding development of the year and one which has untold possibilities.

Already there are a half dozen broadcasting stations in the United States in daily operation, working on definite schedules, with programs which are outlined and published in advance. The development of the radio telephone and the activities of the Westinghouse Electric & Manufacturing Company in opening broadcasting stations stimulated and developed interest along these lines. Offhand, there are at present about 100,000 receiving stations in the United States.

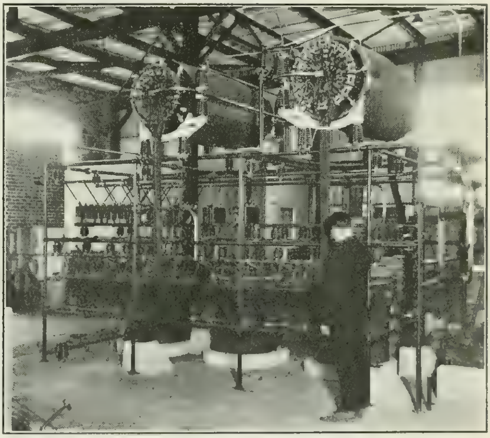
The period is at hand when the broadcasting receiving set will have the appearance of the phonograph, and the receiving antenna may be even placed within the cabinet. The time is not far distant when broadcasting stations will operate at several wave lengths, one of which will be devoted to lectures, another to operatic selections, another to news items, and so on. This will mean that the particular form of entertainment most pleasing to the recipient will be available without any interference with the program being carried out on other wave lengths.

The past year has demonstrated beyond cavil the commercial utility of the radio-frequency alternator. There are more than a dozen of these alternators, developed and built by the General Electric Company, installed in American stations giving outputs of 200 kilowatts each. Not only do these machines give signals at the far-distant receiving stations that are more readily decipherable than those obtainable from a spark station, but also they radiate "purer" or "sharper" waves, which tend to reduce to a minimum interference between a number of stations in simultaneous operation.

Equally important has been the further development and practical application of the multiple-tuned antenna, which has considerably increased the radiating efficiency of high-power radio stations.

Most marked improvements have been made in long-distance radio reception. Incoming radio signals are now automatically transferred from the receiving stations over land-line wires direct to a central operating office where they are automatically recorded on paper tape by specially developed ink recorders and transcribed on message blanks by operators. This eliminates the human relay at the receiving station and obviously results in a marked saving in the time of delivery and a decrease of errors. During the past year a method has been devised whereby two or more radio signals may be transferred to a central operating office simultaneously over a single land wire.

A method has now been devised whereby the signals sent out from four different European radio transmitting stations can be intercepted in the United States on one receiving antenna without mutual interference. This has enabled receiving operations to be centralized at one point with the resulting obvious advantages. Before another year has passed it is likely that all the European radio signals intended for reception in the United States may be received simultaneously at one centrally located receiving point.



MAGNETIC AMPLIFIER AND TRANSFORMER RACK AT NEW LONG ISLAND RADIO STATION

One unit of what will ultimately be the world's largest and most powerful radio station has been put in operation during the past year at Rocky Point, L. I. This station eventually will have from six to ten transmitting units capable of dispatching radiograms to all parts of the world. On the occasion of the recent official opening a radiogram broadcast to the world was recorded in virtually every country, the message, for example, having been copied directly in Australia, New Zealand and Japan. This station will be remotely controlled from a central office in New York City.

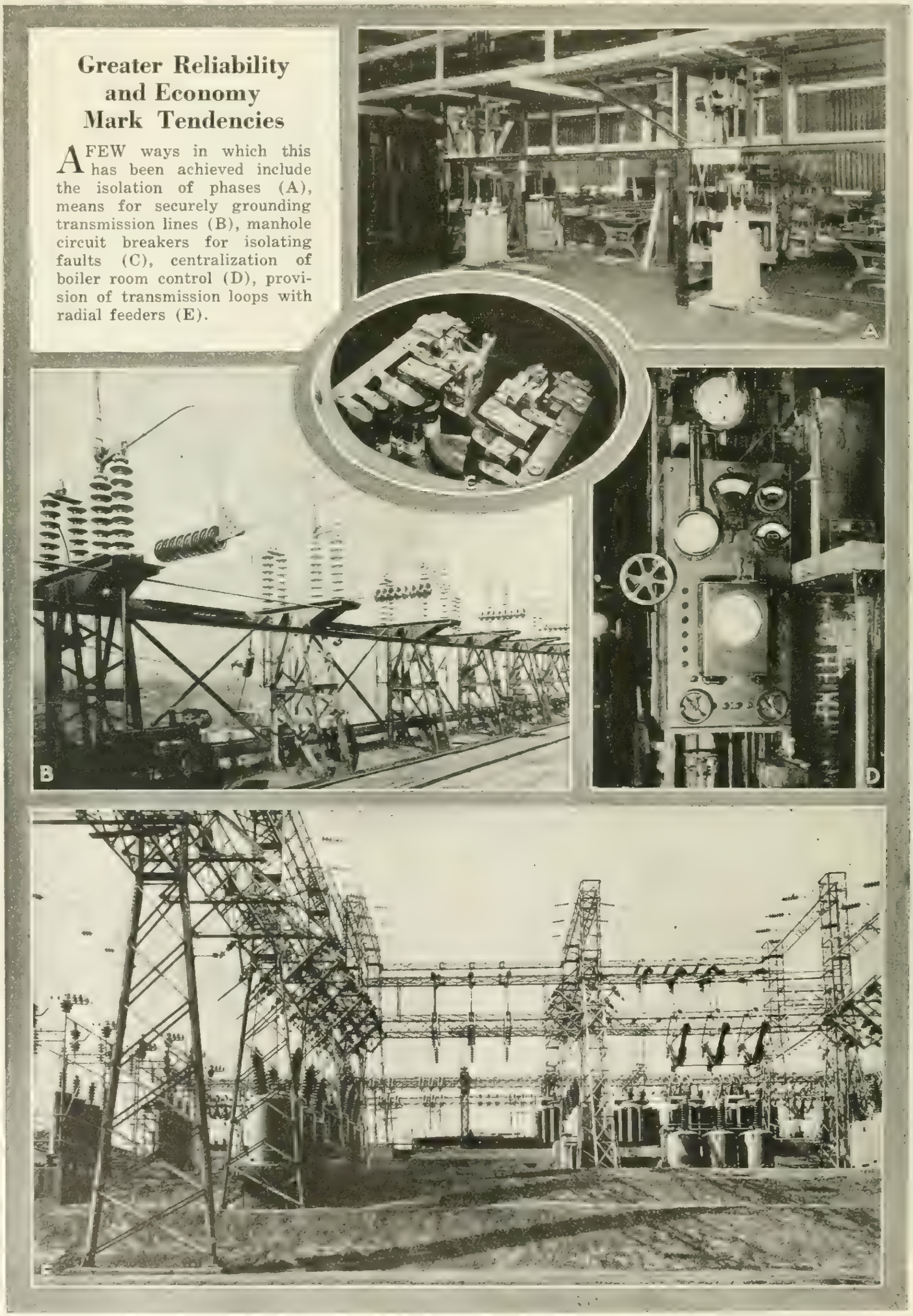
The United States is not only well represented in the world's long-distance commercial radio network but it has actually established itself in the foremost ranks by its providing powerful transmitting and receiving stations in Massachusetts, Long Island, New Jersey, California and Hawaii.

Tests made during the year 1921 have proved quite conclusively that a continuous-wave vacuum-tube transmitter will provide from three to four times the transmitting range by radio telegraphy obtainable from the quenched-spark transmitter.

For the past year or more the American Telephone

Greater Reliability and Economy Mark Tendencies

A FEW ways in which this has been achieved include the isolation of phases (A), means for securely grounding transmission lines (B), manhole circuit breakers for isolating faults (C), centralization of boiler room control (D), provision of transmission loops with radial feeders (E).



& Telegraph Company has had in operation at Deal Beach, N. J., and Green River, Mass., radio-telephone transmitting and receiving stations which were connected up with the land-line network of the Bell telephone system. With such nation-wide land-line facilities as this system possesses, a passenger on a vessel plying the Atlantic coast may hold conversation with his home or office direct from the vessel, the circuit from the ship to the shore station being via the radio method and from the shore station to the final receiver by land line. These experimental sets have been duplexed so that two-way conversation is possible.

There have been developed during the past year a group of medium-power continuous-wave vacuum-tube transmitters designed specifically for the overland radio communication, and already several of these stations are being operated in Central and South America. Tests of a 2-kw. tube transmitter made during the past two months have already disclosed that such a set provides the transmitting range of a 15-kw. to 20-kw. rotary or quenched-spark transmitter. It will soon be possible to duplex these sets.

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Higher Voltage Transmission in the West

BY S. BARFOED
Electrical Engineer, with Frank B. Baum, Consulting Engineer, San Francisco

THE progress which was made in the West during the last year, particularly by the Great Western Power Company, the Southern California Edison Company and the Pacific Gas & Electric Company of California, toward voltages higher than any thus far attempted indicates that the next step to 220,000 volts or thereabouts may be taken with the greatest confidence.

In the past year the Great Western Power Company finished the construction of its Caribou station on the Feather River, which has its line constructed for operation at 165,000 volts ultimately. One circuit has been built and insulated for the full voltage, and this line is the first to be equipped with static shields for the reduction of the voltage duty of the line and units of the insulator strings. In this case the shields consist of metallic disks with rounded edges supported between the conductors and the insulators. Laboratory tests indicate that these shields will be quite effective in reducing the likelihood of flashovers of the insulator strings, although operating experience has been meager.

Opinions seem to be united upon the point that lines to be operated at 220,000 volts will require the use of some form or other of static shields, but the exact form that these should take and their placing with reference to the insulators is a moot point. Extensive laboratory tests would indicate that the exact form of the shields is not a matter of great concern provided that certain rather wide limits are observed. These limits, of course, vary in different cases, depending upon the type of insulator and number of insulators per string and upon the conformation of the line and insulators with respect to the tower members. In each case, however, the aim has been to reduce the unit duty on the line-end unit in order to protect against flashovers, and in the event that such occur to direct the arc away from the insulator string. Another thing to be met is the varying conditions which are introduced when rain starts to fall and the insulators start to dry out.

An interesting test is now being conducted by the Southern California Edison Company upon one of its Big Creek lines, which were designed for and now operate at 150,000 volts. A portion of one of these lines has been insulated for 220,000 volts and provided with shield rings connected to the line conductor and placed so as to surround the second insulator from the line wire. The line is energized from one end only, and from the result of this test the belief is expressed by the Southern California Edison Company that the matter of reinsulating the entire line for conversion to 220,000 volts will be a comparatively easy matter, and that this can be done without the use of insulator units of greater diameter than that of those at present in use.

FLASHOVERS DO NOT CAUSE EXPECTED DAMAGE

The decision of the Pacific Gas & Electric Company with respect to the insulation of its Pit River lines, which are to be operated ultimately at 220,000 volts, has not been announced, although it has been intimated that a more radical change will be shown than in the case of the Southern California Edison Company. The exact date upon which these lines will be placed in operation at 220,000 volts has not been determined, and such a decision is involved with a determination of the control devices, line-end units and other such details.

The real problem in the operation of high-voltage lines is the flashovers, which occur without warning and without explainable cause. Various reasons have been advanced to explain the cause of these flashovers, but thus far none seem to hold true for all cases which have been noted. That these flashovers do not cause any material damage or long interrupt service is a characteristic of such lines and of the generators which supply power to them. These generators are usually constructed with a rather low ratio of short-circuit current to full-load current, and with adequate protection in the way of relays and switches the other portions of the transmission system to which the lines are connected are not seriously influenced by these disturbances. In most cases the lines are immediately returned to service without the need of changing any insulators, and that such may always be the case is the aim of many of the experiments to determine the form of shield to use. If the flashovers cannot be prevented, then it is hoped to reduce their importance and to suppress the spread of the disturbance.

LARGE CONDENSERS FOR LINE REGULATION

The principles of the use of synchronous condensers to line regulation are meeting with a steady expansion in application. Last year a condenser rated at 30,000 kva. was installed at the receiving end of the Big Creek line. Future lines are being designed to operate at constant voltage and with almost flat regulation from end to end. With sufficiently large condensers at points 100 miles apart along the line, it is calculated that such a line would be at practically uniform voltage throughout and that the voltage could be regulated independently of the load or the power factor.

In this connection it should be noted that not only the transformers at the generating-station end and also at the receiving-station end are being considered a part of the transmission line, but also that the synchronous condensers at intermediate points and at the end of the line are being considered as a part of the line itself and designed to operate accordingly.

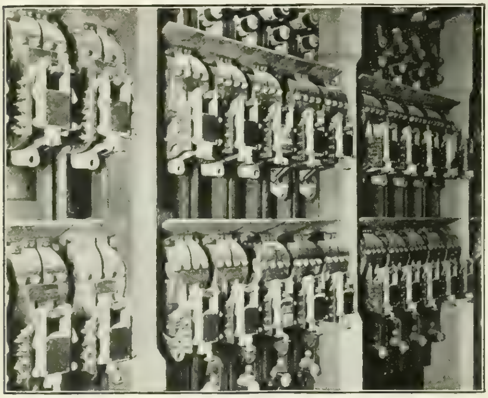
On the lines of higher voltage no lightning arresters are being provided, reliance being placed on added insulation in the winding of the transformer. As disturbances of the frequency of lightning strokes cannot travel along a transmission line for any great distance, it is felt that the inclusion of lightning arresters at the generating stations and substations is a complication which is not fully warranted.

Throughout the entire West the growth of the individual transmission systems has been such as to make for a close approach to the superpower system idea.

Still Greater Reliability the Aim in Station Design

BY B. G. JAMIESON
Commonwealth Edison Company, Chicago

CENTRAL-STATION companies that have been placed in service during the past year, though not so numerous as might have been anticipated, involve some electrical features not altogether new, but of special importance because their inclusion practically amounts to standardization. The evident purpose in these improvements is increased reliability. For example, consider the 1921 plant complement of current-limiting reactors and oil breakers of interrupting rating approximately 1,000,000 arc kva. in comparison with earlier stations with breakers of low duty and minus the current-limiting reactors.



REMOTE CONTROL DIRECT-CURRENT BUS SELECTORS DEVELOPED BY NEW YORK EDISON COMPANY

Within generators fire-extinguishing systems have become virtually a standard accessory. While the extinguishing medium has, perhaps, not been finally standardized, a conducting system consisting of circumferential piping spraying either water, steam or gas directly on the armature coils has been generally adopted. For generator cooling the merit of the inclosed ventilating air-supply system combined with the spray form of washer has also been commonly recognized. Possibly a surface-condenser cooling system will be a development of the near future. The exploration of armature temperatures was considerably extended during the year.

While the shaft-end exciter still holds its place as a standard, investigations have been made to further minimize their susceptibility to system disturbances. In some cases batteries have been found necessary as supplemental sources of exciting energy; in other cases, and for different reasons, separate motor-generator outfits have been used. There has also been some development of automatic throw-over devices to batteries or other unfailing sources of excitation. Of remote origin and yet intimately related to the field strength and stability of generators is the phenomenon of low-system power factor. This has received marked attention during the year past on the part of central-station companies.

The motorizing of auxiliaries has been further extended. Except where thermal efficiency is directly involved, 2,300-volt motors are practically standard for uses of 100 hp. and over. Where the economizer is employed auxiliary motor loads of 6,000 hp. per 100,000 kw. are not uncommon. A great deal remains to be accomplished before actual standardization of excitation and auxiliary drive methods is attained, although 1921 has seen the beginning of some effective organization toward this end. A marked effect on existing practice would result from a definitely established policy toward the house turbine and a study of the power factor and speed adjustment of alternating-current motors.

For the protection of major electrical apparatus differential or balanced relays have become almost universal in their application. During the year there have been made available for use with terminal apparatus balanced-current relays without interconnecting pilot wires, which have the requisite sensitivity and the advantage of greater simplicity. The protective relay equipment of outgoing lines has not undergone development of a radical nature, the general tendency being toward differentiation between earth and interphase short-circuits in order to gain greater selectivity.

In the grounding of system neutrals there is a tendency toward the use of higher resistances. More consideration is also being given to the use of reactors for this purpose. With some relays recommended or actually installed during the past year the higher resistance employed aids in the selective functioning of the outgoing line relays. One company has made provisions for voltage regulators in outgoing feeders.

Quite extensive use has been made of the ironclad truck-type switch for auxiliary service in several large plants. These units are similar to those used for customers' service from primary systems.

Partial outdoor installations of transformers and switching equipment have been made in connection with some stations supplying a portion of their output at high voltage, full outdoor installations being the rule for those high-voltage plants having no local distribution at moderate voltage. For outdoor installations rainproof-type reactors are being considered.

The most radical departure in switch-house design, as exemplified by two larger plants, is the segregation of phases. This innovation, combined with dependable reactors placed ahead of all points of convergence of phases, eliminates the possibility of interphase short-circuits on the buses. This arrangement permits central stations to be operated without sectionalizing, thus making possible all benefits of parallel operation. In one station the automatic control of the disconnecting switches and remote grounding by the use of the same agencies, all placed at one point removed from proximity to the switches or bus, reduce hazards to life and minimize the effects of man failure. Special attention has also been given to the ventilation of switch houses so that gases or smoke may be quickly removed. In one plant the whole structure is convertible to an outdoor installation with a very slight change.

Central-Station Commercial Plans

CONFIDENCE and optimism are strong among the light and power companies, and in spite of all the discouraging influence of past months of business depression, plans are being formed for broad, creative sales activities this year along many lines, backed by a genuine enthusiasm.

Appliance Selling Will Be Intensified and Increased in 1922

CENTRAL-STATION companies throughout the country are planning for increased activity in merchandise sales this year. There is a strong feeling of confidence in the expanding opportunity to sell appliances and the need for a constructive development of the residence load.

The Fort Worth Power & Light Company says:

> We are planning to increase our salesroom space by more than 100 per cent, which will enable us to display a great many large pieces of merchandise which have heretofore been handled at a disadvantage on account of not being properly displayed. As the necessity arises we will, of course, increase our sales force.

The Columbus (Ohio) Railway, Power & Light Company says:

> Our appliance business has been greatly stimulated during the past three months owing to the enlargement of our store and to greater effort being put forth to make sales. We have not curtailed our commercial activities during the business slump, but on the contrary have increased our efforts and plan to continue throughout the coming year.

The United Electric Light & Power Company of New York City says:

> We propose increasing our selling activities in distributing merchandise. Our idea is to bring the electrical shops to the people in the shape of wagons loaded with miscellaneous material supported by a crew leader who will call upon all the customers of the company presenting the many useful devices we have for sale. This campaign will start immediately after Jan. 1 and will be carried on by two crews that will operate in the various districts in the borough of Manhattan covered by our mains. During the year 1922 a combination sale of two appliances every month at a reduced price, with easy time payments, will be continued.

In Spokane the Washington Water Power Company has just participated in a co-operative electric show which has been put on jointly by the central-station company, manufacturers, jobbers, contractors and dealers. It has proved a great success, and the company plans to increase its sales force in order to do more active door-to-door appliance selling and build up the appliance business.

The Rochester (N. Y.) Gas and Electric Corporation is steadily increasing its electric merchandising operations. It says:

> We have provided a larger showroom in connection with our office and are gradually increasing the line of electric merchandise which we carry. Our merchandising operations are conducted with profit, and our prices conform with those of other electrical dealers in the city.

The Cleveland (Ohio) Electric Illuminating Company does no merchandising, but is doing an exceedingly active work in promoting demonstrations, publicity and sales for all local electrical dealers. Its plans for 1922 embrace a "home electric" exhibit, a model electric factory demonstration and a consistent effort to increase appliance sales in every direction. The company is confident of large success.

The current of opinion as expressed in a large number of letters on this point all flows strong in the same direction, and the situation is well pictured in this word from the Public Service Electric Company, Newark, N. J.:

> From present indications we would estimate that next year sales will be made in proportion to the degree of hard work and intensive effort made to secure them. This seems to be borne out by our own experience and that of others whom we have observed. During this past year it has been necessary to work hard to make sales, and results have been in proportion to the effort put forth. If intensive efforts are made next year, we believe good results will be obtained.
>
> In just this same way we shall intensify every phase of our sales work next year. Our newspaper advertising will be published every day or three or four times a week instead of once a week. In other words, we shall make every effort to overcome the present buying inertia of the public and we believe that this increased effort will produce a greater volume of sales next year than we have secured this year.

One Middle Western manager declares to this effect:

> In general it is my firm opinion that now is the time for central-station companies to exert themselves to the utmost in the line of sales activity. This is probably true of every business at the present time, and I believe it is a mistake for electric light and power companies not to appreciate that they should fall into line, and forget the war-time policy which led most of them to give up their sales departments. Instead of assuming that the sales department idea was a wrong policy, I believe that we should go into the matter harder than we ever have done.

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The Prospects for More Power Considered Very Promising

DESPITE the very large industrial capacity that was built up in factories erected for war production, there is a general expectation of a sizable increase in power business this year. The load has fallen off, of course, in almost all sections of the country during this period of depression, but more men are now being taken on in many industries, and there is good prospect that the capacity now idle will be put to work as business quickens this year and goods are flowing more freely out of the works. With this larger activity, central station companies are looking for more motor installations and increased power sales. The Chattanooga (Tenn.) Railway & Light Company writes:

> The outlook for more power business, both in increased loads at plants we are now serving, the changing over to electric drive of plants now operated by steam and the electrification of new plants which we hope will be under construction early in the year, leads us to believe that our power prospects for the coming year are most excellent.

In Boston no spectacular development of power busi-

A Few Developments in Lighting

A—Wrigley Building, Chicago, floodlighted. B—Nest of parabolic reflectors for Albany - Schenectady highway lighting. C—Bare gas-filled lamps in Rochester. D—Blue - glass gas - filled sign lamps.

ness is in sight, but a steady progress is anticipated in the way of taking on new loads, especially among establishments whose equipment is rapidly approaching the wearing-out or obsolescent stage. The demonstration of the value of central-station service during the war has resulted in this territory in general acknowledgment of the folly of building new private generating plants for industrial and mercantile power service.

The Columbus, Delaware & Marion (Ohio) Electric Company says:

> The power business of this company shows an increase each month over the same month last year, notwithstanding the industrial depression, October having been 14 per cent better than October, 1920. We have quite a number of "prospects" for additional power.

The Baton Rouge (La.) Electric Company writes:

> Prospects for power business are very encouraging. We have received a number of inquiries from prospective customers who are contemplating the establishment of industries which will create a demand for more or less power. So we are contemplating the installation of an additional unit of 1,500 kw. capacity at our power plant during 1922, as our load is rapidly nearing the capacity of our present equipment.

From Los Angeles this message comes from the Southern California Edison Company:

> As business conditions become more normal there is every indication of a steady increase in the demand for power service. Many new industries are being started in California and many Eastern manufacturers are considering the installation of branches on the Pacific Coast. This means that the manufacturing and industrial load will be considerably added to during the coming year. In the agricultural line many more acres are being brought under cultivation, and where electrical energy is available, electric power is used for operating pumping plants for irrigation. Development and operation of oil properties is also creating an increased demand for power, and we believe in 1922 this demand will be still greatly enlarged.

The Cleveland Electric Illuminating Company writes:

> We believe that new power business is going to come very slowly. However, some of our more important industries are improving, and during the past ninety days some business has developed from entirely new industries which are starting up. These have all been small, but the fact remains that there has been some new business while six months ago there was none. One of the interurban roads operating east from Cleveland has changed over and is now buying power from us for its entire requirements. The tendency, we believe, is going to be for all of the smaller lighting companies to buy power from some large producing center, where that is possible, and shut down their inefficient generating stations.

But in New York, according to the United Electric & Power Company, they are looking forward to a steady increase in power business during the coming year and believe that the rate of increase of business will materially improve. They have a number of propositions under high-tension contracts which they expect to close during 1922.

And again in Rochester the Rochester Gas & Electric Corporation is extremely confident. The company says:

> The outlook for more power business is very favorable. We have taken on as much new power business in the form of connected load this year as we did in 1920. For a number of years we have maintained a highly efficient sales and service organization, made up of trained college men whose duties are to secure additional power business and give expert engineering service to those power customers already on our books. We have carefully maintained this organization through good and bad times, and the general public has come to have a great deal of confidence in the company through the personnel of this organization. The result has been that we have had a continuous and very satisfactory growth in our power business.

In short, there is no lack of work for the power sales department nor of opportunity for the development of industrial business among the factories of every city, no matter how retarded their production has been of recent months. It is the general belief that better power business is close ahead.

Planning House-Wiring Campaigns in Many Cities

THE expectation of increased building activity throughout the country is gaining steadily, and central-station companies are planning to support the electrical contractor stoutly in promoting more complete installations of electric wiring. But the wiring opportunity will not be limited to new construction, for the coming of better business is expected to bring with it a very large volume of extension and repair work in houses already wired and the wiring of many old houses now located along the lines or within reach of profitable extensions. Campaigns are being organized already in many cities to take up the work as the season opens.

Says the United Electric Company, Springfield, Mass.:

> Next spring for a period of two months we expect to conduct another old-house-wiring campaign. By this plan the contractors do the wiring and we pay them cash when the work is completed, taking over a lease from the electrical contractor signed by the house owner, the terms of which give the house owner ten months in which to pay. We used this plan during the spring of 1920 and in 1921 and secured considerable business which we believe we would not have had otherwise, and up to the present time we have not lost a cent from uncollectible accounts.

The Citizen's Electric Company of Battle Creek, Mich., writes:

> We look for an extensive campaign in house wiring of both new and old dwellings early in the year if tentative plans for exploiting "electricity in the home" do not run amuck. The contractor-dealers have invited the Consumers' Power Company and ourselves to co-operate in a campaign of collective advertising, urging the convenience outlet and its attendant appliances.

The United Electric Light & Power Company of New York City says:

> We are planning a campaign on all unwired houses in our territory. We have prepared a list of every house that can be reached without the extension of our mains and propose to send to the inmates each month pieces of literature which will point out the advantages of electrical service. The progress previously made indicates good business along this line for the coming year.
>
> We purpose also to organize a campaign for more outlets. This applies to already-wired premises where more outlets could be conveniently installed. If our combined effort in a campaign on advertising and solicitation can be organized, I sincerely believe surprising results can be accomplished as more branches of the industry are involved than in any other campaign that I can think of, and if we will go still further and get the manufacturer, contractor, jobber and appliance manufacturer interested in this movement, we can more rapidly accomplish our object than by a single effort of any one organization.

A great many companies have written that their plans are not yet definite, but that they wait only upon the actual evidence that building is really under way to organize for a wiring drive. With the coming of spring everywhere the work of old-house equipment, according to these indications, will be taken up with more energy than has been general for a good many years.

The Year in Association Activities

TECHNICAL, manufacturing and commercial bodies show, alike in their independent and their interrelated proceedings, the steady progress of the science, the art and the industry. All societies ready to take advantage of the prosperous times ahead.

A. I. E. E. Pushes Standardization and Changes Scheme of Meetings

FOUNDED in 1884 for "the advancement of the theory and practice of electrical engineering and of the allied arts and sciences," the American Institute of Electrical Engineers is both the pioneer among American national electrical organizations and the one in which the professional as distinct from the industrial or the commercial side of electrical development is preeminently represented. It has always ranked in dignity, learning and achievement with the leading engineering associations of the world, and an unbroken record of progress has marked its career. In 1921 the membership of the Institute increased from about 12,200 to more than 13,500, or over 10 per cent. Three new sections were organized, known as the Lehigh Valley, the Connecticut and the Omaha Sections, and five new student branches were established, making the total number of sections and branches 107. During the year an important change in the policy of holding meetings was made by the directors, all regular monthly meetings being made section meetings, and general meetings of the Institute being limited to four each year, including the midwinter, the annual and the Pacific Coast conventions.

Last year the revisions in the constitution adopted in 1920 became effective, resulting in the election of one vice-president from each of the ten geographical districts into which the United States and Canada have for this purpose been divided. The standing and technical committees of the Institute, through which the greater portion of the important work is accomplished, have regained and in most instances surpassed their pre-war activity. The standards committee completed another revision of the "Standards of the A. I. E. E.," and the new edition was published in April. The marine committee brought its work to the point where publication of the progress made was deemed desirable, and accordingly in January last the Institute published "Recommended Practice for Electrical Installations on Shipboard." Outside of its own organization limits, the Institute, as one of the constituent bodies of the American Engineering Standards Committee, took a prominent part in the preparation of electrical standards, and it consented to act as distributing agent for the revised report, published in October, of the American Committee on Electrolysis. In this connection it is interesting to note that, in harmony with its policy of close co-operation with other organizations on matters of material interest, the Institute is now represented on the governing boards or committees of fifteen bodies in which electrical engineers have an interest.

The expense connected with printing most of the Institute's important papers twice—once in the monthly *Journal* and again in the annual *Transactions*—has brought about the adoption of a plan whereby, beginning in 1922, the papers and discussions constituting the *Transactions* will be published monthly as a part of the *Journal*, these papers being bound together at the end of the year for members who desire them in this collected form.

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N. E. L. A. Makes Great Progress in Reorganization Plans

AS ITS name indicates, the National Electric Light Association, the greatest in size of all the bodies that draw their members from the electrical industry, dates back to the days when lighting was almost the sole concern of that industry. Founded in 1885, one year later than the A. I. E. E., the association has grown steadily to its present vast proportions, when the companies which send engineering and commercial representatives to its crowded conventions generate approximately 95 per cent of the public utility electrical output of the nation. Included in the organization of the association are four national sections—namely, Accounting, Commercial, Public Relations and Technical—and each of these sections embraces a number of bureaus and committees. In addition there are a number of important national committees.

Within the last eighteen months the reorganization of the N. E. L. A., as proposed and authorized at its Pasadena convention, has been effected, at least in so far as the major elements are concerned. This reorganization included the creation of a staff at headquarters which administers systematically to the multitudinous activities of the association. The organization of this staff embraces a number of departments, each headed by a specialist. Of the thirteen geographic divisions authorized by the Pasadena convention twelve have been formed.

A movement looking toward the revival of commercial activities in the electrical field and having behind it all branches of the electrical industry was launched at a meeting of the executive committee on Dec. 15. The movement will be carried on under the direction of the Commercial National Section and the lamp committee of the N. E. L. A., co-operating with other associations and organizations as well as individuals interested.

Federal taxation, limitation of tax-exempt securities, water-power legislation rules and regulations, customer ownership, rural-line extensions and inductive interference, and many other questions of great importance to the electrical industry of the country, were taken up in a national way by officers and committees of the N. E. L. A. during the first six months of the current administrative year, which began July 1, 1921. Great progress was made with many of these subjects.

With the adoption by the Federal Power Commission of a set of rules and regulations to govern the issuance of licenses and to regulate the licensees, the water-power development committee of the association, working with a sub-committee from the Accounting Section, undertook to have certain of the rules and restrictions modified. The decision of the Federal Power Commission is expected to be made early in 1922.

The financing of new water-power projects, as well as the adequate financing of existing properties in order to enable them to expand to meet the demand for service, was a subject of continuing study by committees. In furtherance of proper financing a customer ownership committee was organized and is undertaking the compilation of facts regarding customer-ownership plans and campaigns of companies which already have undertaken this form of financing. Additional millions of dollars are expected to become available for investment in electric light and power securities as the result of activities of a new joint committee of the N. E. L. A. and the National Conference of Mutual Savings Banks.

A committee on rural-line extensions was appointed and divided into sub-committees which are making special studies of all questions relating to such lines.

One of the larger national activities has been the carrying on of a study of the causes of inductive interference. In this connection there has been developed a joint committee of the American Telephone & Telegraph Company and the N. E. L. A. which is endeavoring to formulate a national co-operative policy. This work, begun more than a year ago, is being carried on aggressively during the present administration.

Closely affiliated with all of the different activities is the national program of good-will advertising and publicity, which was continued vigorously throughout the last administrative year.

Despite Inactivity in Steel Industry A. I. and S. E. E. Reports Advances

WITH a membership composed of individuals actively engaged in or identified with the application of electricity to the iron and steel or allied industries, and firms engaged in the manufacture of iron and steel, the Association of Iron and Steel Electrical Engineers was founded in 1906 for "the advancement of the application of electricity to the iron and steel or allied industries by the co-operation of its members." It now has sections in Philadelphia, Chicago, Pittsburgh, Cleveland and Birmingham, and its growth is indicated by the fact that five hundred engineers attended the 1921 convention at Chicago last September.

Owing to the prevalence of inactivity in the steel industry during the year, much of the work outlined by the electric furnace committee, involving as it did continuity of operation, could not be completed. For the same reason the electrical development committee had little to report, although the advent of a steel-mill controller with contacts and arc chutes lasting from fifteen to twenty times longer than former designs was announced. The educational committee presented a "Crane Operators' Manual." The standardization committee presented specifications for electric overhead traveling cranes, and its sub-committee on motors reported that the general specifications on alternating-current motors for main-roll drives had been revised and would not require further change until new developments had taken place in the art. Working plans were formulated by the sub-committee on illumination.

Illuminating Engineering Society Reports New Types of Street Lighting

"ADVANCEMENT of the theory and practice of illuminating engineering and the dissemination of knowledge relating thereto," the constitutional object of the Illuminating Engineering Society, has been steadily followed during the fifteen years of the society's existence. Although lighting by gas and other mediums necessarily enters into the society's scheme of operations, electrical illumination by the very nature of the case provides its paramount field of work.

The work undertaken by the society during 1921 is indicated pretty clearly in the reports made to the Rochester convention last fall by five committees. The committee on lighting legislation presented a revised code, formal approval of which from the American Engineering Standards Committee is expected. The committee on nomenclature and standards reported the definitions adopted by the meeting of the International Commission on Illumination held at Paris in July. It also directed the attention of the research committee of the society to the desirability of investigating color values in terms of black-body color temperature and arriving at standards of integral color suitable for adoption, and also to the absence of suitable data on which to base definitions of glare. In the report of the committee on progress improvement in searchlamps was reported and two new types of street lighting were described. The standardization of lighting-fixture accessories was hailed as a forward step.

An outstanding feature of the Rochester convention was the announcement of a new light source called the neon-tungsten arc-incandescent lamp, which consists of two slightly separated helical tungsten electrodes inclosed by a bulb containing neon gas.

Institute of Radio Engineers Promotes Standardization

IN MAY, 1912, the Institute of Radio Engineers was formally established with a membership less than fifty. Today it numbers about 1,800. The objects of the institute, as stated in its constitution, are "the advancement of the theory and practice of radio engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members." Its most important committee is the committee on standardization. This committee, composed of twenty of the foremost radio engineers in the country, was at work during the past year revising the definitions of radio terms in use since the beginning of the art and framing definitions of terms which have come into use during the past few years, when the advent of vacuum-tube devices introduced a long list of new terms. The international character of radio communication has made it advisable to co-operate in the standardization of terms with foreign technical bodies and with representatives of the communication departments of foreign governments. It is expected that a "Book of Standards" will be published by the Institute early in 1922.

Society for Electrical Development Forges Ahead

IN THE nine years of its existence the Society for Electrical Development, Inc., on whose board of directors central-station companies, manufacturers, jobbers and contractors have each equal representation with directors-at-large, has persistently worked up further the objects set forth in its constitution, the first of which is "to promote and increase the use by the public of electric current for all useful purposes as an end in itself and as a means for increasing the demand for apparatus and supplies, and to promote and facilitate a co-operative planning and execution of various means and methods effective to this end."

In 1921, which saw the selection of that nationally known champion of co-operation, William L. Goodwin, to have executive charge as assistant to the president, a few of the society's many accomplishments were:

Fifty-five articles pertaining to the electrical industry were accepted and published by leading non-electrical magazines. These articles, which dealt with very many features of electric service, had an aggregate circulation of nearly a million. The *Monthly Sales Service* was improved and a number of new features were added.

About 600 requests a month were received for the booklets compiled and published by the society. Old booklets were revised and plans for new ones made. Two publications concerning the society itself were distributed. Five hundred and seventy newspapers received the society's "Weekly News Service."

An investigation into many fires attributed to electricity showed the prevalent looseness of practice in this regard, and due publicity was given to all of the facts.

Field activities of the society increased, and in four months representatives from headquarters attended fifty meetings of electrical men in various parts of the United States and Canada.

Special service to members and to local leagues was rendered, and efforts at standardized and still more effective service were made. Close co-operation with the National Association of Electrical Contractors and Dealers was achieved.

A campaign for increased membership, to be carried on by the present members, was started and received a gratifying response. Local membership "drives" were also started.

The annual Christmas campaign, in which non-members were allowed to participate, showed an increased appreciation on the part of electrical merchants of the value of intensive selling effort.

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Associated Manufacturers Co-operate Effectively with Other Bodies

ORGANIZED in 1915 "to advance and protect the interests of the manufacturers of electrical supplies and of the manufacturers of materials entering into electrical construction, in manufacturing, engineering, safety and other problems, to promote the standardization of electrical material, to collect and disseminate information and to promote co-operation among the members," the Associated Manufacturers of Electrical Supplies have attained a company membership speaking through 350 representatives. Besides manufacturing and standardization problems, the association includes in the scope of its activities packing and shipping, the collection and compilation of statistics on commercial and marketing conditions and methods, cost accounting, freight rates, insurance, specification and contract forms, warranties, trade acceptances and the interrelation of the various branches of the industry. Remarkable results are claimed from the work of the general standards committee.

The association co-operates with the Underwriters' Laboratories, the Federal Trade Commission and the electrical committee of the National Fire Protection Association, is a member of the Chamber of Commerce of the United States and the Merchants' Association of New York, and has a tariff adviser constantly looking out for its members' interests as regards import duties.

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Electric Power Club Helps to Defeat Bad City Ordinance

STANDARDIZATION of electrical machinery and promotion of a spirit of co-operation among its members for the improved production and increased distribution of electrical machinery and apparatus are the outstanding objects of the Electric Power Club as expressed in its constitution. In accordance with these aims the motor and generator section of the club in the year just past made important recommendations covering the disputed question of 50-deg. versus 40-deg. rating; the word "portable" has been dropped from before the name of the electric tool section to permit this section to deal also with stationary tools; the industrial control section has made good progress in connection with nomenclature, safety and fire hazards and the proper application of controllers, and the power switchboard and oil circuit-breaker section has adopted standard voltage ratings and made many valuable recommendations. The mining and industrial locomotive section, the transformer section and the storage-battery section have also been active, and indications are that very valuable recommendations will soon be made by the last-named section, which is one of the newer ones. In the year which is just past the Electric Power Club assisted very materially in opposing an ordinance introduced into the Chicago City Council whereby it was at first proposed to set up an inspection and testing bureau and to make systematic charges for approval of electrical devices before they could be sold.

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Edison Companies Association Has Its Own Field

THE Association of Edison Illuminating Companies, dating back to 1885, has for its special object "the development of the service to the public of electricity for light, heat and power and the promotion of co-operation among its members in dealing with the scientific, engineering and commercial problems involved." The association does not seek general publicity for its activities, deferring to the National Electric Light Association in matters of service to the industry at large, but seeks to serve in those particulars in which its small and compact membership makes it possible to work to better advantage than can the N. E. L. A. with its very large and diversified membership.

Electrical Contractors and Dealers Take Up Costs and Accounting

TO PROMOTE friendly relations between contractors and dealers, to disseminate helpful information among its members, to collect data and issue engineering sheets, to assist marketing, to increase the attractiveness of stores, to elevate installation standards and to co-operate with all industries and associations whose fields touch its own—these, in brief, are the objects sought by the National Association of Electrical Contractors and Dealers, whose membership on June 30 last was 2,322, an increase of 12 per cent over the preceding year, and which has twenty-one state associations. Committee work was actively pushed in 1921. The committee on cost data completed a manual of estimating which is now being used experimentally by twenty or thirty contractors in different parts of the country and has the indorsement of prominent estimators. The committee on central stations has brought about the printing and distribution of several pamphlets on writing and merchandising.

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Electrical Supply Jobbers Compile Statistics

THE Electrical Supply Jobbers' Association, which has its general office and secretary in Chicago, has three geographical divisions—the Atlantic, the Central and the Pacific. Each division has a secretary. There is no president.

One of the most important activities of the association during 1921 was the continuation of the work of the accounting and statistics committee. This committee is making a study of the costs of operation by lines of material and is having printed and distributed to members information and instructions for obtaining these costs. The method and forms committee suggested methods and forms for use by jobbers in their shipping, receiving and charging departments.

Statistics showing the total volume of business being done by jobbers throughout the country were compiled.

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Electric Hoist Manufacturers Make Extensive Studies

WITH a membership of corporations, firms and individuals actively engaged in the manufacture of electric hoists, the Electric Hoist Manufacturers' Association aims to cover manufacturing, engineering, safety, transportation, standardization and other problems connected with this specialized industry. In 1921 it made noteworthy studies along these lines.

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American Welding Society Turns from Sellers to Users

THE American Welding Society, organized to provide united action in extending the knowledge of the art of welding and its field of industrial application, has six sections, established respectively in Philadelphia, Chicago, Pittsburgh, New York, northern New York and Cleveland, and expects soon to establish others in San Francisco, Los Angeles, Portland, Seattle and Spokane. The society has set up as its advisory committee on research and standardization the American Bureau of Welding, and through this bureau investigations are being made of a kind to eliminate duplication and waste and procure results at a minimum cost to the industry. The bureau serves as the connecting link between the National Research Council's division of engineering and both the American Welding Society and the welding industry. The president instanced in his annual address as an outstanding feature of the society's progress the relinquishment of its control by those interested in the sale of welding equipment and supplies and the assumption of this responsibility by the users.

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Electrical Safety Conference Keeps Active

FIVE organizations co-operate to promote the work of the Electrical Safety Conference. These are the Associated Manufacturers of Electrical Supplies, the Electric Power Club, the National Workman's Compensation Service Bureau, the Bureau of Standards and the Underwriters' Laboratories. In the furtherance of its constitutional objects—the promotion by co-operative effort of the consistent development of manufacturing and installation practice with regard to accident hazards, the development of safety standards for construction and test, and the interpretation and rendering uniform of electrical safety codes—the special committees of the safety conference have continued actively at work.

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Railway and Utilities Commissioners Champion Fair Rates

ALL the railroad and public service commissions of the United States are represented in a national association which meets in convention once a year. Of direct concern to the electrical industry is the determined opposition of the association, as expressed at its convention last year, to government ownership of utilities and its championship of rates fair alike to the utilities and the public. A revised edition of its "Uniform System of Accounts for Electrical Corporations" was printed and distributed by the association.

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Fire Protection Association to Extend National Electrical Code

THE National Fire Protection Association has two functions—one to make the standards by the observance of which fire waste may be checked, the other to educate the public to follow them. At its 1921 convention, held in San Francisco last June, the electrical committee reported that the 1920 edition of the National Electrical Code had been submitted to the Engineering Standards Committee for approval as an "American standard" and that this approval had been accorded. A motion to develop the code to cover both accident and fire hazards was passed at a meeting of the electrical committee held last month in New York.

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Lighting Fixture Manufacturers Push Standardization

STANDARDIZATION, with especial regard to glassware heels and screw heads, was pushed vigorously in the past year by the National Council of Lighting Fixture Manufacturers, which has grown from twenty to 120 members in three years.

Production of Electrical Equipment and Supplies During Years 1919, 1920 and 1921

Item	1919 (Revised)		1920 (Revised)		1921	
	Number of Units	Value	Number of Units	Value	Number of Units	Value
Insulated Copper Wire:						
Rubber covered		$75,000,000		$85,000,000		$40,000,000
Total code	1,400,000	21,000,000	1,700,000,000 ft.	30,000,000	1,271,000,000 ft.	17,408,000
No. 14 code	1,040,000	10,000,000	1,105,000,000 ft.	11,250,000	890,000,000 ft.	5,785,000
Flexible cords	...		204,000,000 ft.		95,000,000 ft.	....
Generators:						
Waterwheel					196,000 kw.	1,100,000
Turbo					510,000 kw.	9,300,000
Motors:						
Fractional		41,000,000		40,000,000		15,000,000
1 hp. to 50 hp		65,000,000		66,000,000		30,000,000
51 hp. to 200 hp		9,000,000		11,000,000		5,000,000
Above 200 hp		2,000,000		4,000,000		1,000,000
Transformers:						
5-kva. and under	300,000 kva.		330,000	...		......
Above 5 kva	600,000 kva.		660,000			....
Distribution type		9,500,000		11,400,000		6,000,000
Power type		11,000,000		13,200,000	1,950,000	6,000,000
Meters, Watt-hour (house type)	2,000,000		2,200,000		1,500,000	....
Control, industrial		17,000,000		25,000,000		15,000,000
Lamps:						
Type "B"	130,000,000	....	172,000,000	....	134,000,000	....
Type "C"	25,000,000		43,000,000		27,000,000	....
Carbon	6,000,000		15,000,000		7,000,000	....
Miniature	70,000,000		105,000,000		105,000,000	....
Socket Devices:						
Heating appliances		18,000,000				....
Domestic		16,900,000		23,400,000		14,040,000
Industrial		1,100,000		1,500,000	....	900,000
Fans	1,000,000		950,000	13,900,000	700,000	10,000,000
Washing machines	500,000	50,000,000	600,000	72,000,000		....
Vacuum cleaners	600,000	19,000,000	1,025,000	51,000,000	600,000	30,000,000
Wiring Supplies:						
Rigid conduit		15,500,000	140,000 tons	20,300,000	58,000 tons	7,000,000
Non-metallic flexible conduit		4,500,000	100,000,000 ft.	4,700,000	98,000,000 ft.	2,500,000
Metallic flexible conduit			2,300,000 ft.	150,000		100,000
Flexible armored conductor	55,000,000 ft.		71,000,000 ft.	6,400,000		4,000,000
Outlet boxes and fittings				1,800,000		1,200,000
Tape:						
Friction			18,000,000 lb.		10,800,000 lb.	......
Rubber		....	2,000,000 lb.		1,200,000 lb.	......
Fuses:						
Renewable		....		3,500,000		2,000,000
Non-renewable		....		3,500,000	....	2,500,000
Schedule Material:						
Key sockets	12,000,000	.....	13,500,000	....	7,500,000	....
Pull sockets	7,500,000	....	9,000,000	....	5,000,000	....
Keyless sockets	4,800,000	....	5,500,000	....	2,750,000	....
Flush switches	9,000,000	....	9,000,000	....	6,000,000	....
Exposed switches	7,500,000	....	8,000,000	....	4,000,000	....
Plugs	7,500,000	....	15,000,000	....	8,000,000	....
Receptacles	7,500,000	....	15,000,000	....	8,000,000	....
Storage Batteries		86,000,000		125,000,000		83,000,000
Starting and lighting	4,000,000		3,500,000	52,500,000	3,200,000	40,000,000
Dry Batteries	50,000,000	7,000,000	65,000,000		50,000,000	....
Electric Vehicles:						
Trucks		....	5,000	22,000,000	1,000	....

Business Outlook for 1922

EVERYBODY IS looking forward to the New Year for release from the period of depression and liquidation, but it is apparent from the viewpoints expressed by manufacturers of different kinds of equipment and jobbers in several parts of the country that only hard work will bring better business.

Conditions More Favorable for Steam-Turbine Business

BY E. H. SNIFFIN
Manager Power Department,
Westinghouse Electric & Manufacturing Company

THE prime movers requirements of the country for 1922 will be large, much larger probably than the business that will be done. For many years there has been a large shortage of power. At the present time this deficiency is not far from 3,000,000 kw. There was a large shortage before the war. Then came the unusual war demand, and although the country's manufacturing facilities were taxed to the utmost, they were not equal to it. Meanwhile the natural increment of increase in power demand has gone on, and although the total power installed has been largely increased, it is no nearer to the country's requirements today than it was.

Electric light and power companies are fully alive to this fact, but income was limited, operating costs excessive, costs for new construction prohibitive, and money scarce. However, the general situation in that respect is rapidly changing for the better. The market for public utility securities is improving, and it will soon be possible for these companies to meet the demands of their growing business. Most of the turbine units purchased during the year will probably go into existing plants. There will, however, be a fair number of new stations started. During the second half of the year we expect to see many large contracts placed.

Meanwhile the manufacturers are devoting the period of comparative business leisure to valuable research work, introducing improvements which will be of great benefit to the art. Greater reliability and lower inherent costs are the ends to be sought. Slight improvement in efficiency can be effected, but not a great deal.

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Heating-Device Business to Increase About 25 per Cent

TWENTY million dollars will represent the 1922 volume of heating-device sales, or about a 25 per cent increase over 1921, according to one of the best informed men in the manufacturing end of this business. He based this estimate on the belief that the general business of the country in all lines will be much better next year, with the heating-appliance industry sharing in the increased prosperity. Moreover, during 1921 most jobbers and dealers had large stocks early in the year, and because of frozen credit situations and high inventories these outlets did not always have on order with manufacturers enough goods to maintain even the limited public demand. An era of hopefulness and optimism generally will have a marked effect on the functioning of such distributing channels.

There are no indications that sales of any of the smaller devices will show a larger percentage of increase than any other, but an increased business is expected in electric ranges and cooking appliances. Appliance developments will be toward improved designs of present devices. One exception to this will be a general tendency to standardize on cords and plugs wherever possible.

As to prices, this manufacturer looks for slight declines, which will be put in effect occasionally if the promised reduction in transportation expenses takes place and if the efficiency of labor increases, as it is hoped it will.

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Underlying Factors Favor Hydraulic Turbine Business

BY ARNOLD PFAU
Hydraulic Department,
Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

OPINION regarding the outlook for this year's hydraulic turbine business can be formed reliably on the basis of an analysis of the underlying factors and from present indications as they are evident. Power plants consuming fuel, whether coal, gas or oil, can be installed at relatively moderate initial cost, the expense for fuel being continuous and constituting a permanent attachment to the investment. Hydro-electric plants require a relatively large initial investment with very small continuous operating expenses, unless the construction work has been poor, or inferior machines have been installed.

These underlying factors are so widely at variance that they necessarily affect to a great extent the decision as to which construction should be adopted, a hydraulic plant or a fuel-consuming plant. When money and labor are scarce and wages are high, a plant requiring small initial investment and a short period of construction will be built; in other words, a fuel-consuming plant, unless the cost of the fuel delivered to the plant is prohibitive. On the other hand, when money and labor are readily available, when wages are low, then hydro-electric developments can be built to best advantage.

During the war hydro-electric development work was virtually at a standstill, a number of fuel-consuming plants having been installed instead. Now that money and labor have come within easier reach, a revival of hydro-electric construction work can be confidently looked for. The cost of fuel went sky-high during the war and has not yet dropped—nor is it likely to drop—back to pre-war levels, a circumstance which further encourages the development of water power. Many hydro-electric plants were kept going during the war almost under emergency conditions, with regard both to safety of operation and to efficiency. Now that we have returned to conditions rendering financial economy and commercial efficiency imperative, the operation of such plants has become almost prohibitive, and reconstruction work, which in some cases amounts to complete replacement, has become unavoidable.

All of the conditions cited prevailed during the past year, and consequently a fair amount of contracts for entirely new plants, as well as for replacement and reconstruction, were placed. Since the same conditions still prevail, there is no reason for not expecting a continuation of the present demand for hydro-electric equipment. Abroad, where the scarcity and high price of coal and other fuels are even more pronounced than they are in the United States, the demand is even on a greater scale.

Conditions Favor Better Pacific Coast Business

By T. E. Bibbins

President Pacific States Electric Company, San Francisco

NOT being a prophet nor the son of a prophet, my judgment regarding 1922 will be no better than any other, but a review of 1921 may be helpful in developing the estimate for 1922. Last year the jobbing business was notably good in the Los Angeles territory as far as volume is concerned. On account of severe competition for this business, however, profits were materially affected. This volume was due in a large measure to the extraordinary influx of people from the Middle West, necessitating an unusual number of new homes. This was most pronounced in southern California.

The growth of the city of Los Angeles from 10,000 people in 1880 to 600,000 in 1920 has no parallel and the possibility of a city of a million people in the next few years is not a small one. Necessarily the demand for jobbing supplies has been heavy. The indications are that for the first six months of 1922 there will be at least an equal volume.

San Francisco and the territory contributory to it have felt the depressing effect of the labor strike in May, yet the volume of business has been reasonably satisfactory, and the prospects for 1922 are for a slightly better condition. This is because the main commodities which go to make up the state's prosperity have been pretty well sold, particularly raisins, rice and canned fruits. It is also true of lumber. I can see nothing on the horizon which suggests anything but a feeling of conservative optimism.

The Northwest had a most unusual boom due to war activities, which developed shipbuilding and everything that goes with it to an extraordinary degree. Of course, this class of business has had to suffer severe liquidation, which has now been completed. Up to July 1, 1921, wool, canned salmon and lumber had been almost impossible to move. The warehouses of the Northwest were full of these commodities. The general liquidation resulted in the north Pacific Coast going through a very low business condition during 1921, affecting the electrical jobbing business, and few if any of the jobbing houses have done any more than break even. The lumber industry is brightening up. The surplus stock of canned salmon has been greatly reduced, and a number of salmon canneries will probably be operated on full time in 1922.

Taking the Pacific Coast as a whole, I believe the business which will be done by the jobbing houses will be slightly in excess of the combined volume of 1921. My own attitude of mind for the long pull of the Pacific Coast is decidedly optimistic.

No Boom Expected in Wire and Cable Market

PAINSTAKING sales efforts and close attention to economies in manufacture and distribution will be demanded of wire and cable producers in 1922, according to a leading wire manufacturer who discussed the outlook a few days ago with a representative of the ELECTRICAL WORLD. Gradual deflation in business bids fair to continue for some time, in the opinion of this manufacturer. Improvement in the building industry will help the wire market when better conditions are established, but there is a time lag of about nine months between the beginning of building construction and the delivery of wire required, so that even if building should be greatly accelerated in the spring, it would be late in the fall before the wire industry would benefit.

At present wire production is not far from 50 per cent of capacity. Small-order business prevails and the demand for circular-mil cable is at a low ebb. In the new year more or less central-station line-extension work is expected to require fair sales of weatherproof wire, but the cable outlook shows thus far no signs of old-time activity. No definite boom is expected in wire this year, and the problems of reconstruction force upon every manufacturer the closest possible consideration of plant economies and careful expenditures in marketing his product.

The general trend of prices, this manufacturer feels, is still downward, and he expressed the opinion that the prices of both copper and cotton have been artificially inflated within the past few months. Refusal to purchase cotton for factory use followed the late spectacular rise, and so far there has been no difficulty in getting enough raw material for wire production. Labor in wire plants has not had any sharp reductions.

To sum up, the outlook is one to require the American wire manufacturer to scrutinize his plant operations as never before, to pay the closest possible attention to rendering 100 per cent service on the business which he obtains, and to rid his mind completely of the idea that any business is "coming to him on a platter" during the next few years. The electrical industry is not going to stop growing, but competition for business in sight in 1922 is going to put the manufacturer on his mettle in order to obtain his share.

Hard Work the Key to Business in 1922

By V. C. Bruce Wetmore

Treasurer Wetmore-Savage Company, Boston, Mass.

FROM the viewpoint of a New England electrical supply jobber it is not possible for me to indulge in the cheerful prophecies of immediate marked improvement in trade that would make such welcome reading. The outlook for 1922 is not pessimistic by any means, but all signs point to a year requiring the hardest kind of work on the part of sales organizations and manufacturers. We shall all earn what comes to us in the new year's business—of that I am confident.

The ability to render prompt service will count not a little. Intelligent study of the customer's requirements will also be demanded in order to serve him economically and efficiently.

Conditions of world-wide importance affect the prosperity of the electrical industry in the United States to a greater extent than many realize. As these conditions improve export trade will grow. This means not only increased sales by American manufacturers to customers abroad, but improved domestic business resulting from enlarged export manufacture and sales. The accomplishments indicated at the Washington conference on armament limitation are generally very encouraging as influencing or being destined to influence world-wide taxation in the direction of reducing enormous burdens of unproductive expense. As successful trade with overseas countries develops the reaction upon business here will favorably affect the electrical industry along with others.

It has been well said that the world is undergoing a period of convalescence, and the United States is no exception. The return to a healthy condition of trade after such an upheaval as the war created takes time. Much as one would like to see a more rapid revival of business, the fact must be faced that hard work is absolutely necessary. Recovery may be closer at hand than can be seen at this writing, but the only safe and sound program is to combine careful and judicious expenditure for business ends with downright hard labor of mind and body, in order that a solid foundation may be built for the great business which ultimately must come with the expansion of the electrical industry.

New and Renewal Storage Battery Business Promising

BY H. B. GAY

Sales Manager Electric Storage Battery Company, Philadelphia, Pa.

THE outlook for the storage-battery business during 1922 is promising. There are two well-defined fields in the sale of storage batteries—new business and renewals.

New business is naturally greatly dependent on general conditions. As the process of readjustment continues the industry will feel not only the new buying but also the accumulated demand. This latter applies particularly in certain fields. It is a well-known fact that the railroads of the country have limited their purchases to the minimum during the past few years. This policy cannot be continued indefinitely, and it is the general feeling that they are reaching a point where they must go into the market and place not only new business but also orders for material held up in the past but which will be absolutely needed at this time. A similar situation exists in connection with the farm-plant business. Declining prices of food stuffs and the general situation have held up farm improvements. This field should also open up with better conditions.

The renewal business is also affected by existing conditions but not as much so as new business. The storage battery is an essential and indispensable part of many different kinds of electrical systems, units and apparatus, and the field for renewals is therefore not a matter of conjecture but a well-defined fact. A battery that has performed its work and is worn out must either be renewed or eliminated. In many cases elimination is impossible. This means that as the curve of general business moves to higher levels the replacement demand will become more and more insistent.

Another point which should accelerate buying in 1922 is that prices on storage batteries have undergone a considerable reduction and have now reached a stabilized level. The industry as a whole has passed through the liquidation period as well as any of the larger industries, and there is every reason to look forward to a satisfactory battery business in 1922.

Southwestern Jobber Expects Improved Demand

BY J. L. BUCHANAN

President Wesco Supply Company, St. Louis, Mo.

THE outlook in the jobbing field of the St. Louis territory is encouraging. No rush of business is anticipated, but, instead, a gradual development, and one or two years may be required to bring what may be termed really good business. The key to the situation at present is more in the industrial field than in agriculture, and each readjustment made in furtherance of industrial activity will better jobbing business. Of the readjustments which are vital to better business, lower freight rates and labor costs are pre-eminent. Needed construction work awaits both.

There is a growing tendency to make municipal improvements, particularly in towns of 3,000 population and less. There is considerable agitation in such towns for "white-way" systems and for better outdoor illumination in general, so that good business from this source by next spring is expected. Business will probably be slack in rural transmission extensions, because farmers have little ready money, but the field of transmission extensions to municipalities is quite promising.

Improved demand should be experienced in virtually every line of electrical goods, when compared with the year just closed.

Analysis of 1922 Wiring-Device Sales Outlook

BY FRANK V. BURTON

Sales Manager, Henry D. Sears, Boston, Mass.

MANUFACTURERS of wiring devices look forward into 1922 with mixed emotions. Last year was a testing time for many, and from all it required courage to grapple with the many extraordinary problems that were the inevitable accompaniment of the process of deflation. Nevertheless, it is probably true that the majority of wiring-device manufacturers greet the new year with buoyant enthusiasm.

The wiring-device business gets its demand from four principal sources: (1) The electrical equipment of new buildings, (2) the repair and extension of existing electrical equipment, (3) the wiring of unwired buildings (principally residences), and (4) manufacturers who purchase wiring devices to sell as part of their finished product.

During 1921 wiring-device manufacturers depended mostly on the second and third sources for their existence, for it is a well-known fact that conditions in the first and fourth were decidedly subnormal. What of 1922?

(1) The number and value of building permits since Sept. 1 has been one of the extraordinary phases of

this very extraordinary year. In normal times building activity decreases with the approach of cold weather, but in 1921 it was just the reverse. It is a hopeful index that building costs have now descended to a level where investors will resume their operations, and therefore a comparatively broad program, especially of residences and apartment houses, can be expected throughout the year.

(2) This class of demand is largely confined to the fall of the year, when the shortening days remind people of the inadequacy of their existing equipment. It is more or less steady year in and year out, and no great increase can be expected this year.

Unwired Houses Offer Opportunity

(3) Unfortunately, this class of business is by many treated as a forlorn hope, to be attacked when all else fails. Electrical World figures on the number of unwired buildings indicate clearly that there is plenty of profitable work in sight for years to come. No longer does a lighting company's transmission line define the limits of the fertile territory. The so-called farm-lighting plant has made of every human being anywhere a "prospect" for electric energy.

(4) Wiring devices bought to equip lighting fixtures required for new buildings are assumed to have been considered under (1), but in this classification are those required for table and stand lamps as well as for the constantly growing array of socket devices. Many appliance manufacturers have wallowed in the depths during 1921, but the sound ones have survived and are planning their 1922 sales campaigns with magnificent courage and resource.

The analysis reveals, therefore, that during the first six or eight months of this year the wiring-device business will be sustained on about the same level as during the close of last year and that it will broaden considerably during the late summer or early fall.

No Important Reductions Expected

It is doubtful if there will be any important price reductions on wiring devices during the year. Since the late summer most manufacturers in this line have based their selling prices on the replacement costs of raw materials, deliberately ignoring the prices paid for materials in stock. Current prices on commodity items represent a level nearly two-thirds of the way down from the high level of 1919 to the 1914 pre-war level. How much further they will descend is any one's guess, but it is perfectly safe to say that future reductions, if there are to be any, will be fractional and at widely separate periods.

Two subjects in particular can well receive the attention of the entire electrical industry, and all will benefit in proportion to the success of the endeavor. One is the sales education of the wiring contractor and the other the electrical education of the architect.

Altogether too much effort has been expended in endeavoring to make of the neighborhood electrical contractor a dealer in electrical appliances and not enough in educating him to be a salesman of wiring equipment. An electric flatiron is of no service whatever in an unwired home, and the utmost convenience cannot be obtained from an electric toaster when there is only one outlet in the dining room and that in the ceiling.

The year 1922 should be a good one, anyway, but intelligent co-operative effort will make it better.

Outlook Depressing in the South

By W. R. Herstein

Vice-president and General Manager
Electric Supply Company, Memphis, Tenn.

In this section I believe that the lines that will be affected most immediately after Jan. 1 will be electrical household devices and pole-line material—the first because negro labor in the South is now cheap and plentiful and the white Southern woman is no longer interested in labor-saving household devices; the second, because the sale of utility securities is being seriously retarded by state and municipal bonds, which are now being freely offered on account of the ready market brought about by their tax-exempt features. I do not believe the utility companies are going to have any great amount of money to spend. From what I can see, the tendency of prices will be to continue downward, particularly as labor becomes liquidated.

In spite of the depressed outlook, however, we are advising our customers to maintain adequate stocks and are ourselves following this policy. We are doing this because we do not believe there are enough electrical goods in existence to supply the demand if it should suddenly become normal. So many manufacturers have shut down, or are working part time that it seems to us there cannot possibly be a surplus of electrical material in existence. While we believe that a jobber's warehouse stock is more of a liability than an asset at the present time, and that it is continually decreasing in value on account of price changes, at the same time any jobber or dealer who is careful of his reputation for service must maintain an adequate stock.

Continued Improvement in Washing-Machine Sales Expected.

By E. B. Seitz

Secretary American Washing Machine
Manufacturers' Association

The year 1920 was the peak year in machine sales, reaching a total of $85,000,000. However, December, 1920, was the valley, sales dropping to about 30 per cent of the year's monthly average. Beginning with January, 1921, this percentage began climbing month by month until June, when it dropped back slightly. The climb started again in July, and each month since has seen a gain over the preceding month's sales. This statement is made before the November statistics are available, and it would occasion no surprise if both November and December should fall slightly under October as there will be no forward buying against the inventory-taking time of Dec. 31.

Throughout the year the washing-machine sales have been spotty with certain sections of the country doing virtually a 1920 business while others gave up early and never recovered. It has been noted and commented on throughout the year that not a single exception had been cited against the general statement that heroic sales effort was needed to market washing machines during 1921 and that the results in every case had justified the efforts.

For 1922 a much improved market is anticipated. Many manufacturers believe that there will be as many units sold in 1922 as in 1920. Much will depend upon what disposition is made of outlaw and dumped machines. If they are allowed to glut the market, discouraging legitimate dealers and educating the public to a fictitious price, then 1922 will be a most gloomy year.

Outlook in the Southeast Interesting as Well as Excellent

BY WILLIAM FARR

President Piedmont Electric Company, Asheville, N. C.

IT SEEMS to me that we are considering too closely the fluctuations in business that have occurred in the past few months as a result of adjustments and for that reason have to a great extent neglected to steer a straight course. Looking forward from an experience of nearly a quarter of a century in the electrical business, the outlook for 1922 is excellent, and in addition it is most interesting. We have with us an ever-increasing market for electrical materials and appliances, not only the result of the natural increase in population, but by reason of the movement of the farming population to small towns and larger cities. In my own State of North Carolina, for instance, while the last census gives us an increase of 16 per cent in population, 54 per cent of that increase went into the towns and cities.

Considerable building is being done, most of which seems to be in new residences or remodeling old buildings. This makes a good demand for electrical construction material, and the electrical jobber is pushing along this line, sometimes to the extent of forgetting profits, and is neglecting the big market for appliances and electrically operated labor-saving equipment because it requires new selling methods. However, one of the weak links in the sale and distribution of supplies and appliances today is the dealer's neglect of the opportunities in his own town. When the contractor and dealer are separated both will be benefited.

The need of the hour is sales ability along creative lines, and whatever can be done to develop this will take the sag out of the electrical or any other business. Otherwise we are going to have a lopsided market with a lopsided sales organization and competition to a profitless point. The principal problem is to reduce overhead.

Hope for New Year in Rocky Mountain Business

BY J. A. KAHN

President Capital Electric Company, Salt Lake City, Utah

LOOKING back over the trail we have come would beget pessimism; looking forward, there is hope. To say that the past year has been a prosperous one for electrical supply jobbers of the Intermountain country would be decidedly inaccurate. There have been several big adverse conditions to contend with.

The shutdown of the big copper plants the first of April was nothing short of a blow to Intermountain prosperity. Its first result was to throw out of work 8,000 laborers engaged in copper production and indirectly to cause other loss of employment at the coal mines, the mills and the smelters. This materially reduced the active market for electrical supplies.

Wool, one of the big staples of the Mountain States, was also hard hit. The precipitous falling off of the market was disastrous to hundreds of sheep men. It will take several years of hard struggling to liquidate notes and get this industry stabilized once more. Stock raisers likewise suffered a severe setback. Sugar-beet growers have hardly been able to meet expenses this year. The hay crop was good, but there is no market.

Added to these reverses there have been a number of country bank failures, with far-reaching and detrimental effect. There is scarcely an important industry that has escaped the blight of business depression.

It is rumored that the Utah Copper Company will resume operations to 40 per cent capacity the first of April. This would go a long way toward renewing hope.

The year 1921 will show about 60 per cent of the 1920 volume of business in the electrical supply jobbing trade, making this the leanest year since 1916. The greatest shrinkage has been shown in the department of household appliances, with industrial, pole-line material and building material following in order.

But there is a way out, and through co-operation and hard driving the jobbers are going to find it. Our immediate task is to spur the retailer on to more courageous and intensive selling. He must widen the outlet to the consuming public, and hence he must be schooled in modern methods of merchandising.

Better Transformer Sales Are Expected in 1922

BY M. O. TROY

Manager Transformer Sales, General Electric Company, Pittsfield, Mass.

COMPARED with the situation a year ago, the outlook for transformer sales is distinctly encouraging. Looking at the 1921 record of this market, it is apparent that the upward trend from the low point in the sales curve, which was reached last June, has on the whole been well sustained, and there is good reason to believe that a healthy advance will continue. It is reasonable to expect 20 per cent increase in kva. production during the new year as compared with 1921.

Public utilities are relatively very large buyers of transformers. The extension of central-station service is certain to continue to add many new customers to the outlying portions of distributing systems, and within the present lines of such companies there is still room for intensive development of business which will require material. The money market is so much more favorable to developments of this kind that a substantial expansion in central-station service may be anticipated.

From the manufacturing viewpoint, conditions are such that even a rapid increase in demand can be cared for with little difficulty. Where efficient organizations have been held virtually intact as regards "key men," with curtailed hours of production instead of full time by more reduced forces, the full stride of production can be attained very quickly. This gives reason to expect excellent deliveries all through 1922. The material supply situation is well in hand also. Progress has been made in gaging the amount of material necessary for anticipated volumes of production and in working to avoid an undue surplus.

It is doubtful if any expectation of further price changes will much affect the transformer market this year. The moderate advances in this class of apparatus during the war period have been quite well liquidated, and it is fair to say that this branch of the industry appears to have settled into a pretty stable condition in this regard. Altogether the outlook is conservatively encouraging, and as world-wide conditions improve a genuine expansion of manufacturing activity may confidently be expected.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Concerning the Light of Other Days

To the Editors of the ELECTRICAL WORLD:

About a month ago I retreated into Colonial times and have since been more or less cheerfully studying the means of illumination which our worthy and ingenious ancestors possessed. The storm hereabouts put out of commission a large proportion of all overhead circuits, and in my particular district the trees went down until they formed veritable chevaux-de-frise that required a good many days of sustained effort to clear away.

Having plenty of candlesticks and no lamps, my retreat was truly into the Colonial period, for even if I had possessed lamps of pre-revolutionary days, no whale oil would have been available for them. A fortnight's experience with candles has given me a better appreciation of their value and of the ingenuity of our ancestors in their use than could otherwise be attained. Of course, my candles contained one great improvement over the eighteenth-century variety in the braided wick, which bends over and burns off clean instead of requiring the use of snuffers. As to the illuminating effect I found that one could read or write quite comfortably by the help of eight or ten candles—a couple of candelabra in full action, and close together, proving satisfactory.

Nor did the candle flame when thus used fairly in the field of view prove in the least disagreeable. The intrinsic brilliancy of the flame is somewhere about 3 cp. to 4 cp. per square inch, and what is of more importance, the total luminous energy received from a single flame is very trivial. A 100-watt lamp shaded to a similar brilliancy would have been very unpleasant, and the condition actually found is an effective demonstration of the necessity of taking into account quantity of energy as well as intrinsic brilliancy in dealing with the subject of glare.

The illumination as measured by the candle-meter ranged from 1 foot-candle to 2 foot-candles, as might be expected, which is about the minimum for reading purposes. It also became very obvious why our ancestors turned to some of the fixtures characteristic of their time. The candlestick placed on a table is too low for general lighting except at very short range. It worked well enough in a living room or even in a kitchen where the cook worked at a low fireplace. As a kitchen light at the present height of ranges the candle proved a dead failure, and one began to appreciate the reason for sconces, particularly the mirrored kind, and *torchères* supporting long candles and giving some downward light. The chandelier too becomes an obvious fixture after experience with candles, it being the only means of carrying the light high enough for any general illumination in a large room.

Another blending of theory and practice appeared when using the candle meter. To keep candles working nicely they must not be too near together; hence our ancestors used somewhat spreading candelabra, the more since they had no hard paraffine candles. Hence the light falling on one's book came from scattered areas, and the effective component of the illumination varied widely so that the effect of my eight candles did not add up at all fully to an 8-cp. lamp. The same difficulty would appear in using any large area of low luminosity.

From a purely sordid standpoint the candle is not a success, and the reason for its rapid displacement by kerosene lamps is clear enough. Even though I purchased candles at sixteen for a quarter at an army supplies shop, one cannot consider them, from the standpoint of economy, as a competitor of the electric lamp or of anything else in the line of modern illuminants. But they served their turn well for a brief period and gave an insight into the early technique of illumination not easy otherwise to obtain. LOUIS BELL.

Boston, Mass.

The Deadly Kite

To the Editors of the ELECTRICAL WORLD:

When Benjamin Franklin risked his life in flying the historic kite in experiments destined to lay the foundation for later-day understanding and control of electricity, the menace of lightning discharges under which he worked was as nothing compared to the chance small boys take, in this era of high-tension power lines, when they persist in the practice of substituting fine wire for the time-honored kite string. From California comes the latest story of a tragedy traced to this more and more frequent practice among youths. One man was killed in Los Angeles, one boy crippled for life and two others were so badly burned that they were confined to the hospital, because one progressive youngster used a metal string for his kite.

Michigan, too, has had experiences of this nature. Only last August a boy in Flint was killed in a very similar accident. The records of the Consumers' Power Company contain two other instances, one in Flint and the other in Lansing, where only good fortune prevented loss of life. Reports of the Los Angeles accident have inspired the central safety committee of the Consumers' Power Company to sound a note of warning to Michigan boys against the practice of using metal strings on kites. The company is laying great stress on the accident-prevention movement both inside its organization and outside.

In this era of rapidly increasing use of toy wireless equipment and other electrical toys fine copper wire is becoming more and more available to the boys. All boys enjoy flying kites, and most of them realize the superiority of a fine wire over heavy cord in getting altitude for their paper ships. Too much stress cannot be put upon the warning against this practice, and sooner or later unquestionably it will be a subject for protective legislation. In the meantime it seems to me it is the duty of every public official, every school executive and every parent to point out to the boys the immeasurable danger and menace in the use of kite strings that will provide a conductor for electrical currents. H. J. BURTON.

Consumers' Power Company,
Jackson, Mich.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Locating Faults in Direct-Current Armatures.—B. A. BRIGGS.—Various conditions are discussed under which grounds may occur in an armature. Instructions are given for testing for grounded coils with a lamp and for cutting these coils out of circuit.—*Power*, Dec. 13, 1921.

Commutator Insulation Failures.—J. L. RYLANDER.—Enumeration of the common causes of failures of commutators, together with methods of preventing these failures. The effect of copper, carbon or ore dust and of oil is explained. The proper materials for construction and the correct methods of putting commutators together are outlined.—*Electric Journal,* December, 1921.

Lamps and Lighting

Incandescent Lamp Temperatures as Related to Modern Lighting Practice.—CHESTER C. DOWS and WILLARD C. BROWN.—This paper, which is based on experimental work carried on for several years, is intended to clear up questions on the operating temperatures of incandescent lamps. The material presented is in four parts —(1) temperatures of lamps without reflecting and diffusing equipment; (2) temperature of lamps with reflecting and diffusing equipment; (3) ventilation versus non-ventilation, and (4) suggestions in the use of incandescent lamps under special temperature conditions. —*Paper presented before Illuminating Engineering Society.*

The Lighting of Printing Plants.—A. D. BELL.—A discourse on the general requirements of printing plants and the special needs of the different departments, including the type-making and composing rooms, the photo-engraving room, the press room and the bindery. Layouts of lighting units for these locations are suggested and certain mounting heights and lamp sizes are recommended.—*Bulletin L. D. 125, Edison Lamp Works of General Electric Company.*

Generation, Transmission and Distribution

Heat Balance in Steam-Power Plants.—E. L. HOPPING, J. H. LAWRENCE and W. M. KEENAN, and C. W. E. CLARKE.—Particulars of systems employed to adjust the rate of steam-generation demand with the least possible waste of heat and expenditure of coal in the Delaware station of the Philadelphia Electric Company, the Hell Gate station of the United Electric Light & Power Company of New York City and the Colfax station of the Duquesne Light Company are given.—*Journal A. S. M. E.*, December, 1921.

Boiler and Furnace Economy.—D. S. JACOBUS.—This paper deals with such questions as when it will pay to use economizers in a new plant, the most economical rating at which to operate a boiler, limitations imposed on efficiency by inability of furnace brickwork to withstand temperatures available with many classes of fuel, furnace volume and length of flame travel, where air heaters are of especial advantage, importance of employing properly trained men for boiler operation, information afforded by flue-gas analysis, etc.—*Journal A. S. M. E.*, December, 1921.

Electrolytic Protection of Steam Boilers Against Scale and Corrosion.—W. PHILIPPI.—A description of a method said to be successful in protecting steam boilers against their two greatest enemies, corrosion and boiler scale. Careful investigations of corrosion on boiler bottoms, water tubes and condensers proved that electrolytic action was the cause of these damages. Owing to the different electromotive forces set up in different metals used in the construction of boilers, condensers, etc., in connection with conducting water, currents circulated from these metals through the water and sooner or later caused corrosion. But it was also found that in many cases erratic currents from electric railways or poorly insulated exciters entered a boiler and caused corrosion. A remedy that suggested itself was to employ a metal of higher emf., like zinc, to be connected electrically to the endangered boiler and to create in this way a counter-emf. to compensate for the corrosive current. But this method did not always give complete satisfaction, as it was impossible to regulate the current in the way made necessary by the different conductivity of the water used. To use an externally generated direct current and to apply this through electrodes into the boiler was found to give a perfect remedy. In fact, by doing this the small but constant generation of hydrogen along the boiler walls will also effectively prevent the formation of boiler scale. A direct-current voltage of from 10 to 20, at a current density of about 2 milliamperes per square foot, was found to be most effective. A small motor-generator of 6 kw. may supply a battery of thirteen boilers, each of which may have four protective electrodes. A small resistance in series with each electrode circuit permits suitable regulation of the voltage. Ordinary wrought-iron gas pipes are used as electrodes. Experience with this protection, extending now over several years, has surpassed all expectations. On boats using sea water in the condensers, for instance, no corrosion of any kind was observed after months of operation, while before installing the electrolytic protection it was necessary to clean them every few weeks.—*Siemens Zeitschrift*, October, 1921.

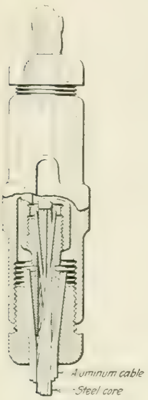
Traction

Third-Rail Systems of the United States.—Various types of construction used on elevated, subway, interurban and steam-road electrification systems are described in this article. Conditions which affect the construction, such as those of traffic, topography and climate, are described for each case. Numerous diagrams illustrate the design of different third-rails.—*Electric Traction*, November, 1921.

Developments in Railway Electrification.—Details of an extended suburban and main-line scheme in the London suburban area, extending as far as Brighton, Eastbourne and Worthing. Advantages of the lower cost of electrical operation and the improved service and traffic facilities are discussed.—*Electrician* (*London*), Nov. 25, 1921.

Installations, Systems and Appliances

Power Station at Sheffield, England.—An account of the construction and equipment of the new generating station of the Sheffield Corporation, which has a capacity of 35,000 kva. Of especial interest is a portable ash crusher which may be placed under the receiving pit of any boiler. The ashes are passed through this crusher, which is driven by a 10-hp. motor, and thence they are delivered into cast-iron suction pipes and drawn into ash-receiving tanks.—*Electrical Industries*, Nov. 23, 1921.



CONNECTOR FOR STEEL-CORE ALUMINUM CABLE

High-Voltage Line Hardware.—Ch. Lavanchy. — Descriptive article describing and illustrating a great many special accessories used on modern high-voltage lines to join wires and to fasten them to the insulators. Suspension-type insulator hardware, however, is not included. Of special interest is a concentric, solderless wire connector system "Pairard," intended for bimetallic conductors, such as an aluminum cable with a steel core. This device clamps the two metals separately.—*Revue Générale de l'Electricité*, Nov. 19, 1921.

Individual Motor Drive for Spinning and Twister Frames.—George Wrigley.—The article discusses the proper size and type of motor and connections for driving spinning and twister frames for textile mills. An interesting diagram is given showing power required for different parts of a spinning frame.—*Electric Journal*, November, 1921.

Developments in Power-Station Design.—Continuation of a series on the subject, the present article dealing principally with coal and ash-handling equipment.—*Engineer* (*London*), Nov. 25, 1921.

Power-Factor Correction and Its Relation to Plant Operation.—P. Vanderwaart.—A description of methods used in an industrial plant to find the causes for low power factor and remove them as far as possible. After a survey of one department, motors were rearranged to fit the loads and the power factor was raised from 78.4 per cent to 83.8 per cent. The power factor at maximum demand was raised from 76.5 per cent to 82.1 per cent. This was in a plant with 258 hp. maximum demand and 424 hp. connected load before the change (319.5 hp. after). The cost of changing the motors was $1,500, while the price of the motors released is $2,640.—*Paper read before the A. I. and S. E. E.*

Electrophysics and Magnetism

Methods of Magnetic Testing.—T. Spooner.—Methods for testing the magnetic properties of iron used in the cores of transformers and motors are described. Various apparatus for determining the eddy current and the hysteresis losses and means for separating these losses are discussed at some length.—*Electric Journal*, December, 1921.

Electrochemistry and Batteries

Electric Iron and Steel Plant for Brazil.—N. A. V. Paulsson.—The installation described, the first of its kind, includes two Swedish pig-iron furnaces, two Bessemer converters, a Ludlum steel furnace and two merchant mills, all driven by electric power and heated by electric energy.—*Chemical and Metallurgical Engineering*, Dec. 7, 1921.

Electrodeposition of Metals.—W. E. Hughes.—One of a series of articles. The one now noted deals with depositing lead. A number of uses for lead coatings are mentioned. Three types of lead baths have been used successfully in plating. Their methods of application and the resulting products are explained.—*Beama*, December, 1921.

Units, Measurements and Instruments

Acoustic Impedance and Its Measurement.—A. E. Kennelly and K. Kurokawa.—This paper describes the measurements of acoustic impedance and offers a technique for such measurements in the laboratory.—*Publications of Massachusetts Institute of Technology, Serial No. 27.*

Measurements of Three-Phase Wattless Power.—G. W. Stubbins.—Some methods of integrating wattless power without the use of special meters are discussed. Use is made of various taps on the windings of the instrument transformers.—*Beama*, December, 1921.

Telegraphy, Telephony and Signals

Transmission Characteristics of the Submarine Cable.—John R. Carson and J. J. Gilbert.—Besides providing a method for accurately calculating the transmission characteristics of a submarine cable, the analysis given leads to the following general conclusions: (1) Contrary to usual assumption, the "sea-return" impedance is by no means negligible; (2) the armor wires which surround the cable and which are necessary for mechanical protection have a very pronounced effect on the impedance of the sea return and even at moderate frequencies may become the controlling factor; (3) the rapid increase in the impedance of the armor wires with frequency and their pronounced and even controlling effect on transmission make a thoroughgoing study of their rôle in the electric system a matter of first-class importance; (4) at relatively high frequencies the return impedance, and hence the attenuation and the distortion, may be very greatly decreased by a correctly designed thin metallic sheath concentric with the core and in electrical contact with the armor wires.—*Journal Franklin Institute*, December, 1921.

Miscellaneous

Use of Electric Vehicles for Municipal Purposes.— F. Ayton.—Advantages of electric vehicles are brought out as regards length of service, permanency of economical energy supply, cleanliness and reliability. Comparisons between the cost of operating electric vehicles and the cost of gasoline-driven trucks or horse-drawn vehicles are shown to be always in favor of the electric truck.—*Electrician* (*London*), Dec. 2, 1921.

The St. Lawrence River Power Development.—The salient features of a report by Hugh L. Copper to the International Joint Commission on navigation and power in the St. Lawrence River. The report recommends Croil Island as a site for the main dam and power plant.—*Canadian Engineer*, Dec. 1, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

All Branches of the Industry to Co-operate for Better Business

MANUFACTURERS, jobbers, contractors and dealers have been invited to meet with a number of central-station-company members of the National Electric Light Association in New York on Monday of next week to consider the program for the "more business—better business" movement about to be launched by the association. Invitations to this meeting were sent out by President M. R. Bump after meeting with First Vice-president Frank W. Smith, R. H. Tillman, chairman of the Commercial Section, and M. H. Aylesworth, executive manager of the association, for the purpose of outlining a comprehensive and constructive program.

At the meeting on Monday it is proposed to discuss ways and means, lay plans for making this movement simultaneous throughout the country and start the ball rolling for a revival of commercial activity in which the electrical industry will take the lead in building better business of all kinds.

Colorado River Commission to Meet This Month

A MEETING of the Colorado River Commission will, it is expected, be called by Secretary Hoover on Jan. 26. The meeting will be held in Washington. Later it is the intention of the commission to hold hearings in the Southwest. At the Washington meeting a general plan of procedure will be agreed upon and limits placed on the scope of the work which the commission will undertake.

First Unit in Calumet Plant Started

THE first 30,000-kw. unit in the Calumet plant of the Commonwealth Edison Company, in the southern part of Chicago, was started on Dec. 28. The installation in this plant will for the present consist of two 30,000-kw. units, though when completed the station is designed to have a capacity of at least 180,000 kw. This plant will eventually be balanced by a station of more than 200,000 kw. rating to be built by the Public Service Company of Northern Illinois on the shores of Lake Michigan at Waukegan, Ill. With the existing Fisk, Quarry and Northwest stations of the Commonwealth Edison Company in Chicago, the two new stations are expected to become the hub of a great network of transmission lines in the upper Mississippi Valley that even now extend well toward Minneapolis on the north and to the coal fields of Kentucky and close to St. Louis on the south.

In connection with this growth of electric service a recent announcement revealed the purchase of a piece of lake shore property near the Indiana-Illinois state line that is designed for eventual use by the Insull interests as another power-plant site. This will be in the vicinity of the large industrial developments in the southern part of Chicago and its adjoining territory, and the plant when erected will be one in the group formed by the plants mentioned above. No plans are as yet contemplated for the plant on the lately purchased site, and there probably will be none made for some time.

Governor Miller Advocates Amendment of New York Water-Power Law

TWENTY-ONE applications for preliminary permits and licenses for the development of water power under the act passed at the last legislative session have been made, Governor Miller of New York State said in his annual message this week, but no licenses have yet been granted, as the commission is proceeding slowly and endeavoring to make sure that the law is adequate to protect the public interest. The Governor, who is firmly convinced that the development of water power under private enterprise is "the only policy that offers any prospect for the economical and efficient development of the potential water power of the state," estimated at 1,000,000 continuous horsepower in interior streams alone, explained that the commission would report to the Legislature with recommendations for needed amendments to perfect the law. The Governor suggested that the state should grant licenses for the development of power for general distribution, not for private use. The statute now provides for granting licenses to municipalities. "I think," the Governor said, "it might well provide for a preferential right in municipalities to purchase on the terms prescribed by public authority power developed under a license from the state. Of course, such a preferential right should not be permitted to interfere with other disposition, if not exercised, and unless exercised within a given time of notice of the quantity of power available such power should be released from such right to purchase.

"The surplus waters of the canal present a different problem," the Governor went on. "They are a by-product. Navigation is the primary purpose of the canal. Any use of the surplus waters must be entirely subordinate thereto. That subordination can only be effectively secured, in my opinion, if the development of power from the surplus waters and the maintenance of the canal for navigation are under a single control. It would not do to incur any risk of subordinating navigation to the needs of power users. It is estimated that 40,000 hp. can be developed from the canal surplus."

The Governor recommends the passage of an act authorizing the Superintendent of Public Works to sell the use for power of the surplus waters of the canal where practicable at public letting and an appropriation of $1,000,000 to start at once developments at Crescent Dam and Vischer's Ferry.

Providence Company to Issue $2,720,000 New Stock

DIRECTORS of the Narragansett Electric Lighting Company, Providence, R. I., voted at a meeting held Dec. 27 to issue capital stock to the amount of $2,720,000. The stock will be dated April 1, 1922, and every stockholder of record at the close of business Feb. 4 will have the right to subscribe for the issue at par, or $50 per share, in the ratio of one share of new stock to each five shares held by him on the foregoing date. Payments may be made in full by April 1 next or in three installments of 30, 30 and 40 per cent by Oct. 2. Six per cent interest per annum will be allowed on partial payments. Subscriptions will be received and rights transferred at the company's offices from Feb. 4 to 25, at noon. Franklin L. Hall is secretary. Expansion of business and plant requires the new issue to be made.

Oklahoma Utilities Association Convention Set for March

THE fourth annual convention of the Oklahoma Utilities Association will be held March 14, 15 and 16, at Oklahoma City. Interesting exhibits by electrical and gas manufacturers, jobbers and suppliers will be features of the convention. Prominent speakers in the public utility industry are being engaged by the committee in charge of the arrangements. New officers will be elected at the convention.

New Orleans Negotiations May Be Resumed

THE negotiations between the security holders of the New Orleans Railway & Light Company and the members of the Commission Council which were so abruptly terminated about two weeks ago by the State Supreme Court, just as the finishing touches were being put to the modified Maloney plan of settlement of the city car troubles, may now be resumed, if only temporarily, under a decision just rendered by Judge Porter Parker of the Civil District Court.

Judge King, of another division of the Civil District Court, on June 30, 1921, at the instance of the Attorney General of the state, issued an order on the city of New Orleans, the Commission Council and Mayor McShane to show cause why they should not be enjoined from entering into an agreement with the public utilities company for a rate of car fare in excess of 5 cents.

A suspensive appeal sought by the city was denied by the court and upheld by the State Supreme Court, the high court holding that Judge King was right in refusing to grant the appeal and that application for a dissolution of the injunction, which the city sought, should be made to the lower court. At this stage the negotiations between the city and the security holders in the trolley company were broken off and the conferences halted until the opinion of the lower court could be had.

Judge Parker, in his decision, took cognizance of only one of the exceptions of the city, namely, that the action instituted by the state was premature, the court holding that the city was well within its rights in negotiating with the New Orleans Railway & Light Company and could not be prevented from adopting an ordinance affecting street-car rates unless the ordinance so adopted was illegal and ultra vires. In the latter case an appeal to the courts to restrain the city from enforcing the provisions of the ordinance would lie. It was anticipated that the court would pass upon the validity of the authority which the city assumed as a rate-making power in the negotiations interrupted by the Supreme Court. This question, however, is unaffected by the decision of the lower court.

Plan for Reorganization of the American Cities Company Ready

AN AGREEMENT for the reorganization of the American Cities Company has been prepared by the committee formed to deal with the company's 5/6 per cent collateral trust bonds and now awaits ratification by the holders of certificates of deposit. The American Cities Company controls six Southern electric companies —the Birmingham Railway, Light & Power Company, the Houston Lighting & Power Company, the Knoxville Railway & Light Company, the Little Rock Railway & Electric Company, the Memphis Street Railway Company and the New Orleans Railway & Light Company. All of these except the New Orleans company will be affected by the new plan.

Three of the subsidiary companies—those at Birmingham, Memphis and New Orleans—are in the hands of receivers. The New Orleans company will be disposed of in accordance with a decision reached a year ago, the Chase National Bank of New York taking over the American Cities Company's interest in this subsidiary company in exchange for interests held by the bank in several others of the six companies controlled.

It is planned to operate the Memphis street railway in combination with the gas and electric properties owned by the Memphis Gas & Electric Company, which has defaulted on bond interest (see ELECTRICAL WORLD, Nov. 26, 1921, page 1089). Through holders of a substantial majority of the bonds in default an arrangement for such a combination has been made.

To carry out the plan a new company, known as the National Power & Light Company, has been organized under New Jersey laws. Its shares, both common and preferred, are without par value. The preferred stock is entitled and limited to dividends of $7 per share per annum, cumulative from Jan. 1, 1923, and is redeemable after three years from date of issue at $110 per share, and cumulative dividends upon the vote of not less than a majority in interest of the outstanding common stock. The National Power & Light Company will also issue fifty-year 7 per cent income bonds, subject to the prior payment of all indebtedness now or hereafter outstanding. With these bonds and the preferred and common stock of the company, in stipulated proportions, it will buy the defaulted bonds of the Memphis Gas & Electric Company.

The Electric Bond & Share Company is to assist in the reorganization as planned, and the further supervision, development, financing and engineering of the new company and its subsidiaries will be in its hands. The National Power & Light Company will offer to the holders of preferred stock of the American Cities Company the right with respect to every full twenty shares of said stock to purchase a block of securities of the National Power & Light Company consisting of a fifty-year 7 per cent income bond for $100 principal amount and seven shares of common stock for $262.50. The Electric Bond & Share Company and Isidore Newman & Son have agreed to purchase from the new company sufficient of these blocks to insure the company a total of $2,000,000.

The companies that will be controlled by the National Power & Light Company, if the plan is adopted, serve an aggregate population of approximately 757,000 and supply electric light and power to approximately 108,000 customers.

Prominent Electrotechnicians to Take Part in A. I. E. E. Midwinter Meeting

THE tenth midwinter convention of the American Institute of Electrical Engineers will be held in New York City on Feb. 15-17, in the Engineering Societies Building. In addition to the technical papers, the program will include the presentation of the Edison medal for 1921 to Cummings C. Chesney, a lecture on some recent advances in electrophysics, excursions to various electrical operating companies and manufacturing plants in New York City and vicinity, and a dinner-dance on the evening of Feb. 17.

The following technical papers have been tentatively scheduled for the program:

"Printing Telegraph Systems Applied to the Handling of Commercial and Railroad Telegraph Traffic," by A. H. Reiber.

"Modern Developments in Submarine Telegraph Cable Operation," by J. W. Milnor.

"Condenser Discharge Through General Gas Circuit," by C. P. Steinmetz.

"Questionnaire on Lightning-Arrester Practice," by F. L. Hunt.

"Deviations from Standard Practice in Lightning Arresters," by E. E. F. Creighton.

"Effect of Moisture on Thermal Conductivity of Soils Surrounding Cables," by G. B. Shanklin.

"The Use of Superimposed Imaginary Emfs. and Fluxes in the Solution of Alternating-Current Problems," by V. Karapetoff.

"Wave Form and Amplification of Corona Discharge," by J. B. Whitehead and N. Inouye.

"Questions of the Economic Value of the Overhead Grounded Wire," by E. E. F. Creighton.

"Surge-Proof Windings for Transformers," by J. M. Weed.

"The 'Indumor,' " by V. Karapetoff.

"Heating of Railway Motors in Service and on Test Floor Runs," by G. E. Luke.

Preferred Stocks Prominent in December Financing

THE total amount of stocks and bonds offered investors by the electric light and power companies, which has been increasing so markedly, continued on the upward trend during the month of December. The high total of $66,300,400 exceeds the total for December of last year by over $32,000,000 and that of November by over $12,000,000. Offerings of preferred stock again played a prominent part in the month's flotations. The rate of return yielded the investor, 6.64 per cent, remained comparatively low, though it showed a slight increase over that of November, 6.33 per cent. The largest single issue was that offered by the Philadelphia Electric Company, amounting to $12,500,000.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Durham Public Service Co. (North Carolina)	$100,000	Fifteen-year	General mortgage sinking-fund gold bonds, series A		8	8 10	99½
Hagerstown & Frederick Ry. Co.	540,000	One-year	Convertible collateral trust notes, series A	Refunding	7½	7 50	100
Connecticut Power Co	500,000	Five-year	Gold notes		7	7.00	100
Indiana Power Co.	1,100,000	Twenty-year	Non-callable first lien and general mortgage bonds, ser. A	To reimburse company for expenditures for additions to plant	7½	7 50	100
Kansas City Power & Light Co	2,000,000	Twenty-five year	First and refunding mortgage gold bonds, series C	To reimburse company for expenditures for extensions and improvements	7½	7 40	101
Nevada-California Electric Corp.	1,100,000	Thirty-year	First lien gold bonds, series B		6	6 40	95
Penn Public Service Corp.	750,000	Ten-year	First and refunding mortgage gold bonds, series A		6	6 70	96
Utica Gas & Electric Co	1,500,009	Three-year	Gold notes	To fund floating debt	7	7	100
Public Service Corp. of New Jersey	10,000,000	Twenty-year	Secured gold bonds	To pay maturing notes	7	7 10	98½
Philadelphia Elec. Co.	12,500,000	Twenty-year	Refunding and collateral bonds		6	6 05	99
Vermont & Quebec Power Corp. (Richford, Vt.)	300,000	Twenty-year	First mortgage gold bonds		8	8	100
Kentucky Utilities Co.	600,000	Twenty-year	First mortgage lien gold bonds, series B		7	7	100
North American Co.	10,422,400		Common stock			. .	Par
Consolidated Gas, Electric Light & Power Co. of Baltimore.	700,000		Cumulative preferred stock, series A	Reimburse treasury for additions and extensions	8	7 47	107
Queens Borough Gas & Electric Co	1,533,000		Cumulative preferred stock	Enlarge gas and electric plants	8		100
Southern California Edison Co.	7,500,000		Common stock				97½
Electric Bond & Share Co.	1,250,000		Cumulative preferred stock	General corporate purposes in expanding the business	6	6 75	89
Pennsylvania-Ohio Power & Light Co.	750,000	Ten-year	Secured sinking fund gold notes		8	8 15	99
Columbus Railway, Power & Light Co.	5,000,000	Twenty-year	Refunding mortgage gold bonds	To retire mortgage bonds due and to reimburse company for expend'trs	6	6 60	93½
Washington Water Power Co.	2,000,000	Two-year	Notes	To retire in part notes falling due	6½	6 50	Par
Morris & Somerset Electric Co.	405,000	Nineteen-year	First mortgage sinking fund gold bonds of 1910	Purchase of property	7	7	100
St. Paul Gas Light Co	1,500,000	Thirty-year	General and refunding mortgage gold bonds, series A		6	6.03	99½
San Antonio Public Service Co.	3,800,000	Thirty-year	First mortgage and refunding gold bonds, series A	To retire bonds falling due. To reimburse company for construction and improvements. To provide funds for further construction and improvements.	6	6.10	98½
Iowa Light, Heat & Power Co. (Carroll)	450,000	Thirty-year	First mortgage sinking fund gold bonds	To reimburse company for expenditures, to reduce floating debt and for other corporate purposes	5+2% additional	7 10	98½
Total	$66,300,400						

Province of Ontario Bonds on a 5.55 per Cent Basis

AN AMERICAN banking syndicate has just purchased from the Province of Ontario $15,000,000 fifteen-year 5½ per cent gold bonds which were offered this week to investors at a price of 99¾. The bonds are non-callable. At the same time a small block of the 6 per cent bonds of the province due in 1943 were offered on a 5.55 per cent basis. These bonds are a direct obligation against all the revenue of the province, including that of the Hydro-Electric Power Commission in Ontario, which has just started the first unit of its new 500,000-hp. plant at Chippawa Falls, estimated to cost at completion more than $80,000,000.

Portland, Ore., May Regulate Its Retail Electrical Dealers

REGULATION of retail stores selling electrical supplies, in order to prevent inferior material being sold, is provided for in an ordinance which will come up for passage before the City Commissioners of Portland, Ore., soon. After an investigation made by L. W. Going, chief electrical inspector of the city, it is said to have been conclusively shown that many small retailers are selling electrical supplies of inferior quality which do not comply with the specifications of the building code and tend to increase the fire hazard. The ordinance provides for a license fee from all dealers in electrical supplies. Cancellation of permits granted is the penalty for selling material not coming up to the specifications of the building code.

American Engineering Council Takes Up Patent Office Conditions

WHEN the American Engineering Council of the Federated American Engineering Societies convened in Washington on Thursday for a two-day session, conditions in the United States Patent Office were one of the chief topics brought up for discussion. The council is co-operating with other agencies in a nation-wide campaign to bring about reforms necessary to the protection of American invention and industry. The deplorable conditions existing in the Patent Office have been once again brought to public attention by Edwin J. Prindle, chairman of the patents committee of the council, who takes issue with the contention of Representative Mondell that the bill for the general reclassification of government positions will take care of the Patent Office. Mr. Prindle urges that the Patent Office relief bill be pushed to a vote. He says, in part:

"Owing to the meager salaries ($2,700 for primary examiners), resignations of Patent Office examiners have been going on steadily for a number of years, until now more than half of the force consists of young men fresh from college. There are more than twenty positions for examiners unfilled because it has not been possible to get men who are qualified to pass the entrance examination to offer their services. At the same time, the work of the Patent Office has increased by leaps and bounds.

"The examining corps, which would be unable to cope with the work even if every man were effective, has been so decimated that the process of disintegration cannot go much further without the Patent Office becoming stalled, both because of the loss of morale and because of its being swamped with work. A few months more of this process of going to pieces will complete its disorganization. As the general reclassification bill, even if it should ever become a law, cannot, by its terms, become effective in less than eighteen months, it would be fatal to drop the Patent Office relief bill and wait for the reclassification bill.

"There are scores of positions in the government service which pay salaries above that proposed for a primary examiner in the Patent Office relief bill ($3,900), and if the services required of primary examiners were only scientific, the proposed salary would still be fully justified. But these examiners must not only have scientific but legal training as well. The engineers believe that the salary proposed for the primary examiners is the very lowest that will keep any considerable proportion of the examiners in the Patent Office and that relief must be given now if disaster is to be averted. The bill, by increasing the fees for patents by $5, much more than provides for the increased expenditure. Thus the Patent Office would under the new bill continue, as it has always been, to be more than self-supporting.

New York Grants Preliminary Permits for St. Lawrence

PRELIMINARY permits have been granted by the New York State Water Power Commission for the development of the St. Lawrence River at Croil Island to the Louisville Power Company and at the Long Sault Rapids to the St. Lawrence Transmission Company. These are the first permits issued under the new state water-power act. Both these developments are being promoted by Col. Hugh L. Cooper, who designed the Mississippi River Power Company's development at Keokuk. The Croil Island plant will have an ultimate capacity of 1,000,000 hp. and the Long Sault plant approximately as much.

The permits are entirely preliminary, with provision for any changes that may be necessary if proposed water-power legislation that is expected to come up at this session of the State Assembly should become law.

No action has been taken as yet by the Federal Power Commission on applications for St. Lawrence development permits. These were held up awaiting the report of the International Joint Commission.

Contracts for Additions to Pittsburgh and New Orleans Plants Announced

ANNOUNCEMENT was made this week of two important contracts in the electric light and power field, one for the installation of the second 60,000-kw. unit at the Colfax plant of the Duquesne Light Company, Pittsburgh, Pa., and the other for the 20,000-kw. addition to the plant of the New Orleans (La.) Railway & Light Company. Both of these contracts were secured by Dwight P. Robinson & Company of New York, who are also engaged in preliminary engineering work on several large developments.

The work for the Duquesne Light Company includes, besides the installation of the 60,000-kw. unit, three additional substations along the company's lines in the Pittsburgh district. The Colfax station is designed ultimately to be one of the largest steam units in the country and to contain six 60,000-kw. units. The first unit was put in operation last year.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Chicago Firm Buys Electric Utility Property in Ohio.—The Northwestern Ohio Light Company of Delphos, Ohio, has sold its Hicksville branch to Cotter & Winslow of Chicago for $225,000.

Power Sent Over Guilford (Me.) Line.—Last month saw the inauguration of service between Lakewood Junction and Guilford, Me., by the Central Maine Power Company. This is a 33,000-volt line, part aluminum and part No. 1 copper. It will form part of a longer line, extending back over the Kennebec River to the Weston station, which will soon be completed.

Dann (N. C.) Municipal Plant Will Be Sold to Utility Company.—The electors of Dann, N. C., have voted to sell the municipally owned electric system to the Carolina Power & Light Company of Raleigh. The contract which was ratified obligates the company to pay the city $45,000 for its plant and lines. The Raleigh company also contracts to bring its own lines into Dann and assume control of the system within ninety days.

Contracts Awarded for Southern Power Plants.—It is announced that contracts have been let by the Southern Power Company both for the hydro-electric power plant at Mountain Islands, N. C., and for the new power house at Great Falls, S. C. The former plant, which will involve the eventual expenditure of $8,000,000, will have a maximum rating of 80,000 hp., and the Great Falls development a rating of 60,000 hp. The projects are scheduled for completion in the next two years.

Relative Advantages of Wire and Radio Service.—Summing up a description of the achievements and advantages of wireless telephony, more especially in the Pacific Coast States, the *Pacific Telephone Magazine* says: "The natural characteristics of radio and wire transmission are fundamentally different. Each, owing to its unique capabilities, is performing a service for which the other is unsuited, and each is supplementing the other to such good effect that all important needs for communication are being met as rapidly as they arise. For the large amount of traffic on land, both telegraph and telephone, which must be handled with certainty and a minimum of cost, the use of wire is necessary. But as an agency for communicating over wide stretches of water, with moving conveyances generally, for a host of maritime and military purposes, and for the broadcasting of information, radio today is rendering services of the greatest value. All considerations point to the conclusion that in these fields its use will become of ever greater importance."

Electricity in British Mines. — The aggregate horsepower of electric motors in use in the mines of Great Britain is put in the official 1920 statistics at 1,080,822, or an increase of 5 per cent over the previous year. The total horsepower under ground was 618,868, while surface motors were rated at 461,954 hp. In addition, motors of 20,045 hp. were employed in metalliferous mines. Charts show, says the London *Electrician*, that the progress in the introduction of electrical machinery has been more rapid in Scotland than elsewhere, and then come the South Wales, the Northern and the Yorkshire and North Midland divisions.

Associations and Societies

Philadelphia Section, A. I. E. E.—"The Philadelphia-Pittsburgh Section of the Philadelphia-Chicago Cable" will be discussed before this section on Jan. 9 by J. J. Pilliod of the American Telephone & Telegraph Company.

Iowa Engineering Society. — The twenty-fourth annual meeting of the Iowa Engineering Society will be held at Sioux City on Jan. 17-20. The headquarters will be in the Woodbury County Court House and there will be exhibits of manufactures and material on an extended scale.

Washington Section, A. I. E. E.—At a joint session of the Washington sections of the A. I. E. E. and A. S. M. E. to be held on Jan. 10 two papers on "Superpower" will be read, one by I. E. Imlay, consulting engineer Niagara Falls Power Company, and the other by Henry Flood, Jr., consulting engineer, New York; N. W. Storer, general manager Westinghouse Electric & Manufacturing Company, and others are expected to discuss the topic.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Philadelphia, Jan. 9; Washington, Jan. 10; Lehigh Valley, Jan. 12; Baltimore, Jan. 20; New York, Jan. 27; Salt Lake City, Jan. 27.

A. I. and S. E. E. Section Meetings—Philadelphia, Jan. 7; Cleveland, Jan. 14; Pittsburgh, Jan. 21; Chicago, Jan. 27; Birmingham, Jan. 28.

Indiana Public Utility Association—Bloomington, Ind., Jan. 14.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)

Iowa Engineering Society—Sioux City, Jan. 17-20.

American Society of Civil Engineers—New York, Jan. 18-19.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Arizona Corporation Commission's Powers.—In Haddad vs. State the Supreme Court of Arizona has found that though the constitutional function of the Corporation Commission is to regulate "public service corporations" within the state, and not individuals engaged in public service, an order affecting both corporations and individuals is not void as including classes of persons not mentioned in the law. (201 Pac. 847.)*

Telephone Line Owner Not Liable for Injury Caused by Felling Tree.—Affirming a judgment for the defendant in an action for damages (Gillespie vs. Andrews), the Court of Appeals of Georgia declared that the mere fact that the defendant might have allowed his line of telephone wire to touch the limb of a tree could not be taken to have as a natural and probable consequence that some other person would fell the tree across a properly strung line of electric wires six feet above the telephone wire and thereby complete a short circuit. The negligence charged against the owner of the telephone wire was not therefore the proximate cause of the injury for which recompense was sought (108 S. E. 906.)

Service at a Loss and Proper Measure of Inability to Pay.—In a suit (North Coast Power Company vs. Kuykendall) where the company's rates to diking districts were found excessive by the Department of Public Works (formerly the Public Service Commission) of the State of Washington, the Supreme Court of that state has found that the burden of showing the rates to be excessive fell on the original complainants since the new tariff had gone into effect before the complaints were made. The rule that where the general business of a public service company is bringing a fair return on the total investment it may be compelled to serve a given class of customers at less than cost was held inapplicable, but it was further held that the measure of a diking district's inability to pay is its actual financial resources and not the estimate of officials who provided for expenses without anticipating a change in rates. Whether the rates of the company are fair cannot be affected by the question of whether it solicited the business or the business was spontaneously offered. (201 Pac. 780.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Leonard T. Dickinson has been appointed professor of electrical engineering at the University of Vermont, in charge of the electrical engineering department. Professor Dickinson was graduated from the Massachusetts Institute of Technology in 1896. Immediately after graduation he was connected with the American Telephone & Telegraph Company and the General Electric Company for two years, after which he served as instructor in electrical engineering at the University of Maine, Armour Institute of Technology and Massachusetts Institute of Technology. From 1903 to 1909 he was instructor and assistant professor of electrical engineering in Lafayette College, and from 1909 to 1915 he was professor of physics and electrical engineering in Rhode Island State College. In 1919 and 1921 Professor Dickinson was professor of electrical engineering in Robert College, Constantinople, Turkey, and upon his return to this country was appointed professor of electrical engineering in the University of Vermont and put in charge of that department. Professor Dickinson is an associate member of the A. I. E. E. and a member of the Society for Promotion of Engineering Education.

L. T. DICKINSON

Walter P. Schwabe, vice-president and general manager of the Northern Connecticut Light & Power Company, has been appointed a member of the committee to devise a system of uniform accounting for municipally owned water companies, the committee being named by the Public Utilities Commission of the State of Connecticut. Mr. Schwabe is already a member of the committee on uniform accounting of the New England Water Works Association.

M. H. Gerry, formerly engineer and power superintendent of the Metropolitan West Side Electric Railway, Chicago, has been made secretary, agent and engineer for the St. Anthony Falls Water Power Company and the Minneapolis Mill Company, succeeding William de la Barre, who was elected president. Mr. Gerry was graduated in 1890 from the College of Mechanical Engineering of the University of Minnesota. He was employed for several years by the General Electric Company. For more than twenty years he lived in Montana, where he built the first dam in the Missouri River for the commercial development of power and the original transmission lines to Butte, Anaconda and Helena.

R. I. Baird has returned to the Electric Storage Battery Company after an absence of four years and is now in charge of Western sales of "Exide" batteries, railway car lighting, industrial trucks, etc., with headquarters in the Marquette Building, Chicago. After graduation from the Armour Institute of Technology, Chicago, in 1905, he spent two years with the Automatic Electric Company and worked for some time at Albuquerque, N. M., for this company. Then he served with the Bryant Zinc Company and also with the signal department of the Illinois Central until 1909, when he joined the sales department of the Electric Storage Battery Company, Philadelphia. In 1917 he left this company and went to Montana, where he had charge of the territorial office of the Delco Light Company while developing his own ranch interests.

R. I. BAIRD

R. W. Stovel, who served overseas as lieutenant-colonel in the A. E. F. in charge of the mechanical and electrical equipment at all ports used by the American forces, has entered consulting engineering practice with H. A. Brinkerhoff in New York City. Mr. Stovel was graduated from McGill University, Montreal, as an electrical engineer in 1897. From 1898 to 1903 he was with the Pittsburgh & Lake Erie Railroad and from 1903 to 1914 held various positions, including those of mechanical engineer and managing engineer with Westinghouse, Church, Kerr & Company, New York City, and had charge of a large number of railroad electrification and central-station construction undertakings. From 1914 to 1917 Mr. Stovel was with Gibbs & Hill in charge of several railroad electrification projects. After the war he re-entered the employ of Westinghouse, Church, Kerr & Company, later merged with Dwight P. Robinson & Company. Here he remained until he resigned to practice for himself. Mr. Stovel is a member of the A. I. E. E. and an associate member of the A. S. M. E.

R. W. STOVEL

T. I. Dekle, who has been with the Westinghouse Electric & Manufacturing Company since 1917, has left to enter the service of the Cline Electric Manufacturing Company, Chicago, as control engineer.

J. B. Straw has taken up his duties as associate professor of electrical engineering at the Agricultural and Mechanical College of Texas. Mr. Straw is a graduate of Purdue University and was connected with the electrical engineering department of the University of Pennsylvania for eight years. He has also done engineering work with the William Gordon Corporation of New York and other engineering concerns.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Electrical Industry Weathers Hard Year and Now Shows Recovery

A HISTORY of the electrical industry in the year just past is not a chronicle of prosperity, but it does contain many valuable business lessons and much of the wisdom that comes with adversity. It has been a year of struggle between slowly dropping production costs and stationary overhead charges on the one hand and a dwarfed demand and fast-decreasing sales value on the other, and few concerns in the electrical industry or any other for that matter reached the end of the year as well off financially as they entered it. Yet every one that has weathered the storm so far is richer in experience, better fitted to progress rapidly when the opportunity arises again, more efficient in doing current business, and all in all better prepared to go into the markets of the world and compete with all comers, than was the case during the easy times of 1919 and part of 1920.

The year started as one of hope. The depression had got well started during the last part of 1920, and there was a general expectation that conditions would have hit bottom and rebounded by spring. The automobile, textile and some other industries actually did show signs of life for a short time in these early months, but it was not well sustained, and during the first half of the year business sought a low level and activity was negligible.

Competition Replaces Order Taking

The electrical industry, though many companies had gone into the year with orders ahead, was forced more and more to resort to keen competition for all business, to forget the old order-taking days and revive the almost-forgotten art of salesmanship. There were consolations, though, for labor was more amenable and produced more, raw materials were in excellent supply, deliveries were short, and transportation problems had been largely overcome. Production, in short, was no longer a matter of difficulty. Prices of electrical products almost without exception have followed the downward path the whole year, the general policy being to liquidate as fast as costs dropped, and thus small reductions made often have allowed the market to readjust itself without much pain. There were other factors, of course, such as topheavy stocks, the immediate need for cash to meet debts and the demand of the public that prices come down. At the end of the year some electrical goods were down around pre-war levels, and there were few less than 25 per cent below peak quotations. Stocks have been much reduced during the year, and while immediate deliveries may be had in most lines, the inventory period brought little worry with it. Many jobbers and dealers have gone to the other extreme and hand-to-mouth buying is complained of by the manufacturer. Production in the electrical field has varied considerably, but there are few plants working to capacity. Credits and collections have been all-absorbing topics. There is reason to believe collections are now improving, but credits are still watched closely by the manufacturer and because of this losses are being minimized.

General conditions were bad also until early fall. Steel, textiles, agriculture, retail business, building, copper and other metals, railroad loadings, all continued on the downward path. Worst of all, because basic, was agriculture, which with the exception of cotton has not yet recovered to any extent. The most pronounced improvement has been shown by the construction industry. Since August building permits have shown a large increase.

Out of all this misfortune the coming year emerges with reasonably bright prospects. Labor has been partially liquidated, inventories are small, central-station companies are adding heavily to their residential loads, demand is improving somewhat, and building is going ahead rapidly even now. International relations are being adjusted satisfactorily, and this will help in foreign markets. There is no room in the coming months for an unreasoning optimism, but in all quarters there is confidence that 1922 brings opportunity and gradual improvement.

Export Total Below Last Year

Fortunately for the final record, exports in the first three months of the year reached high totals, March establishing a peace-time record. After that there set in a steady decrease, and at the present rate 1921 exports will amount to about $94,000,000, against $102,000,000 last year. Owing to the smaller money value of the articles, this indicates a volume at least equal to last year's. Smaller foreign buying ability, low exchange and the fact that many foreign plants, especially those of Germany, were back in production were factors in the decreased shipments in the later months of the year.

Apparatus Demand Becomes Light

From a condition of heavy bookings and uncertain deliveries the motor market rapidly changed after the year began to one of heavy stocks and light demand. Cancellations were frequent, and even popular sizes from 1 hp. to 10 hp. moved slowly. A general price reduction of 10 per cent was announced in July, and a readjustment of alternating-current motor prices was made around Dec. 1, but this did little to stimulate demand. Since early spring production has been small. During the fall some improvement has been noticed, but shipments may still be had quickly. Second-hand stocks are not so heavy and more new equipment is reaching the purchaser.

Transformers encountered much the same demand as other power apparatus. Back orders had been virtually overcome by early spring, and stocks of distribution transformers, while not burdensome, included virtually all sizes. Prices were reduced 10 per cent in February and 10 per cent again in July on certain makes of distribution transformers, but without much net result in demand. Sales of apparatus transformers were moderate, and deliveries were measured by time of production.

As industrial production fell away, demand for turbines and generators decreased. Central-station companies were hard put to it to maintain their load even with large numbers of residential customers being put on their lines, and there was no need to install much additional capacity. Repair and maintenance demand has held, and here and there new plants are being installed to cover new territory. For the last half of the year deliveries have been normal.

Pole-Line Equipment Much Reduced

Reductions on pole-line equipment, including poles, cross-arms, pins, insulators and line hardware, were frequent during the year, and though the volume of sales was fair, their money value is far below 1920. Western red cedar poles were cut about 18 per cent in April and 15 per cent in December, while Northern white cedars were dropped about 20 per cent in August and 15 per cent in December. Fir and yellow pine cross-arms dropped approximately 30 per cent during the year. Buying of both poles and cross-arms held up surprisingly well during the year, much of it being for central-station repair and maintenance work. Electric railway buying has been small. Producers have good stocks and are no longer hampered by transportation conditions in making deliveries. The season in the woods is not to be so heavy this year as it was last, producers state. The Far East and South America provided a good market for steel poles and tower.

Porcelain insulator deliveries ranged from three to four months in January but quickly changed to immediate delivery as demand declined. By October sales were starting to increase for the small distribution sizes, though orders are still individually small. Prices were reduced twice during the year, a total of from 15 to 20 per cent. Scattered reductions on line hardware were made a number of times and amounted in all to over 30 per cent. Manufacturers operated all year at from 50 to 75 per cent of capacity.

Keen Competition in Wire

At the beginning of the year the wire market had become the delight of shoppers, and from that time until August buyers were able to obtain many concessions. In the meanwhile quotations slid from around $8.50 per 1,000 ft. of rubber-covered in 5,000-ft. lots to as low as $6.15. Underselling the market ceased to be a novelty. But by the middle of the year unwieldy stocks had been reduced and a firmer copper market aided in bringing better conditions for wiredrawers and distributers. Production of No. 14 rubber-covered increased in September and it has sold well since. In December quotations had come back to around $6.60 per 1,000 ft. in New York. Conditions in the weatherproof field were much the same, and quotations have risen to 16 to 16¾ cents per pound in the last month.

Bare wire base fell to 13.25 cents per pound in August, and though not a very large demand has sprung up since, its price followed the copper market to 15.25 cents in December. Magnet wire has been a drug on the market most of the year, for many motor manufacturers, spurred on by the shortage in 1920, obtained heavy stocks a year ago and still have good supplies. Lamp cord and heater cord returned to the market in good supply early in the year and may be easily obtained in quantity.

Pipe Buying Hand-to-Mouth

There has been little margin of profit on rigid conduit all year. Purchasing has been of a most cautious nature, and the practice of local price-cutting has been observed frequently. The lower steel market fortunately has helped manufacturers keep production costs down, and quotations in New York on ½-in. black in twelve months fell from $70 per 1,000 ft. to around $48.50. Stocks of all sizes are plentiful in contrast with last year's shortages.

Increasing Construction Helps Wiring Materials

The gradual resumption of building during the summer aided schedule-material manufacturers in maintaining good sales. Supplies of raw material were better than in 1920, labor conditions in the factories were considerably improved, and some producers operated at or near full capacity from the middle of the summer on. Drops averaging from 10 to 20 per cent went into effect during the year, but there was not the general price cutting here observed in other lines.

Flexible Armored Conductor Reacted from Slump

Stocks of armored conductor at the beginning of the year were heavy, but manufacturers have been fortunate in encountering a steady demand throughout the fall, and deliveries now range from three to four weeks, with a few plants reporting bookings for six weeks. Prices are close to pre-war levels, and with more manufacturers in the field than in 1913 competition is strong. The No. 14, two-wire, single-strip is currently quoted in New York at around $45 per 1,000 ft. in 1,000-ft. lots, as against a quotation of $65 to $70 last January.

Lamp Production Held Down

Shortly after the first of the year lamp sales were so strongly affected by general business conditions that the "Mazda" lamp companies started operating on a four-day-week basis. By spring the seasonal recession in sales was unusually noticeable, though small agents' business was holding up well, indicating more residential and less industrial lighting. Fall brought little improvement. Stocks of consumers are pretty well used up by this time, though, and the lamp companies are on a better basis of production. Stocks of B agents have been complete all year. Gas-filled-type lamp sales have been astonishingly good owing to street lighting and electric sign activity. Prices on this type were reduced somewhat on Oct. 1. A few minor changes in lamp listing were effected May 1, dealing with diffusing-bulb lamps and candelabra decorative lamps. At the beginning of the year a new selling plan for miniature "Mazda" lamps went into effect, permitting agency appointments to be given only to wholesale distributers with a fixed basic compensation for services to the manufacturer. A revised discount schedule was arranged for retail distributers.

Smaller Appliances Have Fair Sales

The smaller appliances, such as toasters, irons, curling irons, percolators, etc., met with favor in a year when the public was inclined to be careful with its money. Irons had perhaps the best sales. Vacuum cleaners and washing machines partly recovered from the slump of last fall, reaction being due in part to generous reductions.

Fractional-horsepower motors were to be had in any quantity at low prices, and conditions in that field were chaotic for months. Improvement has been shown this fall, and motor-driven appliance manufacturers have bought moderately.

Metals Up in Last Half Year

Copper did not falter in the descent which was well started on the first of the year, and in August reached a price of 11½ cents a pound, lower than it had gone since 1914. There the turning point was reached, and slowly and painfully it struggled back a quarter of a cent at a time. In November the threat of a rail strike sent it back to 12 cents, but later in the month it rallied, and it is now at 14¼ cents. Early in the year mining was largely shut down to give the surplus a chance to find a market. Sales since September have been good, and the surplus of 1,250,000,000 lb. at the beginning of the year is now close to a normal supply. Resumption of mining is looked for in the spring. The formation of the Copper Export Association in the early spring aided greatly in resuscitating copper export trade and the year's foreign buying reached a large total.

	Dec 27, 1920	Dec. 31, 1921
Copper:	£ s. d.	£ s. d.
London, standard spot...	72 5 0	66 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13 75	13.87½
Electrolytic	14 00	13.75
Casting	13 00	13.00
Wire, base	16 00–16.50	15.00–15.25
Lead, Am. S. & R. price	4.75	4.70
Antimony	5.25	4.50
Nickel, ingot	43.00	41.00
Sheet zinc, f.o.b. smelter	11 50	8.50
Zinc, spot	6.00–6.10	5.15–5.20
Tin, straits	33.00	33.12½
Aluminum, 98 to 99 per cent	28.50	19.00
OLD METALS		
Heavy copper and wire	11.00–11.50	11.50–11.75
Brass, heavy	6.00–6.50	5.25 –5.50
Brass, light	4.50–5.00	4.87½–5.00
Lead, heavy	3.50–4.00	4.00 –4.12½
Zinc, old scrap	3.25–3.50	2.50 –2.75

Copper-wire base, net, at the mill reached its lowest point, 13.25 cents at the beginning of September, and gradually came back to its current quotation, 15.50 cents, one cent lower than a year ago.

Lead prices fluctuated between 4 cents and 5 cents all year, and the metal touched its low point, 4 cents a pound in New York, in March, long before copper reached its ratio. In May producers obtained 5 cents a pound but were unable to hold this price, and lead declined gradually to 4.40 cents in July. On Oct. 1 it climbed to 4.70 cents and held this price to the end of the year.

The steel market has shown a downward tendency all year, and producers claim that steel liquidation is about finished. Actual movement of steel for 1921 has been better than was expected, the estimate of total ingot production being around 20,000,000 tons. The collapse of the shipbuilding industry was the worst blow suffered. Prospects for 1922 are good, particularly in the export market.

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE last week of the year proved as dull as the week before had been busy. Retail demand for socket appliances receded from its high-water mark of the previous week, and taking of inventories made hand-to-mouth buying by dealers and jobbers imperative. Inventories are expected to show very small carryovers of the small socket appliances, such as toasters, percolators, irons, grills, etc., while stocks of most wiring materials are comfortable. Jobbers are of the opinion that it will take two weeks for demand to reassert itself and that after Jan. 15 the march back to prosperity will be resumed.

There have been no important price changes reported, outside of those noted in the ELECTRICAL WORLD last week. High spots, too, are few.

NEW YORK

As could be expected, the week between Christmas and New Year's was comparatively quiet in the electrical trade after the rush of holiday business the week previous. The demand for wiring supplies has moderated somewhat, but in view of the fact that this is the inventory period, orders have held up well. Most jobbers and contractors are busy closing up the year's business, and little activity is looked for until after the middle of the present month. Indications are that building is on the increase, and jobbers are receiving requests for bids on large quantities of materials. At least one large order was placed this week for the material necessary for "roughing in" a big job.

No important price changes were announced with the first of the year. In fact, jobbers have been rather slow in adjusting their conduit prices to cover the additional warehousing charge on rigid iron conduit placed by the manufacturers on orders delivered from warehouses.

Credit conditions are improving slowly, and the large accounts which have been outstanding for several months are being gradually whittled down. New accounts are opened only after very careful scrutiny, and current billings are on a thirty-day to sixty-day basis.

Conduit.—Some jobbers have not as yet adjusted their prices on this material to take care of the additional warehousing charge announced in the ELECTRICAL WORLD last week. Prices quoted this week ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $46; ¾-in., $56 to $59, and 1-in., $80 to $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted respectively from $48.50 to $51, $62.50 to $66 and $89.50 to $94 per 1,000 ft. Jobbers have fair stocks and report a moderate demand.

Rubber-Covered Wire.—The demand for rubber-covered wire has improved slightly and orders are for larger quantities. There appears to be a general sentiment that quotation on this material will be seen at higher levels. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks are fair to good.

Flexible Armored Conductor.—No change in price on this material was reported this week. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft. and double-strip at $47 per 1,000 ft. in lots of that quantity. Demand continues active and jobbers' stocks are only fair.

Metal Molding.—Jobbers carry small stocks as a rule and demand is light. In 1,000 ft. lots the three-wire size is quoted at $5.60 per 100 ft.

Lamp Cord.—Quotations on this material have remained unchanged for some time, probably because of the large stocks on some jobbers' hands. No. 18, cotton, twisted, is quoted at $12.90 per 1,000 ft. and the parallel at $15.60 per 1,000 ft. in lots of that quantity.

Heating Appliances.—Holiday business left most jobbers with small stocks of heating devices to carry over. In fact, there is some shortage of toasters and percolators. The slight price reductions on some appliances which became effective on Dec. 31 will make little difference in inventory figures.

Schedule Material.—Demand is fairly active in line with other wiring supplies. No price changes have been reported. Key sockets in standard package lots of 500 are quoted at $18.15 per 100 and keyless in the same quantity at $16.50 per 100. Pull sockets in lots of 250 are quoted at $33 per 100.

CHICAGO

During the past week more attention has been paid by electrical dealers to the inventory situation than to anything else, although in a few cases strong after-Christmas buying has been reported. But in the majority of cases jobbers and dealers are taking a breathing spell and are examining the sales results of 1921 and planning activities for 1922. A large number of dealers are satisfied with the total volume of Christmas sales; although it was not equal to sales for 1920, they feel that, in view of past conditions of trade, a good showing was obtained. The general spirit is one of optimism tempered by conservatism, and it is held that 1922 business will come to him who fights for it.

During this inventory period wiring materials have slumped a little and a slight increase in the price of copper wire has been noted. A fair demand for silk lamp cord has been reported, possibly to facilitate arrangements of new Christmas appliances. One manufacturer of heating appliances reports an average reduction of about 11 per cent on his goods. Inquiries on high-tension substation equipment by anthracite coal-mine companies were active during the week, and one manufacturing company reports a similar interest shown by public utility companies for extending transmission lines for farm-lighting projects.

Wire.—Rubber-covered No. 14 has stiffened a bit and is quoted at $6.75 to $7 per 1,000 ft. in 5,000-ft. lots. The call for weatherproof had a slight drop, but it is going fairly well at 16¾ cents a pound in 1,000-lb. lots. A few jobbers have increased the bare-wire base, while others feel that they should give the purchasers a slight inducement to buy and accordingly have not changed the price.

Flexible Armored Conductor.—Jobbers, in general, report a decreased activity and no increase of price has been noted, although expected. No. 14 two-wire, double-strip, sells for $46 to $48 per 1,000 ft. in 5,000-ft. lots.

Conduit.—A few jobbers have reported a good movement on conduit, but as a whole this material has not kept up its recent movement. It sells in 5,000-ft. lots for $47 per 1,000 ft.

Heating Appliances.—The final Christmas rush for these appliances was very satisfactory and in some cases continued into the following week. Jobbers and dealers everywhere reported a very brisk sale of flat-irons, toasters, open-air heaters and curling irons which continued right through the holiday period. This action might have been produced by an 11 per cent reduction on these appliances by one prominent manufacturer. It may also be possible that some people waited until after Christmas in order to obtain better bargains. However, the majority of dealers had sufficient stocks to supply this trade and thereby reduced their inventories.

Lamp Cord.—A continued demand for silk lamp cord has been noted this week, possibly to supply extensions for wiring of newly received appliances. No. 18, silk, twisted, sells for $27.50 per 1,000 ft., while this same size in parallel wire sells for $30 per 1,000 ft.

Meters.—Movement of meters increased a little last month. An increase of 3 per cent over November in sales of watt-hour meters for houses was noted in December.

BOSTON

The new year opens in the trade with widespread confidence tempered by the expectation of gradual improvement. Jobbers have reduced their stocks probably at least 50 per cent in the past year and a half and, in the faster moving lines tied into domestic service, are in good shape to resume buying more actively as conditions improve. The final week of 1921 was dull as is usual for the post-Christmas inventory period. Reports of holiday trade show that in the lower-priced socket heating devices rush shipments by manufacturers saved the day on deliveries, many retailers having underestimated the extent of buying which developed in the final week before Dec. 25. Prices last week underwent little change in Boston jobbing circles. Residential building is still under way in this district.

Conduit.—Fair sales are taking place from week to week. Stocks are readily meeting requirements. Prices are easy, representative figures on ½-in. black in 2,500-lb. lots being $49.21 per 1,000 ft. and $90.77 for the 1-in. size. Galvanized pipe, ½-in., sells at $53.82 per 1,000 ft., and 1-in., galvanized at $99.96, in the foregoing quantities, per 1,000 ft.

Fixtures.—Sales are spotty, but encouraging. Improvements in mercantile establishments are absorbing considerable material, and the residential market is showing moderate activity. Stocks are still widely diversified, and intelligent sales effort is reaping the reward which is its due.

Wire. — Moderate wire movement is reported, rubber-covered selling at $6.75 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is 16½ cents. Occasionally a little bare copper wire moves out of the reel yard or distributer's basement to piecemeal line-extension jobs.

Porcelain.—Sales do not indicate anything exciting in prospect just yet, but fair buying of knobs and tubes appears now and then to parallel the wire demand. "Nail-it" knobs sells in barrel lots at $18.50 per 1,000 and tubes in barrel lots at $6.20 and $13 per 1,000 in the 3-in. and 6-in. sizes respectively.

Flexible Armored Conductor.—This material is moving enough to satisfy a moderate demand only, with very close competition in prices. In 2,500-ft. lots single-strip sells from $43 to $45, delivery from Boston stock. Enough such material is still in hand to lead jobbers in some cases to cut quotations very close to the line in order to move it.

Lamp Cord.—Replacement orders come in to swell an otherwise non-spectacular demand. Fair quantities are moving. No. 18 cotton-covered cord sells at $17.50 per 1,000 ft. in 1,000-ft. lots. Appliance sales are a constant factor in stimulating the growth of diversified lamp-cord business, for new and for repair applications.

Sockets.—Trade is not bad in these as the year closes. Prices are steady, case-lot sales going as follows: Pulls, 31½ cents net; keys, 18 cents, and keyless, 16½ cents. A little more ordering for stock in January is not unlikely among far-sighted jobbers.

Appliances. — Shelves are pretty well cleared of the lighter and less expensive appliances. Very heavy demands on jobbers and even on manufacturers' stocks were made by retailers at the end of the pre-Christmas period. Prices are a little easier on flat-irons, percolators, etc., effective Jan. 1. The opinion is advanced in jobbing circles that present prices of standard devices of this type should encourage a more active non-seasonal trade in the near future.

ATLANTA

The last ten days have shown a remarkable improvement in the retail lines. Up to the close of business Christmas Eve the trade reported business in excess of anticipations, especially in toys, Christmas-tree outfits, heating devices and portables. As a result the carryovers in these lines will not be so heavy as was expected a few weeks ago. This week witnessed a very marked decrease in the amount of orders received by jobbers, due, of course, to the fact that no purchases are being made by contractors except for urgent needs, these orders being mostly for construction materials. All electrical firms are busy on inventory and other matters preliminary to winding up the year's business.

Canvass of the jobbing trade results in the impression that in the months of January and February, 1922 orders will be received mostly from the larger centers, with only a small volume of trade to be expected from the rural districts. Conditions are expected to improve in the small cities around March 1. A number of large industrial projects are reported under serious consideration awaiting action of directorates about the first of the year. No sharp price reductions are anticipated in the immediate future; in fact, heating-device prices already announced show no material cuts. Local jobbers have pulled stocks down to a very fair basis, most of it being on the thirty to sixty day turnover.

Electric Hoists.—Construction of industrial and commercial buildings has stimulated the market, and manufacturers report a very satisfactory volume of orders and inquiries, a number of these being for coal handling and dock equipment.

Electric Elevator Equipment.—Considerable activity is reported in this line, the volume of sales throughout the district for several months past being very satisfactory. A majority of the machines are of the freight type, though a fair quantity of orders for traction and high-speed passenger machines for office buildings have been received. A number of inquiries for installations subsequent to Jan. 1 are reported, with prospects for early closing good.

Industrial Motors.—The amount of business of one of the largest distributers shows considerable increase, particularly in the 220-volt and 550-volt sizes of 50-hp. and the 550/2,300-volt synchronous type in excess of 50-hp., the majority of the latter type going to raw-water ice installations. Shipments vary from stock to six weeks.

Lamps.—All jobbers report the lamp business for the last quarter of 1921 as showing an increase over the same period of 1920. Sales of the round bulb frosted, and to a lesser degree of the white bulb, have been satisfactory, while the bowl-enamel, type C lamp is rapidly increasing in popularity. In the "Mazda" class, the 25, 40 and 60-watt types lead in the volume of sales.

Transformers.—The demand continues fair to good in distributing transformers of 200-kw. sizes and under. There is a growing tendency to abandon a general use of the very small transformers, the 5-kw. to 25-kw. sizes coming more into popularity. Stocks are in good condition.

Fans.—The fan prices for 1922 have just been announced and show an approximate reduction of 10 per cent from the prices of last year. No orders are being received for spring delivery as yet, but sales campaigns are being mapped out by a number of jobbers, who report prospects to be as good as those of this time last year.

ST. LOUIS

On account of the holidays last week and the fact that many of the business concerns were busy with inventory taking, jobbers found business quiet. Stocks of electrical goods—wiring materials as well as appliances—have been well reduced during the year, and the new year finds them on a very conservative basis. For a time stocks of some items were short, but suitable replacements have been made, and virtually all orders, except those of great magnitude or for special materials, can be immediately filled from St. Louis stocks.

It is very encouraging to note increased attention being given by industrial concerns to improvements in their power systems. Competition is enforcing more economical manufacturing, and the central-station companies are taking advantage of this condition to demonstrate to the manufacturers the economy of purchasing power. A few plants in St. Louis are now converting, many others have signified their intention to change as soon as business conditions permit, and the same situation is reported to exist throughout the territory. This field will afford a most important outlet for electrical materials until construction of new plants becomes more extensive. In fact, any electrical device that will promote economy will be viewed with favor by the managers of industrial plants, provided that the initial cost is not excessive.

Wire.—Close attention is being given price adjustments. The market is becoming more firm as stocks purchased at the lower prices become less. The base for bare is about 15 cents per pound, and that for weatherproof is 16½ cents per pound. A representative quotation on No. 14 rubber-covered is $7 per 1,000 ft. in 5,000-ft. lots and $6.87 per 1,000 ft. in 10,000-ft. lots. Sales for the week were quiet, and stocks are in very good condition. The greater portion of the sales are of No. 14 rubber-covered, for residential work.

Loom.—Stocks were heavy, but have been reduced to a conservative basis. The demand has slackened appreciably in the last few weeks. The 7/32-in. size is selling for $16 per 1,000 ft., and the ¼-in. size for $17.50 per 1,000 ft., both in 5,000-ft. lots.

Portable Drills and Hammers.—Sales must await a reduction in building costs to reach a satisfactory volume. A new ½-in. drill has just been placed on the market to sell for $55.

Sockets.—A steady demand of good volume has persisted, and stocks are in excellent condition. Representative prices are: Key, $18.15 per 100; keyless, $16.50 per 100, and pull, $33 per 100.

Pliers.—Storm and sleet conditions have strengthened sales to some extent, though as a whole the demand is quiet. Klein's 6-in. side-cutting pliers are selling for $2.80 per pair, and the same plier in the 8-in. size sells for $3.75.

Flexible Armored Conductor.—No appreciable change in the demand is found, but some improvement is expected soon after the first of the year. Stocks are being maintained as conservatively as possible. No. 14, two-wire, double-strip, is selling at $45 to $52.50 per 1,000 ft. in 5,000-ft. lots.

Outlet Boxes.—The demand is steady but somewhat less than might be expected. Stocks are conservative, yet complete. The 3¼-in. round box sells for $7.20 in the black and for $8 in the galvanized.

PORTLAND—SEATTLE

Business in general is quiet following Christmas trade, and stores are attempting to bolster up trade by offering very exceptional price reductions. The general outlook for business in the Northwest during the coming year is good. Already large domestic orders for lumber for early delivery have been booked, and mills which have made the usual shutdowns for repairs over the holidays are planning to open up again by the first of the year.

Electrical trade during the past week has been fairly quiet, following a week of active holiday trade. The latter was very satisfactory, the volume of sales and their value comparing very favorably with and in many cases exceeding those of last year. This week the stocks in certain lines are badly demoralized as a result of heavy Christmas buying and understocking on the part of the retailers. This is particularly true of household appliances and certain hollow-ware items, such as waffle irons, toasters, coffee urns, grills, etc. Most jobbing houses are virtually closed this week on account of taking inventories. Some jobbers report that there was an unusual demand for high-priced goods, while others report that the majority of sales of holiday goods were in medium-priced lines. Nevertheless the best-grade urn-type percolators, Sheffield plateware, and the better-grade waffle irons were exhausted, in some cases several days before Christmas. On the other hand, Christmas tree outfits did not move so fast as was expected except in the case of Japanese goods. The market was flooded with Japanese Christmas lamps that sold at retail lower than the American goods could be purchased at wholesale. These goods apparently have the reputation of standing up very satisfactorily, and their appearance completely demoralized the sale of higher-priced goods in this line. Retail electrical stores report volume of sales greater than last year and ranging anywhere from 75 per cent to 125 per cent of last years' sales' in value.

Stocks of heating appliances in general were well cleaned out, and most stocks are well balanced at the present time. Some Christmas-tree outfits will be carried over, but the stock in general is not heavy. Contracting in Portland is reported good, and prospects for the year are excellent.

The general tendency in prices is toward small reductions on everything with the possible exception of rubber-covered wire which shows a tendency to strengthen in Portland.

Lamp Cord.—All cord wires show a slight reduction in price. Seattle quotes No. 18 twisted-pair, cotton-covered, at $11.97 per 1,000 ft. and No. 18 twisted-pair, silk-covered, at $28.48 per 1,000 ft. Stocks are in good shape.

Rubber-Covered Wire.—Quotations in Seattle are: No. 14, $7.40 per 1,000 ft. in 5,000-ft. lots; No. 18 fixture wire, $4.35 per 1,000 ft. The demand is good and stocks are ample.

SAN FRANCISCO

Although electrical jobbers and dealers are striving to look facts squarely in the face and are not regarding 1922 prospects with any unjustified optimism, yet there is a more cheerful tone among the people generally. California depends largely upon the sale of agricultural products for prosperity, and 1921 crops not only brought good prices, but during the year many of the 1920 surpluses were cleaned up satisfactorily. This meant renewed prosperity for the districts which had been rendered stagnant while these surpluses existed. Building prospects are good, for there is a large amount of unreleased work in the hands of architects. The last year proved the futility of certain methods of appliance solicitation, so that 1922 will build on that dearly acquired experience. It will be a year of competition because of high stocks on the Coast and big stocks in Eastern factories which must be moved, but it is the general opinion that it will not be a disappointing year because it has been foreseen and provided for.

Heating Appliances.—Prices on some makes have been reduced and they are now selling in the 6½-lb. size for $7.50 each, list. There is a new selling schedule working out at about 30 per cent for flat-irons in case lots and 35 per cent in four-case lots, with a parallel schedule on other household appliances in lots of one and in lots of six respectively. Heating appliances sold quite well during the holiday season. Many last-minute purchases of fairly large lots were reported with a continual tendency on the part of dealers to cut their purchases to the smallest amount consistent with a fair discount.

SALT LAKE CITY—DENVER

The best news from this section is the announcement that most of the idle mines in Montana will resume operations Jan. 16. This includes properties of the Anaconda Copper Mining Company, Butte & Superior Mining Company, Tuolumne Copper Company, North Butte Mining Company and several others. A horizontal wage decrease of 50 cents a shift will go into effect. Whether this favorable action presages a general revival of the metal industry of the West is not certain. The announcement, however, has awakened widespread interest and is sure to have a favorable effect on general business conditions.

Governors of a half dozen Intermountain states have just completed a conference at Salt Lake City in which they considered recommendations to be made to the Interstate Commerce Commission at a hearing on the freight rate question to begin Jan. 11 at Washington, D. C. The commission will be appealed to for a reduction of freight rates on basic commodities produced in the West.

Electrical Dealers are beginning the year with stocks at low ebb. They have little of their capital tied up in merchandise and will probably continue to pursue the policy of small orders and intensive selling along the lines where there is least resistance. Holiday selling was generally satisfactory and has resulted in building up a small working reserve. In many cases jobbers are laying plans for sales conventions and will launch determined drives for an augmented volume of sales in 1922.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Southern Electric Starts Fuse Production

The Southern Electric Manufacturing Company, Bristol, Tenn., it has been announced, started production of inclosed fuses, plug fuses, fuse links and cut-out porcelains on Nov. 1 last. The company was formed earlier in the year, being incorporated in Tennessee and backed by men with long experience in the electrical industry in the South. A factory was obtained at 619-621 Shelby Street, Bristol, in August and shipping commenced on Nov. 1. The output of the factory is at present 5,000 plug fuses and 2,500 inclosed fuses per day, but, according to a statement made to the ELECTRICAL WORLD by William M. Nelson, general manager of the company, provisions have been made to enlarge production on short notice. Distribution is being obtained through district sales agents in the larger cities and through direct-by-mail advertising campaigns.

Plans Maturing for St. Louis Electrical Show

Arrangements for the electrical show to be given in the St. Louis Coliseum March 20 to 25, under the auspices of the St. Louis Electrical Board of Trade, are being made definitely. General E. J. Spencer, secretary-manager of the Board of Trade, will be directly in charge of the operation of the show, and according to General Spencer the number of reservations on hand at present indicates that the success of the show will be complete. There are 156 exhibit spaces, and of these over 60 per cent have already been taken. Arrangements have been made to include manufacturers in the show, and a number of interesting exhibits have been secured by those in charge.

Direct Sales for Green Company in Chicago

The Green Engineering Company, East Chicago, Ind., manufacturer of chain-grate stokers, steam-jet ash conveyors, cast-iron hoppers and ignition arches, has opened a direct branch sales office at 941 Monadnock Building, 53 West Jackson Boulevard, Chicago. The former agency representation has been discontinued in the Chicago district. The change was made, according to the announcement of the company, in order to maintain better service and closer relations with the company's business friends in the district.

J. W. Himmelsbach has been appointed district manager, with supervision over sales in northern Illinois, northern Indiana, Iowa and Michigan. P. Albert Poppenhusen, president of the company, will maintain an office at the Chicago address. The general sales office will remain at the factory.

Whiting Controls Grindle Fuel Equipment Company

A controlling interest in the Grindle Fuel Equipment Company, Chicago, manufacturer of powdered-coal equipment for use with steam boilers, malleable furnaces, etc., has been purchased by the Whiting Corporation, Harvey, Ill. The Whiting Corporation manufactures electric traveling cranes, hoists and other handling machinery. The headquarters of the Grindle company have been moved to Harvey, but the name of the company will not be changed and the business will be handled on the same plan as before. The equipment for the Grindle company will be manufactured by the Whiting Corporation. Officers of the Grindle company as reorganized have been elected as follows: President, S. H. Whiting; vice-president and general manager, A. J. Grindle, and secretary and treasurer, T. S. Hammond.

Retail Fuse Sales Stimulated by Manufacturer

The increased use of electrical appliances in the home, according to Henry D. Sears, general sales agent of the Weber Electric Company, has brought with it an increased demand for plug fuses by the householder. Considerable attention has been given by the company during the past few months to business of this character, and to assist dealers in handling retail sales at a profit it has designed a fuse card of substantial thickness, about 6 in. square, and holding two 30-amp. fuses for the main service cut-out and eight 10-amp. fuses for branch circuits. These cards are being furnished to dealers, one being inclosed in each carton of 10-amp. and 30-amp. fuses, the thought being that certainly not more than 20 per cent of all the fuses of those two capacities that are produced by the manufacturer are turned over at retail. The card is provided with a brass eyelet so that it can be hung in a convenient place. If more than half the holes are empty, it is a reminder to the householder that it is time to have it refilled.

Canadian Manufacturer to Make Electric Vibrating Screens

The Stimson Equipment Company, Salt Lake City, Utah, has leased the rights to the Canadian manufacture and sales of its electric vibrating screens to the Engineering Equipment Company, Montreal. Manufacture of the screens will be carried on in that city. James W. Davis, formerly with the Canadian Ingersoll-Rand Company, has been appointed sales manager of the Engineering Equipment Company.

Bussman Announces Sales Department Changes

Changes of personnel and office location have been announced by the Bussman Manufacturing Company, manufacturer of "Buss" fuses, St. Louis, Mo. H. V. Flora has recently been appointed as factory representative in direct charge of sales for the States of Minnesota and Wisconsin. The appointment is now in effect, and Mr. Flora's offices are in Milwaukee. A. F. Fitzsimmons has been transferred to the Cincinnati territory with headquarters there, while the Chicago office has been transferred to 29 South Desplaines Street.

Underwriters' 1921 Electrical Work Equals 1920 Volume

During the year the work of the electrical department of the Underwriters' Laboratories, Inc., has been of about the same volume as in 1920 but has been spread over a somewhat larger number of items, according to an announcement just made. The applications received have not been for so large a number of what may be described as standard wiring devices as in some previous years but have included a very wide variety of special appliances. Among those which have been dealt with by the electrical department are water-heating devices, special forms of fixtures, toys, hairdressing outfits and many small machines for special industrial purposes. An item of significance is the growing activity of foreign manufacturers in seeking a market in this country for their wares. This applies particularly to Belgium, Germany and Japan, also to some extent to England. Samples of such products as originally submitted are usually of a quality decidedly sub-standard as compared with listed devices of the same class made by American manufacturers.

"The number of devices received," the statement continues, "from the Pacific Coast directs attention to the increasing use of electricity for cooking and heating whenever low service charges are established. Through the Underwriters' Laboratories industry conference on rubber-covered wires and cords a standard on a new form of portable cord known as rubber-sheathed cord (type S) has been developed. This cord with its jacket of a high-grade rubber and without braided coverings is expected to prove very useful where the conditions of service are severe.

"With the co-operation of manufacturers, plans have been completed for a standard on Christmas-tree lighting outfits with the result that hereafter a better grade of such devices will be available, free from some of the defects heretofore observed. A large amount of work has been done on new lines of inclosed switches produced in response to the widespread objection to the old 'open knife switch.' Special testing machines for these switches have been designed and installed in the Laboratories.

"While the volume of work on fuses has not been so great as in 1920, the fuse-testing equipments in Chicago and New York have been extensively used both on new designs and in retesting under the label service. The Electrical Safety Conference, of which the Laboratories is a member, has issued its safety standard for industrial control equipment and will shortly issue others on rotating electrical machinery, cranes, switchboards, oil-switches and oil circuit breakers."

Westinghouse Obtaining Power Equipment Business

Slightly increased business activity is noticed by the Westinghouse Electric & Manufacturing Company, which has received two large orders for power equipment within the last few weeks. One of these orders, for four large booster converters, four large transformers and auxiliaries and amounting to $120,000, was placed by the Brooklyn Edison Company, New York. The other, for rotary converters and transformers for two substations, was received from the city of Philadelphia. This amounted to $100,000. All this equipment will be built at East Pittsburgh, the work to begin at once.

A very good demand for radio equipment, particularly around Chicago, where opera is being broadcasted, is reported by the Westinghouse Company and production has slightly increased.

Electric Motor Repair Company Moves Into New Quarters

Increasing business during 1921 has led the Electric Motor Repair Company, Springfield, Mass., to seek new and larger quarters at 15 Park Street, Springfield. J. B. Tufts, treasurer, stated to the ELECTRICAL WORLD this week that in the new location the company will have improved facilities for testing and repair work on motors and generators and that a better departmental arrangement has been secured, with greater accessibility for customers. Looking forward to 1922, Mr. Tufts expressed confidence in the further development of preventive maintenance practice in industrial establishments and the ability of engineering to meet the requirements of better service in the coming year.

Stovel-Brinkerhoff Engineering Company Formed

R. W. Stovel and H. A. Brinkerhoff, both formerly with Westinghouse, Church, Kerr & Company for some period during their previous engineering work, have formed a partnership as consulting engineers with headquarters at 136 Liberty Street, New York City. The company, under the firm name of Stovel & Brinkerhoff, will handle design, construction and equipment of electric and steam power stations, factories and railroad shops and investigations and reports on factories and power plants and on the purchase and generation of power.

Phillips Electrical Works to Have Brockville Plant

The first contract for the construction of the plant of the Eugene F. Phillips Electrical Works, Ltd., electrical wire manufacturers at Brockville, Ontario, Canada, has been let and work will proceed immediately, according to word received from that city. The company's original plant is at Montreal. The contract is in connection with the construction of the pumping station intake pipe and other work preliminary to the main plant. Work will be started on it at once. The pumping station is to be of brick and concrete construction. Bids are now being invited for the construction of the factory building, which it is estimated will cost about $40,000.

Wetmore-Savage Sales Conference Optimistic Toward 1922

Department heads, executive officers and affiliated manufacturing representatives of the Wetmore-Savage Company assembled at the Boston City Club Dec. 28 for conference, the meetings lasting three days. The principal topics discussed were the recent advances in electrical apparatus and appliances which can be featured in 1922 sales. The general opinion was that a gradual improvement in business is to be expected this year, followed by a decided acceleration in trade in the latter part of the year. Besides representatives of Wetmore-Savage, the principal speakers included J. F. Lamb and F. J. Wachter, vice-presidents Landers, Frary & Clark, New Britain, Conn.; B. G. Kogamanhoff, general sales manager, and J. F. Patrick, New England sales manager, Benjamin Electric Manufacturing Company, New York; J. H. Trumbull, president, Frank Wheeler, vice-president, and L. L. Brastow, sales manager, Trumbull Electric & Manufacturing Company, Plainville, Conn.; W. W. Mumma, general sales manager Robbins & Myers Company, Springfield, Ohio; James Tuohey, New England representative Holophane Glass Company, Newark, Ohio, and Messrs. Stryker, Moore and A. W. Marcou of the Bryan-Marsh Division National Lamp Works, Boston.

The Save Electric Corporation, 254 Thirty-sixth Street, Brooklyn, N. Y., has filed notice of increase in capital stock from $250,000 to $1,050,000.

The Wireless Improvement Company, 18 Broadway, New York City, has filed notice of increase in capital stock from $150,000 to $400,000.

The Packard Electric Company, Warren, Ohio, announces the removal of its Buffalo office to 502 Marine Trust Building. Merle D. Summer, district manager, has been placed in charge.

The Stevens Sales Company, distributers of motors, pumps and lamps and handling a general line of such electrical apparatus and equipment of standard type, has moved to its new home at No. 134 West Second South Street, where it has more commodious quarters, including a well-equipped office and warehouse.

The Jarvis Storage Battery Company, 229 South Liberty Street, Winston-Salem, N. C., recently organized with a capital of $50,000, has purchased a site on which it proposes to erect a plant, with a capacity of 600 units per week, for the manufacture of farm-lighting-plant and automobile storage batteries.

The W. A. Jones Foundry & Machine Company, Chicago, manufacturer of power-transmitting machinery, has appointed F. E. Holtz as its Milwaukee distribution representative, with headquarters in the First National Bank Building there. The appointment is to take effect at once.

The Maher Engineering Company, 30 North Michigan Boulevard, Chicago, has appointed C. B. Adams as vice-president and sales manager and C. H. Peterson as secretary-treasurer and general manager. The company has just been made the representative of the Atlas Valve Company, Newark, N. J., in Chicago and also in Detroit, where the offices are located at 744 David Whitney Building.

The Betson Plastic Fire Brick Company, Rome, N. Y., has placed C. Z. Dillenbeck in charge of its Chicago office at 1,514 Kimball Building. L. S. Shaw & Company, 5,716 Euclid Avenue, Cleveland, Ohio, have recently been appointed general agents and distributers in Michigan, Ohio, Indiana, Kentucky.

The Ideal Commutator Dresser Company, Chicago, manufacturer of commutator resurfacers, has established district sales offices in New York, at 1,905 Tribune Building. A full line of samples will be carried there, the company states. The office will be in charge of R. W. Becker.

The Combustion Engineering Corporation, Combustion Engineering Building, New York, has opened a branch office at 806 First National Bank Building, Pittsburgh, Pa. The new office will be in charge of W. C. Stripe, formerly manager of the Philadelphia office of the company.

Foreign Trade Notes

SUBURBAN RAILWAY LINES IN BOMBAY, INDIA, TO BE ELECTRIFIED —An extensive scheme, the *Electrician* states, has been adopted for the electrification of the Bombay (India) suburban lines.

ELECTRIFICATION OF RAILROAD IN NORTHERN ONTARIO.—Investigation of complete electrification of the Temiskaming & Northern Ontario Railway, with particular reference to the proposed extension from Cochrane north to Oil Can Portage, has been decided upon by the Railroad Commissioners.

ELECTRIFICATION OF RAILWAYS IN SOUTH AFRICA. — The electrification of the Durban-Pietermaritzburg Railway between Pietermaritzburg and Glencoe, a distance of 171 miles, according to the *Electrician*, has been definitely decided upon by the South African Railways and Harbors Board. The direct-current system at 3,000 volts will be used, and the total cost is estimated at between £3,000,000 and £4,000,000.

MERGER OF HYDRO-ELECTRIC COMPANIES IN FRANCE.—A group has been formed by a number of hydro-electric companies under the name of Société de Transport d'Energie du Centre, according to the *Electrician*, for the purpose of establishing a large system for the distribution of electricity in the southeast of France and the Massif Central. The headquarters of the new company are at Saint-Etienne.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An importing firm in Norway (No. 464) desires to secure an agency for the sale of electrical cooking and heating apparatus.

An engineer in Switzerland (No. 467) desires to secure an agency for the sale of steel wire and other articles in steel, iron brass or copper, tools, new systems and electrical apparatus.

New Apparatus and Publications

ELECTRIC SIGN.—The Mitchell Advertising Company, Cincinnati, has placed on the market an electric sign, "Mov-A-Long," designed for use in show windows.

MOTOR-GENERATOR SET.—A small two-bearing motor-generator set, equipped with switchboard mounted on the set, for private or public battery charging, signal work or plating, has recently been placed on the market by the Electric Specialty Company, Stamford, Conn.

RUBBER BELTING. — The New York Belting & Packing Company, 91 Chambers Street, is distributing a booklet covering its "Test Special Rubber Belting."

PIPING SYSTEM.—Bulletin W-11, published by the M. J. Dougherty Company, Twenty-fifth and Washington Avenues, Philadelphia, contains interesting comments on the importance of the piping system and the value of proper design and erection.

TRACTOR.—The Mercury Manufacturing Company, 4118 South Halsted Street, Chicago, is distributing a small bulletin entitled "The Trackless Train for Textile Mills," describing its new "Mercury" type K electric tractor, designed particularly for the textile industry.

RIVET HEATERS.—The United States Electric Company, New London, Conn., is distributing bulletin No. 6, describing and illustrating various types of electric rivet heaters.

WATER HEATER.—The United States Electric Company, New London, Conn., is distributing a four-page leaflet covering its "Economy" instantaneous electric water heater.

GENERATORS.—Circular 3439, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes its "EV" type of alternating-current, vertical water-wheel-driven generators.

SWITCHES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently developed and is now manufacturing an improved line of indoor disconnecting switches, known as type "S." These switches are available in front-connected types as high as 66,000 volts and rear connected types as high as 25,000 volts, single-throw and double-throw.

New Incorporations

THE NEW LONDON ELECTRIC COMPANY, Lancaster, Pa., has been incorporated with a nominal capital stock of $5,000 by John H. Ware, Jr., Oxford; R. F. Simons and J. Guy Eshleman, Lancaster. The company proposes to operate an electric light and power system.

THE SHELL ROCK (IA.) ELECTRIC LIGHT AND POWER COMPANY has been incorporated with a capital stock of $300,000. C. L. Gotshall, 208 South La Salle Street, Chicago, is president.

THE KORENA BUSINESS DEVELOPER COMPANY, New York, N. Y., has been incorporated by J. D. Korena, R. Perry and L. Berrington. The company is capitalized at $100,000 and proposes to manufacture electrical devices. J. A. O'Brien, 1402 Broadway represents the company.

HEWITT & RICHARDSON, INC., Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 to manufacture radio and other electrical equipment. The incorporators are J. K. Hewitt, G. D. Murray, Jr., and A. P. Nevin, 30 Church Street, New York City.

THE DIAMOND WIRE COMPANY, Buffalo, N. Y., has been incorporated by Herbert T. Dyett, Frank M. Potter and Harry W. Barnard, all of Rome. The company is capitalized at $300,000 and proposes to manufacture electrical wires and cables.

THE DOERING ELECTRIC SPECIALTY COMPANY, Atlantic City, N. J., has been incorporated with a capital stock of $20,000, to manufacture and deal in electrical specialties. The incorporators are Joseph Milligan, Arch Davis and Oscar F. Ross, 206 Humphries Building.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 13, 1921)

1,399,728. Automatic Switch for Telephone-Exchange Systems; Arthur H. Adams, Galion, Ohio. App. filed July 26, 1919.

1,399,760. Fire-Alarm System; Manious Garl, Akron, Ohio. App. filed Aug. 20, 1920. Normally closed-line circuit.

1,399,775. Common-Battery Substation; Kenneth S. Johnson, Jersey City, N. J. App. filed Feb. 1, 1918. Telephone substation.

1,399,801. Circuit Breaker for Reversible Motors: Lester E. Samuel, Brownsville, Ore. App. filed April 17, 1920. To operate window shades, window sashes, fire doors, revolving shutters, etc.

1,399,832. Dynamo-Electric Machine; Henry H. Wait, Chicago, Ill. App. filed Aug. 23, 1917. For lessening noise occasioned by rotating armatures.

1,399,852. Regulator for Furnace Electrodes; Waldemar Dyrssen, New York, N. Y. App. filed Dec. 12, 1919. Hoisting and regulating mechanism.

1,399,853. Portable Electric Light and Power Plant; Charles H. Ferguson, Valhalla, N. Y. App. filed Dec. 27, 1919.

1,399,857. Trolley Clamp; Arthur L. Freret, Ensley, Ala. App. filed Sept. 22, 1921. Readily assembled.

1,399,877. Sound Generator; Michael I. Ppin, Norfolk, Conn. App. filed Feb. 4, 1918. For generating compressional waves.

1,399,899. Convertible Plate or Cover for Electrical Receptacles; Joseph P. Sontgerathe and Raymond Kale, Cherryvale, Kan. App. filed Jan. 18, 1921. Convertible face plate.

1,399,931. Electric Fan Heater; Joseph C. Clutts, Fort Thomas, Ky. App. filed Nov. 23, 1920.

1,399,945. Radio Telegraphy; Harold F. Elliott, Palo Alto, Cal. App. filed July 24, 1920. Continuous-oscillation radio telegraphy.

1,399,968. Electrical Measuring Device; Otto A. Knopp, Oakland, Cal. App. filed March 1, 1917. To overcome ratio error and phase-angle error of instrument transformer.

1,399,983. Motor-Control Apparatus; Alexander J. Nicht, Jr. App. filed Aug. 23, 1919. To change relative speeds at which sets of rolls are operated.

1,399,988. Automatically Adjustable Tensioning Device; Frank M. Pierce, Chicago, Ill. App. filed April 29, 1920. For use in wrapping and unwrapping machines.

1,399,989. Horizontal-Shuttle Wrapping Machine; Frank M. Pierce, Chicago, Ill. App. filed Nov. 13, 1920. Applying tape, etc.

1,399,991. Short-Circuiting Means for Armature Windings; Edward I. Pearson, Toledo, Ohio. App. filed Jan. 19, 1921. Operated by fluid pressure.

1,399,993. Printing Telegraph; Harry Pfannenstiehl, East Orange, N. J. App. filed Jan. 23, 1919. Receiving apparatus.

1,399,995. Negative Plate for Electric Accumulators; Adolfo Pouchain, Turin, Italy. App. filed Sept. 18, 1919. Zinc.

1,399,996. Negative Plate for Electric Batteries; Adolfo Pouchain, Turin, Italy. App. filed Feb. 11, 1920. Zinc.

1,399,997. Telegraph System; Paul M. Rainey, Glen Ridge, N. J. App. filed Jan. 3, 1918. Device for storage of signals.

1,399,998. Telephone System; Arthur Raynsford, New York, N. Y. App. filed Nov. 25, 1919. Signaling arrangements.

1,400,001. X-Ray Tube; Thomas B. Rider, Los Angeles, Cal. App. filed Jan. 22, 1919.

1,400,005. Holder for the Glowers of Tungsten Lamps; Otto Schaller, Sudende, near Berlin, Germany. App. filed Oct. 27, 1916. Tungsten wires having an addition of 0.25 per cent of thorium oxide.

1,400,018. Electrical Measuring Instrument; William M. Bradshaw, Wilkinsburg, Pa. App. filed June 13, 1917. Demand meter.

1,400,035. Telegraph System; Amos F. Dixon, Newark, N. J. App. filed Nov. 20, 1917. For driving distributers in synchronism.

1,400,038. Coil Terminal; Henry C. Egerton, Passaic, N. J. App. filed April 26, 1918. To prevent breaking fine wire.

1,400,039. Signaling System; Henry C. Egerton, Ridgewood, N. J. App. filed Dec. 27, 1918. Impulses for synchronizing purposes.

1,400,047. Single-Phase Alternating-Current Commutator Motor; George H. Gascelon, Swissvale, Pa. App. filed Aug. 11, 1917. Squirrel-cage winding of inherent reactance.

1,400,050. Signaling System; Bertram B. Grace, Upminster, England. App. filed Sept. 5, 1918. Vibrating diaphragm.

1,400,059. Battery Terminal; Alda F. Hawkins, Fort Worth, Tex. App. filed Aug. 2, 1919. Fastened by less than quarter-turn of nut.

1,400,075. Telephone Exchange System; Charles W. Keckler, Newark, N. J. App. filed Aug. 11, 1917. Selective party-line signaling.

1,400,076. Telephone Signaling System; Charles W. Keckler, Newark, N. J. App. filed Dec. 16, 1919. Automatically discontinuing.

1,400,077. Motor-Control System; Harold L. Keith, Wilkinsburg, Pa. App. filed Dec. 14, 1918. For automatically accelerating motors.

1,400,085. Vibratory-Diaphragm Signaling Device; Duncan A. McConnell, Arlington, N. J. App. filed April 24, 1918.

1,400,092. Controlling Device; F. D. Newbury, Pittsburgh, Pa. App. filed Feb. 4, 1918. Controlling force proportional to quotient of two forces.

1,400,101. Pantagraph Trolley; William Schaake, Pittsburgh, Pa. App. filed Sept. 16, 1918. Controlled by pneumatic means.

1,400,103. Artificial Busy Circuits; Dawson M. Taggart, East Orange, N. J. App. filed Sept. 4, 1919. For use with trunks.

1,400,113. Audible Alarm and Indication Apparatus; George E. and Harold Washington, Manchester, England. App. filed June 25, 1919. Audible alarm at predetermined times.

1,400,116. Method of Wrapping and Means for Practicing the Same; William M. Wheildon, Ashland, Mass. App. filed April 6, 1918. Tire-wrapping machine.

1,400,120. Telephone-Exchange System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed April 17, 1918. Automatic switches.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SPRINGFIELD, MASS.—Plans have been filed by Meekins, Packard & Wheat, Inc., Main Street, for extensions and improvements to the power house at their factory.

Middle Atlantic States

ALBANY, N. Y.—Plans have been prepared for increasing the output of the electric plant of the Municipal Gas Company from 15,000 kw. to 32,000 kw. A 17,000-kw. turbine will be installed. Alexander Anderson is chief of the electric power department of the company.

BROOKLYN, N. Y.—The Brooklyn Edison Company, it is reported, will ask for bids early in February for the construction of an electric generating plant at the foot of Sixty-sixth Street, to cost about $1,200,000. G. L. Knight, 360 Pearl Street, is engineer.

LONG ISLAND CITY, N. Y.—Plans have been filed for the construction of a one-story power house at the factory of Lind Mathews, Inc., 243 Thirteenth Avenue.

NEW YORK, N. Y.—Estimates prepared by Daniel L. Turner, chief consulting engineer for the Rapid Transit Commission, 49 Lafayette Street, place the cost of electrical and other operating equipment for the proposed river-to-river moving platform under Forty-second Street at $3,000,000. The total cost of the project is estimated at $7,500,000.

NEW YORK, N. Y.—Bids, it is reported, will soon be received by the U-Need Ice Company, 2050 Amsterdam Avenue, for the construction of an ice plant at Inwood Avenue, to cost about $250,000. Koch & Wagner, 32 Court Street, Brooklyn, are architects and engineers.

TRENTON, N. J.—The Raritan Valley Hydro-Electric Company has been granted permission by the Board of Public Utility Commissioners to issue $20,500 in stock, part of the proceeds to be used for extensions and improvements.

HARRISBURG, PA.—A petition has been submitted to the City Council for improvements to the lighting system on North Cameron and other streets in Harrisburg.

PHILADELPHIA, PA.—Bids will be received at the office of the Construction Quartermaster, Frankford Arsenal, until Feb. 8 for the completion of power plant, including the installation of equipment.

PITTSBURGH, PA.—Tentative plans are under way by the Philadelphia Company, Pittsburgh, operating the Pittsburgh Railways, for extensions and improvements to its car shops and barns, additional track and line construction, power improvements, etc. Arrangements are being made by the company to secure the sum of $5,000,000, part of which will be used for the above work.

HAGERSTOWN, MD.—Plans are under way by the City Council for the construction of a municipal electric power plant, to cost about $300,000. Bids, it is reported, will be asked for early in the spring. C. E. Davis is clerk. A. B. Grubmeyer, 21 East Franklin Street, is engineer.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until Jan. 18 for the construction of underground utilities at Bellevue, D. C. (Specification 4530.)

North Central States

DETROIT, MICH.—The Belle Isle & East Side Creamery Company has had plans prepared for the construction of a one-story power house, 38 ft. x 60 ft. Warner Brothers, **1111** Kresge Building, are architects.

CINCINNATI, OHIO.—The Lion Light, Heat & Power Company, recently incorporated, plans to furnish power to the Lion Building, Fifth and Elm Streets, exclusively.

CLEVELAND, OHIO.—The City Council has adopted a resolution authorizing extensions to the ornamental lighting system on Lorain Avenue from West Fifty-seventh Street to West 117th Street, and on Clark Avenue from West Fourteenth Street to Lorain Avenue.

DAYTON, OHIO.—The Terminal & Cold Storage Ice Company is having plans prepared for the construction of an eight-story refrigerating and cold-storage plant at Baker and Ludlow Streets, to cost about $500,000. The G. B. Bright Company, 103 Marquette Building, Detroit, Mich., is architect.

NEWARK, OHIO.—The American Gas & Electric Company, 30 Church Street, New York City, has tentative plans under consideration for the erection of a 220,000-volt transmission line connecting its Windsor (W. Va.) plant with the Newark (Ohio) plant. Electricity will be furnished to Zanesville and other cities along the route. The cost of the line is estimated at $1,250,000.

LOUISVILLE, KY.—The United Casket Company, 3,022 West Chestnut Street, is planning the construction of a one-story power house to be used in connection with a proposed extension, 100 ft. x 450 ft., to its plant.

INDIANAPOLIS, IND.—The Orange County Public Service Company has filed notice of an increase in its capital stock from $86,000 to $200,000.

CAIRO, ILL.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 24 for conduit and wiring changes, lighting fixtures, etc., in the United States post office and custom house at Cairo, Ill. James A. Wetmore is acting supervising architect.

HARVEY, ILL.—Tentative plans are under consideration for the construction of a new power plant to cost about $10,000 at the local works of the Wyman-Gordon Company, manufacturer of forgings, 332 South Michigan Avenue, Chicago. Nothing definite has been decided upon.

MILWAUKEE, WIS.—The construction of a municipal electric power plant in conjunction with the new sewage disposal plant on Jones Island is recommended by D. W. Hoan Mayor.

BEDFORD, IOWA.—A new company is being organized by J. H. Baker and J. J. Clarke for the purpose of constructing an ice-manufacturing and cold-storage plant, to cost, including equipment, about $200,000.

MUSCATINE, IOWA.—Plans are under consideration by the Council for the construction of a municipal electric light and power plant, to cost about $250,000.

Southern States

WINSTON-SALEM, N. C.—Bids will be received by James G. Hanes, Mayor, until Jan. 18 for the construction of the Richard J. Reynolds memorial white and colored annexes, the Sterling Smith annex and alterations and additions to the present hospital building. Separate bids will be received at the same date and place for plumbing work, electric wiring, elevator work, heating work, etc.

ATLANTA, GA.—Plans are under consideration by the Georgia Railway & Power Company for extensive additions and improvements to its system, including the completion of the 80,000-hp. Tugalo plant, about half finished, to cost about $2,000,000; increase in the capacity of the Morgan Falls plant to 22,500 hp., about $400,000; erection of additional high-tension transmission lines, $2,000,000; development of the Mathis-Tallulah Seed and Burton projects, $2,000,000, and extensions and improvements to electric and gas distributing systems, street-car service, etc., about $2,000,000. H. M. Atkinson is chairman of the board of directors.

FORT MEADE, FLA.—The Town Council has decided to obtain electricity for Fort Meade from the proposed electric light plant to be erected by J. G. Fancy and associates. The plant will cost about $10,000.

ORLANDO, FLA.—The City Council is considering issuing $500,000 in bonds for the purchase of the plant of the Orlando Water & Light Company.

BRISTOL, TENN.—The city of Bristol, it is reported, has purchased a site on the Holston River about 9 miles southeast of Bristol, near Fish Dam, for power development.

MOBILE, ALA.—The Standard Gas & Electric Company, 208 South La Salle Street, Chicago, Ill., which controls the Mobile Electric Company, has plans under consideration for the construction of an electric power plant in the vicinity of Mobile, Ala., to cost about $400,000.

MERIDIAN, MISS.—The power plant of the Meridian Light & Railway Company, it is reported, has been acquired by the city authorities.

DONALDSONVILLE, LA.—The Municipal Light and Water Commission expects to purchase within the next sixty days another oil-engine generating set of about 150 kva. capacity. L. A. Tucker is superintendent in charge.

NEW ORLEANS, LA.—The date of bids to be received by R. M. Murphy, Commissioner of Public Finances, City Hall, for furnishing and installing incinerator equipment of the Decarie type, including electric traveling crane and electric generating equipment complete, has been extended to Jan. 17.

TULSA, OKLA.—W. E. Page, manager of the Sand Springs Light & Power Company, and a number of business men in Tulsa have been granted two franchises, one at Ramona and the other at Ochelata, in connection with the erection of a high-tension transmission line from Avant to Ramona and from there to Ochelata, a distance of about 12 miles. Equipment required will include 500 30-ft. poles with 6-in. tops, 500 four-pin cross-arms, 1,500 13,000-volt insulators, 35 miles of No. 6 bare copper wire, transformers, meters and miscellaneous hardware. Address all correspondence to W. E. Page, 1618 East Fifteenth Street, Tulsa.

WILSON, OKLA.—The City Council is considering improvements to the municipal electric light plant and the installatoin of an ornamental lighting system. Equipment, including a 400-hp. engine, boiler, etc., will be required.

HALLETTSVILLE, TEX.—Bids will be received by the city until Jan. 12 for improvements to the municipal electric light plant, including the installation of a steam engine, switchboard panel, horizontal tubular boiler with steel casing, stack and fittings, water heater, boiler-feed pumps, interconnecting pipe fittings, etc. S. M. Kuykendall is city secretary.

Pacific and Mountain States

MODESTO, CAL.—Arrangements are being made by the Modesto Irrigation District for the sale of its eighth issue of Don Pedro bonds, amounting to $181,600, the proceeds to be used for the construction of power plant.

TURLOCK, CAL.—Arrangements are being made by the Turlock Irrigation District for an issue of $1,028,000 in bonds for the construction of a power house and distribution system.

SAN DIEGO, CAL.—Plans have been completed by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of cold-storage and refrigerating equipment at San Diego, Cal. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4543), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

Canada

WINNIPEG, MAN.—In a report to be submitted to C. D. McPherson, Minister of Public Works, by Joseph Rochetti, Power Commissioner, the amount required for construction work of the Manitoba hydro-electric power system for 1922 is estimated at $2,000,000. The work will require the erection of 150 miles of transmission line. Power extensions have been requested by the towns of Gladstone and Charleswood.

NORTH BAY, ONT.—The Temiskaming & Northern Ontario Railway Company is considering investigating the possibility of complete electrification of its railway system and the construction of a new line from Cochrane to New Post. It is estimated that about 500,000 hp. can be developed on the Abitibi River, as well as several waterfalls on Ottawa, Montreal and Sturgeon watersheds. S. B. Clement, North Bay, is chief engineer.

TECUMSEH, ONT.—The Council is considering submitting to the ratepayers a bylaw authorizing securing electricity from the Hydro-Electric Power Commission of Ontario.

Miscellaneous

PANAMA.—Bids will be received at the office of A. L. Flint, general purchasing officer, Panama Canal, Washington, D. C., until Jan. 11 for furnishing watt-hour meters, meter-sealing wires and rotating meter-testing standards. (Circular 1461.)

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary. H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Midwinter convention, New York City, Feb. 15-17.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Semi-annual convention, Toronto, Jan. 26-27.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field Manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill. Meeting, Chicago, March 15-16.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., W. 65th and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive Secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual convention, Albuquerque, Feb. 13 and 14.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co.. Minneapolis.

Northwest Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Oklahoma Utilities Association. Manager, H. A. Lane, 1106 First National Bank Bldg., Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary-treasurer, R. F. Paige, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Convention, Chicago, Jan. 17-19.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, W. M. Chester, 1408 First National Bank Bldg., Milwaukee, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

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Volume 79 New York, Saturday, January 14, 1922 *Number* 2

What Does It Cost to Wait?

ACCORDING to the statistics for 1920, the value of all the commodities produced in the United States in that year totaled seventy billion dollars. These goods were harvested or mined or manufactured. They were sold and sold and sold as they progressed from the producer to the consumer.

As these commodities were moved along, this money that they represented was turned over time and time again. Interest on it, calculated at 6 per cent, exceeded $11,500,000 every day. And this almost unthinkable amount was won or lost each day by some one, either because it was possible for him to turn the goods he held into cash that day or because he had to hold them over until tomorrow. Delayed shipments, delayed deliveries, delayed collections, delays from start to finish all along the line of distribution, were wasting capital and losing profits just as definitely as though the goods had been lying dead in frozen shelf or warehouse stocks or the money that they represented had been buried in a sack.

BUT there was another kind of delay that cost as much per day as this slow handling of the goods. It was *delay in selling*. And delay in selling is going to rob American industries this year of more in interest loss than it has ever sacrificed before unless American business men stop waiting for bad times slowly to go and set to work to make good times come back at once.

People are human and procrastination is a traditional human failing much condoned. If a man is slow and does not get things done on time, it is supposed to be too bad—for him. But when it bulks together and becomes a matter of $11,500,000 loss to the business men of the United States on every day of unnecessary delay in selling the nation's goods, it is something to be thought about. And the picture of the electrical industry all set to go but waiting "for things gradually to pick up" takes on an aspect of dollars and cents and prompts the question: What does it cost to wait?

IT would be well if every manufacturer and jobber would lock his desk for thirty days and take the road to spread this thought. For we must speed all laggards up by carrying to the men in every town real conviction that they can wire houses *now* and sell their goods *today*.

Business can be increased by working harder. Delay in selling can be reduced by selling faster. The money that it costs to wait can be turned into profits by not waiting. Automatically this greater profit can be made to create these "good times" we hunger for.

Oscar Dickinson Street

An executive operating a system of fifty jobbing houses who has built up one of the most efficient distribution organizations in the electrical industry.

ONE of the most pressing issues before the industries of America today is the broad problem of distribution. Through the recent years of rapid scientific advancement our methods of production have made great progress in efficiency and resource, but our systems of disseminating our foodstuffs, our raw materials and our manufactured goods to the consumer have not kept pace. The processes of distribution are costing our people too much, and electrical men along with men of other lines have come to realize that perhaps here must soon be wrought the next important step in the economic evolution.

Of all those now engaged in the business of distributing electrical supplies, probably no other individual has had so extensive an opportunity to study this problem as O. D. Street, general manager of distribution of the Western Electric Company and executive of the fifty jobbing houses operated by the Western Electric system in as many cities. These branch houses serve the entire United States, from coast to coast and from the Great Lakes to the Gulf. They maintain an intimate contact with the varying conditions in all sections of the country and provide an experience impossible in an ordinary jobbing business restricted to the usual territory that may be served from a single warehouse. As the operating head of this great distribution system Mr. Street has acquired a practical knowledge and vision of the electrical jobbing business that has made him an authority.

Mr. Street was born in Massachusetts in 1877. During the last four years of his schooling he worked after hours behind the counters of four different kinds of retail stores. Then he went to college and after a major course in economics was graduated from Williams in 1901. He then joined the Western Electric Company and spent the next year and a half in a training which carried him through all departments, including office, factory and stock. Then he was sent to San Francisco to take charge of telephone sales on the Pacific Coast, remaining there until recalled to act as assistant to President E. M. Barton. Here he gained a broad executive contact, and promotion followed first to the management of the Atlanta branch, next as general telephone sales manager and then as general manager of distribution with a far more complicated problem of distribution and operation.

During the war Mr. Street rendered invaluable service to the nation by reorganizing the warehousing division of the Quartermaster's Corps and establishing an orderly system of forwarding to Pershing's Army where chaos had existed before. Under his administration the Western Electric system has been expanded by the creation of twenty-two branch houses and there has been perfected a degree of standardized efficiency alike in the warehouses, the offices and the sales departments that merits close study by other electrical distributers.

Mr. Street is gifted with a searching mind and a clarity of vision that have given him a rare capacity for practical analysis, constructive organization and progressive development. He believes that the function of the jobber is (1) to provide a more economical means of distribution than is possible direct from manufacturer to trade; (2) to afford a broader market for the manufacturer's goods, and (3) to make possible through service a greater success for the dealer. He believes that the profits of the jobber in the future will be gained more by scientific warehousing and merchandising than by scientific salesmanship; and to that end he has bent his energies to the study of costs and methods both in principle and in the detail of practice. For it is his opinion that only through a knowledge of the cost of operations can a jobber know what class of merchandise it pays to sell and what class of customers it pays to serve, and only in this way can he maintain not alone the prosperity of his business but his very ability to function economically and maintain his place in the established plan of distributing electrical supplies.

Editorial Comment

Electrical World, January 14, 1922
Volume 79 Number 2

Safety Code Is Entitled to Support

AFTER all the discussion of which it has been the center, there is still a tendency to misunderstand what the National Electrical Safety Code really is. Recent discussions indicate a tendency on the part of some to consider it as a statement of the attitude of central-station companies on the requirements that should govern line construction. Those who so deem it take the attitude in controversy that it is composed of one-sided minimum requirements that should be upset and something more drastic substituted. The safety code has its weaknesses, but it represents, above all, the only compilation of rules on which all branches of industry interested in central-station operation and construction have in any manner approached agreement. While the code will probably have to be modified somewhat and be made less general, it must be remembered that it is the product of a long period of controversy in which all sides have had a full opportunity to present their views. Although the Bureau of Standards necessarily took opposing views, these have been harmonized into a compromise which, while in some respects not all that can be desired, is the best that has so far been attained. Regardless of what individual viewpoints may be, the code is entitled to the united support of all industries concerned. Any other course is certain to produce anew the confusion, due to conflict of interest, that was so marked eight or ten years ago. The Bureau of Standards has expressed its intention of revising the code as further study shows need and offers a full opportunity to every one for the presentation of data and suggestions. Attempts to amend the code by discrediting it through the action of commissions or other bodies are short-sighted in policy and cannot fail to bring chaos later on.

The New Spirit Down in Washington

THERE is a distinct encouragement for the business man in the story elsewhere in this issue of the work that the Department of Commerce is doing for industry under the administration of Secretary Hoover. For the first time within recollection, it seems, we have the refreshing spectacle of a great government department coming to business men to ask how it can serve them best instead of striving to regulate and legislate for business on the basis of the imagination and ambitions of the official and the employee. It is a most practical expression of the new idea of less government of business and more business in government that Mr. Hoover and Director of the Budget Dawes are talking and fighting for so energetically.

The detail story which Mr. Feiker tells of the work that is being done for standardization by the new "Division of Simplified Commercial Practice" should be an inspiration to the exponents of better standardization in the electrical industry. It is a forceful picture of the good that may come of this kind of waste elimination and of the ease with which such benefit may be had when once the leaders of an industry sit down to see what they can do to make their contribution to a national movement of this sort. And the manner in which the trade association is contributing in several industries to the advancement of this work is worthy of some thought.

But the best of it all is the promise which it holds of a more intimate contact between our government and our men of business and a more helpful understanding between them. It is good to hear of this work that the government is doing. As an industry what can we do to help the government go still further?

Superpower Necessary to Economical Service

THE need for a larger and national viewpoint on power production grows more and more imperative. The federal government has sensed it and through its power survey has crystallized thought along that line. It is important, therefore, that the existing utilities give the matter serious consideration. Great Britain, which is plagued with a greater number of electric systems than a centipede has of legs, has been forced to find a solution to her power problem. For some years now she has had an electric power supply committee at work on the subject. To make sure that the utilities would be subservient to the needs and interests of the general community, large powers have been vested in the commission. It can, for instance, enforce the policy of pooling resources, the standardization of voltages and frequencies, the erection of huge power houses and their interconnection with other efficient generating systems, the establishment of reasonable rates for service, and, besides possessing the equivalent of the power of eminent domain, can sanction loans and do away with small and inefficient plants. There is no denying the wisdom of such a scheme. If the war had lasted much longer, we should have been forced to superpower systems in most of the large industrial districts in this country, just as the railroads were forced to consolidate and pool their terminals, equipment and ticket offices. The public convenience is served by these measures, and if the plans are properly carried out, substantial public benefit results as well.

Obviously a solution must be soon found. The question is, shall the utilities under private management in this country take up this problem first and solve it, or shall government force the issue as it did in the case of the Province of Ontario or as it is doing at present in Great Britain? We have in this country interconnected systems which are the marvel of the world, but greater unification is still possible and greater economy as well. The country still abounds with thousands of isolated systems, inefficient, unreliable and costly, which should be welded into less than one hundred groups and made to serve twice the territory now covered from one-tenth as many generating stations. Colonel Kellar's report on the power situation during the war indicates the economic possibilities in the great industrial sections in the country, as does also Mr. Murray's Boston-to-Washington superpower survey. Were the possible economies only partly realized, the carrying out of the plans suggested would be of immense benefit to the utilities and the general public as well.

Surge Possibilities Important in Adopting Higher-Voltage Cable

ITALIAN engineers, who are excelled by none in resourcefulness, have taken the lead in underground practice. For the last seven or eight years they have been working successfully cables of 40,000 volts and 50,000 volts and are now, according to Philip Torchio, who has recently made a survey of European practices, undertaking the installation of single-conductor cable for 80,000 volts. The only troubles encountered have been from surges originating in the overhead part of the system. Three-conductor cables up to 33,000 volts have also been in use abroad, and one has been made in this country by the Commonwealth Edison Company. The New York Edison Company is getting ready to try some 45,000-volt, single-conductor cable. There has been very material improvement in dielectrics, resulting in considerably decreased loss and thereby rendering it possible to work at somewhat higher temperatures, the limitation in this respect being the danger of expansion of the lead coverings, leaving air spaces in which ionization may take place with serious results.

In this increase of pressure in underground cables the main trouble to be feared is not failure from normal operation in the cable itself but surging and similar manifestations due to the connection of the cables to overhead circuits. Just how far it would pay to push up the voltage of cables is a matter which is very intimately associated with the general distribution now being undertaken. So little underground work in this country is quite straight-away and so much is mixed up with all sorts of complexities of distribution inherited from past years that it is no small task to get down to the basic economics of underground service. One thing is certain—that cables are quite available for higher pressures than we are inclined for the present to take on.

Savings Bank Investments and Electric Public Utilities

THE laws of every state throw unusual safeguards around the savings banks because they are the people's institutions. Not for investment, not for gain or reward, does the workman place in them his hard-earned savings, but for safekeeping. Safety is the primary requisite, and in every state the nature of the investments savings banks are permitted to make is specifically set forth in detail in the law itself, so that so far as it is humanly possible to do so the depositor is guaranteed against loss. The mutual savings banks of the country command deposits of about six billion dollars held in the interest of more than ten million depositors, who show greater confidence in them than they do in commercial banks or even post offices with savings departments. By law a certain percentage of the deposits may be invested in interest-bearing bonds of the United States, states, cities, municipalities, towns, etc., in real estate mortgages and in railroad securities. In a few states the securities of public utilities are also included to a limited extent. Feeling that, within properly safeguarded limits, the securities of electric public utilities possess the elements both of security and liquidity to warrant their inclusion among the investments open to mutual savings banks, the National Electric Light Association has appointed a committee to work with a similar committee from mutual savings banks in an endeavor to have the state laws amended to that extent.

There is a growing appreciation on the part of savings-bank investment committees that certain classes of seasoned public utility securities can be safely bought, and it is significant that the savings banks and public utility organizations have joined hands for a closer study of the matter. About twelve years ago California adopted what bankers admit to be one of the most scientific, thorough and practical banking codes in the country. By the California law savings banks may invest in the bonds of any railroad, street railway, water, gas, light, telephone, telegraph or other public utility incorporated under the laws of the state and operating its property in part within the state, provided that the net earnings of the utility reach a certain amount and that certain guarantees as to both principal and interest are given. It is to be hoped that the joint committee may succeed in getting other states to adopt like progressive legislation. Regulated as they are by public authority, the time ought not to be far distant when the securities of electric public utilities will be as stable and as safe as the securities of the municipalities and the states themselves.

Reactance Important in Furnace Operation

ORIGINALLY one of the bugbears of all forms of alternating-current generation and utilization, inductive reactance has through study and understanding advanced from the position of a thing to be feared and avoided to a point where it is treated with respect and even courted as an agent which under control may contribute to successful operation. Its importance in all forms of radio and telephone equipment for tuning, coupling and similar service is well known. In the power field its chief value lies in its current-limiting properties, to take advantage of which the reactance of lines, generators and transformers is often increased. An account of the use of reactance for improving the operation of electric furnaces is given in the article by P. B. Short in this issue. It presents an interesting example of the control which engineering knowledge and experience now exercises over the now obedient servant, inductive reactance.

A moderate reactance is necessary for satisfactory furnace operation, say 40 per cent corresponding to a power factor of 92 per cent. Part of this may be in the transformers and leads, but usually an additional reactor is necessary. This must often be of variable value to take care of starting as well as operating conditions. Although the furnace is often subject to complete short circuit and sharp current surges, owing to the high value of reactance necessary for satisfactory operation, the necessary protection may be had in an iron-core reactor. Since two and a half times full-load current is the limit reached, a core of moderate size will not saturate. Further adjustable values for different conditions of operation and ready alteration to higher values to follow the present tendency to higher voltages are easily possible.

A Translation of the Building Situation

STATISTICIANS tell us that 1,200,000 homes, 22,000 apartment buildings, 5,000 public schools and 20,000 office and public buildings, factories, etc., must be built in this country before we shall stand equipped as we would have been if war had not interrupted our usual continuous building construction. For six years we have been marking time. Now business is on the positive increase and confidence and initiative are responding to the impulse. The erection of residence, business and public buildings will follow with cumulative acceleration.

These numerals alone are big and interesting enough, but translate them into the equivalents in electrical material and the mind refuses to grapple with the calculation. If there are to be 1,247,000 new buildings, how much wire will it take? How many switches, sockets and receptacles? How many lamps, shades and fixtures? How many motors? How many fans? How many heating devices both domestic and industrial? How many household labor-saving appliances? How many new power units to supply the energy? How many kilowatt-hours? How many orders? How much profit? Figure it a little on your favorite pad.

A graphic analysis of what this means was presented in last week's issue, and elsewhere in this issue further figures are given showing the growth in electrically lighted houses, with a five-year forecast.

Our Interest in the Thrift Campaign

A WORTHY opportunity presents itself to every central-station company in the great and growing work of preaching and teaching thrift to all the people. There is no better way for any man to save than to buy securities, and there are no better securities to buy today than those sold by utility companies. Here is a point of contact and a purpose that should engage the interest of every light and power company executive, and there is no better time than now to make this interest felt.

Next week will be devoted throughout the country by many earnest workers to the annual national "drive" for thrift. Under the leadership of the Y. M. C. A., organizations and individuals everywhere will unite in a co-operative campaign to carry this message to the people. Beginning as it does on the birthday of Benjamin Franklin, the great American exponent of thrift, the drive should have particular appeal to electrical men. It is seemingly well grounded, with a definite program of daily activities by which the effort is to be directed. The basis of the movement is a ten-point economic creed combining these strikingly well-chosen admonitions: "Work and earn," "Make a budget," "Record expenditures," "Have a bank account," "Carry life insurance," "Own your home," "Make a will," "Invest in safe securities," "Pay bills promptly," "Share with others."

Separate days are to be set apart as "Budget Day," "Make-a-Will Day" and so on. We suggest to the electric light and power companies a "Buy Securities Day" in each locality, on which day the thrift value of utility stock might be interpreted to the community.

Industrial Phases of Electric Service Need Painstaking Study

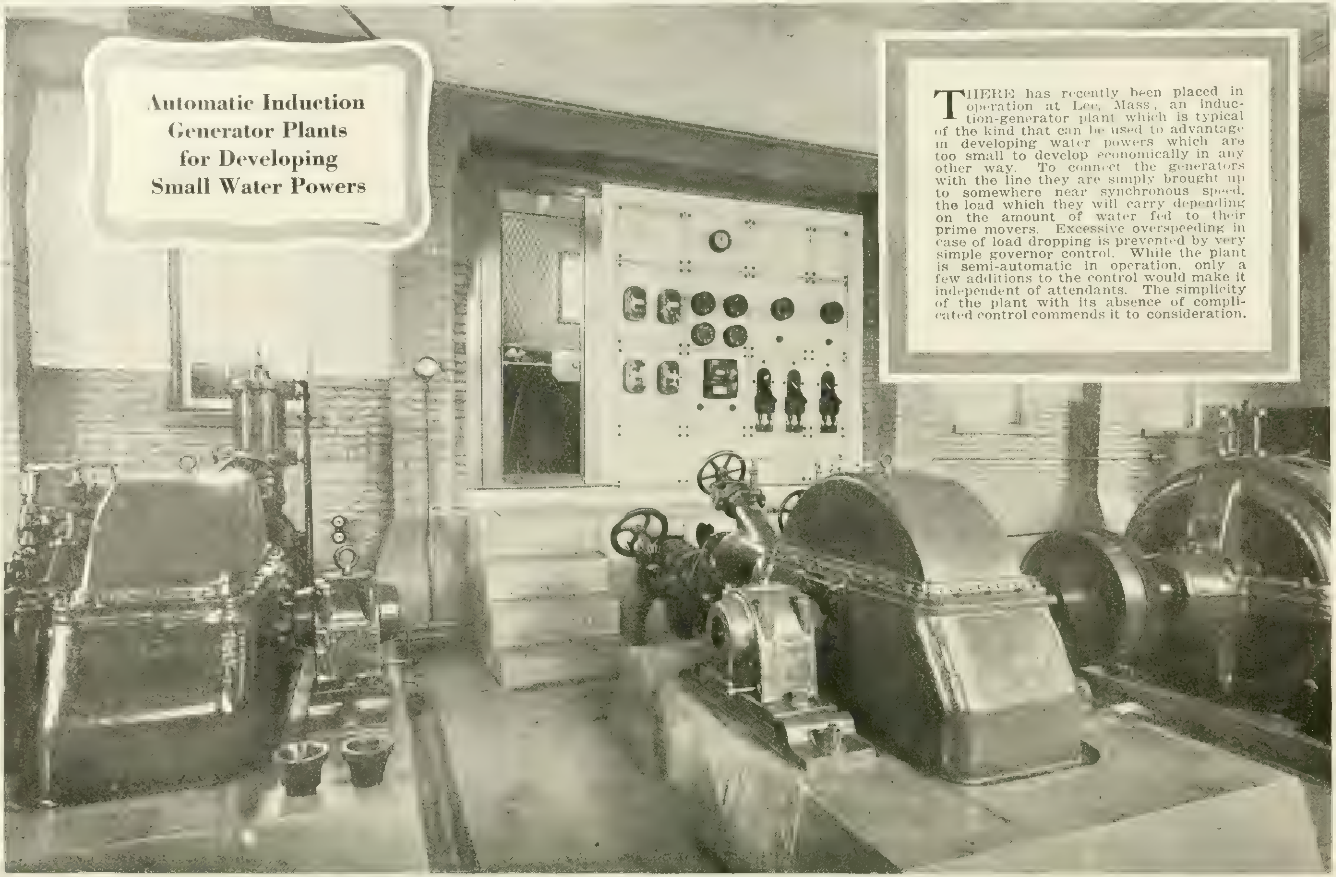
THE study of industrial distribution with respect to working voltages, the control of industrial service presenting needlessly bad load conditions and the remedial effect of condensers are well worthy of the painstaking study of engineers during the coming year, which is more than likely to show still further increase in industrial work and a much greater need for its thorough control.

To any one whose first experience in central-station practice was gained a score of years or even a decade ago the present situation with respect to distribution of load is like breaking in on the economics of another planet. In the old days when the lighting load was predominant in its financial importance and its value to the community the technical situation of the central station was comparatively simple. Today, with the vast increase in industrial service, an entirely new group of conditions control the situation. Fundamentally the use of big motors for industrial purposes over the wide area that depends for service on every central station raises questions of voltage and kind of distribution which cannot be dodged. The older and simpler methods break down when applied on the scale that is now imperative. It is not easy to generalize regarding the nature of the problems involved, but one cannot help feeling that increase of distribution voltages, very likely with the more general employment of the four-wire, three-phase distribution, is coming to lighten the burden of distance and the difficulties of regulation. When one stops to think that the United States is virtually the only large country in which the 110-volt lamp is dominant, he comes to a realization of the self-imposed limitations which have to be faced, and these are as important in the power field as in that of lighting.

Power-factor control is another problem of predominant importance and one which should be thoroughly investigated. In the very early days of the three-phase system power factor was a grave matter indeed. Motors were actually put into service that would barely start themselves running light and that even at full load showed power factors which would give a modern engineer the cold shivers. As time went on the situation bettered itself, particularly as motors were not a large factor in the load. At the present time the load of motors is so great that power factor has assumed renewed importance. The problem is due now not so much to poorly designed motors as to motors operating at load factors which, taking everything into consideration, are atrociously bad.

Whether it is better to go out on a punitive expedition and compel better practice or to improve the technical situation is a matter of doubt. We have inclined to the belief that a good kilovolt-ampere-hour meter for three-phase circuits, the bills to be prepared on its evidence, would do wonders in checking careless practice. Another line of advance is through the compensation of power-factor static condensers, tried thirty years back with a good measure of success on a small scale and now to the front again with some hope of use upon a large scale. What we need now more than anything else is a careful study of the economics and effects of placing condensers at various points. What we hear of their modern development is altogether encouraging, and yet it may be somewhat futile to use them to avert conditions of loading which ought not to be allowed to exist.

Automatic Induction Generator Plants for Developing Small Water Powers



THERE has recently been placed in operation at Lee, Mass., an induction-generator plant which is typical of the kind that can be used to advantage in developing water powers which are too small to develop economically in any other way. To connect the generators with the line they are simply brought up to somewhere near synchronous speed, the load which they will carry depending on the amount of water fed to their prime movers. Excessive overspeeding in case of load dropping is prevented by very simple governor control. While the plant is semi-automatic in operation, only a few additions to the control would make it independent of attendants. The simplicity of the plant with its absence of complicated control commends it to consideration.

What the Department of Commerce Is Doing for Industry

An Outline of the Practical Results that the Three Bureaus Which Serve the Business Man Are Achieving — The Opportunity for Co-operation with the Trade Association

By **F. M. FEIKER**
Assistant to the Secretary of Commerce and Vice-President of the McGraw-Hill Company

MOST electrical men and men of other industries have but a vague idea of the functions of the United States Department of Commerce and the work which it is actually achieving for them. Yet there are three bureaus in the department that concern the electrical business intimately and are rendering a valuable service. I believe that some of the details of this work will be of interest.

In the first place the Department of Commerce consists of seven principal bureaus and divisions associated with commerce. They are the Bureau of Fisheries, the Bureau of Navigation, the Bureau of Steamboat Inspection, the Bureau of Lighthouses and the three others I have referred to, which are the Bureau of Census, the Bureau of Foreign and Domestic Commerce and the Bureau of Standards. It is the three last-named bureaus in particular with which I have been working since I have been in Washington, and some very material changes have been effected both in the scope and in the point of view during the present administration.

When Mr. Hoover went to Washington last March about the first thing he did was to call together leading business men from all the industries, among them a good many representatives from the electrical industries, and say to them: "Here is the Department of Commerce, with the miscellaneous bureaus which go to make it up—what can it do for you?" For the first time, I think, a Secretary of Commerce went to collective industry to find out what the department could do for it, instead of imagining some things that it might do and turning those back on industry. It is not trying to regulate business or to exercise government control, but it is aiming to set itself up as a place where American business can express itself through the government and where the department in turn can perform useful services for business.

I have been working for six months upon the questions of personnel and organization to carry out this policy. I can perhaps best describe how we are going about it by telling what we have been doing in the Bureau of Foreign and Domestic Commerce. In the first place, it hasn't anything to do with domestic commerce. Congress, in its wisdom, passed an empowering act establishing a Bureau of Foreign and Domestic Commerce and in one paragraph said that it would have nothing to do with domestic business. Therefore the Bureau of Foreign and Domestic Commerce at the present time has only to do with foreign commerce. It still bears "Domestic Commerce" in its title, and I am hoping to see industry demand the development of the domestic side.

This bureau had been built up solely on the geographical basis. There was a man in charge of the Far Eastern Division, and another of the South American Division, and another of the European Division, and so on, and if an electrical manufacturer or jobber wanted to know what was going on in all the markets around the world, there was no contact man with special electrical knowledge in the department.

I have been working, under Mr. Hoover's general plan, helping Dr. Kline, the chief of the bureau, to reorganize the department on a commodity basis, so called, as well as a geographical basis. There is in the department now an electrical man, R. A. Lundquist, who probably knows more about electrical foreign markets generally than any other single man in the United States. He has at his beck and call the six hundred contact men of the department who are abroad, the commercial attachés and the consuls and the trade commissioners, and also as his advisers the men in the industry. For a part of the program is to work out committees with the organizations in the industry through which the Department of Commerce may go, and these commodity men may go, to find out what the industry wants done in this foreign trade.

GETTING THE MEN

Let me be a little more specific. The Automobile Division has got along a little further than the others. We went to the Automobile Chamber of Commerce and we said, "We want two men for this commodity work."

"How much can you pay them?" they asked. "Maximum, five thousand dollars," we told them, "and we want a ten-thousand-dollar man for that."

And we got him, because we got the association back of it. The association interviewed ninety-eight men and picked out two, and we have two men down there in Washington with the backing of the association, worth much more than the money they are getting, and we have already begun to get some very definite things done in the automobile industry as far as foreign trade is concerned. These men are first contact men with industry, getting the ideas through the collective action of the association into the department, and then getting the stuff that is in the department back to industry in some usable and simplified form. A committee of electrical manufacturers has recently been formed to make its contact with the electrical man in that department, and there are other committees to be formed to make contact with some of the other divisions.

Many electrical men have had some contact with the Bureau of Standards. This bureau is the largest research laboratory in the world. It has the largest equipment for research of any government bureau in the world, and it has about four functions.

In the first place, it is a sort of a laboratory for all the other government buying departments. If the Congressional Library wants to buy a copper gutter, it goes to the Bureau of Standards to find out what is the most approved type at the present time, and through this activity there has been built up a series of specifications for government purchases.

A second function of the department might be compared with the village scale; but it is not so much the simple establishment of physical standards of weights and measures, in the older sense, that is sought as it is to relate these standards to industry, with the co-operation of the industry. For most of the trouble in standardization comes by not having the standards come out of the industry itself first, but by trying to force something in the way of standards back to industry.

Division of Simplified Commercial Practice

What Dr. Stratton is trying to do in the Bureau of Standards is to make this plain to business men, and we have set up completely a new division of the Bureau of Standards, to be called the Division of Simplified Commercial Practice. W. A. Durgin, who has been assistant to Vice-President Ferguson of the Commonwealth Edison Company of Chicago, has been loaned by Mr. Insull to head that job. I am glad that an electrical man is there, although the job to be done is very much larger than the electrical side alone.

Let me picture that job in a moment or two. We have in this country a great many organizations working on this matter of the elimination of waste. The Bureau of Standards has started certain programs leading to simplification of production programs and standardization of measurement, and that sort of thing. Besides, for example, the automobile tire manufacturers are now working out a series of standard specifications intended to eliminate the excess number of sizes of tires. If all those miscellaneous sizes are cut out, there will result a great saving of material and products now tied up in stocks of dealers and manufacturers. We have now started a Division of Building and Housing which will do this same kind of standardization work for the building industry.

All over this country houses are being built. The cost of construction will never probably go back to where it was before the war as regards the cost of materials. Probably the cost of labor will never go back completely. That means that we have got to increase individual production; we shall have to work harder. We have got to use material and labor and capital more effectively and use less material and labor and capital than we have done before. The way to do that is to introduce into industry as a whole certain elements of standardization and uniformity so we will cut out the wastes that go on in industry in certain detailed operations.

To accomplish this in the Division of Building and Housing, first, we have got together all the building codes in the country, the municipal building codes, and any one who thinks that the electrical industry is lax in the matter of diverse codes should look at these. Every municipal building code in the country varies from every other building code. An 8-in. wall in one city is recommended as a fire wall for a house in a certain district, and a 12-in. wall in another city is a fire wall in a like district. An agreement has been reached through the commissioners and architects that an 8-in. wall is all that is necessary for a fire wall in a certain city zone. That means at once about a 20 per cent reduction of cost of certain kinds of building construction that require fire walls.

We have discovered in the plumbers' codes that in some places you have to trap a closet with two vents and in some places with one vent, and in some towns you have to run a vent pipe from every trap in the house and in some towns you can run a vent pipe from only three or four. We can cut out about 20 per cent of the cost of plumbing if we can discover what is the right way to trap and vent a house and otherwise simplify and codify plumbing codes. There is a committee now at work on that—a committee of plumbers, not a committee of the government—to tell us what to tell them, which is a very practical way to get at this thing.

Now, along that line there are probably certain opportunities for the standardization of equipment for small houses. We have brought together a committee of architects and they are working out plans for small houses to be used by the contractors and the carpenters in the small towns where an architect is not ordinarily employed by the owner. These small houses, of good design and character, are to be built up of combinations of standards already available in the trade but generally unknown.

The sash and door manufacturers, for example, have said that today a man will order a door 6 ft. 11 in. high and 32 in. wide, and tomorrow another man will order a door 6 ft. 10 in. high and 31 in. wide, and the next day another fellow wants still a different dimension, when the largest volume of their orders are for doors 7 ft. high and 32 in. wide. Now, if we can get everybody to say that is a standard size, then we can agree on that size and it will cost considerably less on account of its being produced in quantity. So we are tackling that problem, through a committee of the sash and door men, who are going to make a survey of all the sash and door sizes there are, and as a result we are probably going to cancel about 50 per cent of the sizes by mutual consent and set up standards to be used by the building trades in certain classes of house construction.

The third group that is undertaking this work is the Federated American Engineering Societies. You have seen something of its report on the "Elimination of Waste in Industry," in which a committee of engineers, under the inspection of Mr. Hoover as chairman, has produced a remarkable basis for analyzing industrial wastes.

Trade Association Helping

The fourth group is one started by the trade associations themselves, and here is an example of what they are doing. The paving-brick manufacturers have been trying for three years to introduce standards for the paving-brick industry. There were something like thirty styles and varieties of paving brick manufactured, and they wanted somebody to help them out of the woods, because every time they started to tell anybody there ought to be only three or four, the men that bought them said, "Oh, you are trying to put something over on us."

We said to them: "The first thing to do is to get together as an industry and find out really what you are doing yourselves. Go out and make a survey; use the name of the Department of Commerce to get facts from men who probably would not give them to you if you asked them for yourselves alone."

They made a wonderful report. They analyzed the sales of paving brick of 90 per cent of the manufacturers in the paving-brick industry for this country for the last eight years. They found not thirty but sixty-six sizes and varieties of paving brick now being made. They put down the sales of all the sixty-six varieties for the last eight years. Here was something to talk about. So, in the name of the Department of Commerce, we issued an invitation to the municipal engineers and the architects and the technical societies and the manufacturers, who are the buyers of paving brick, and there were some thirty-three associations represented. We called a meeting in Washington and we laid the report before them.

"Now," we said, "gentlemen, what does common sense say we ought to do? We are not going to force you to do anything." All it required was common sense, and they looked down the total column and in one resolution eliminated from sixty-six down to twenty, by mutual consent. Then we appointed a committee, and it took the twenty sizes remaining and spent the noon-hour luncheon with them and cut them down to eleven.

We left at the end of one day with sixty-six varieties cut to eleven, without forcing it on anybody. The municipal engineers went back to their association to recommend these sizes as standard in their association, and the Navy Department has already sent in and said that hereafter all the bricks ordered by the department will be ordered on those standard sizes. In one day we accomplished something that only the Department of Commerce, exercising this particular function, could possibly do. We have already requests from several other industries to do just that sort of thing. It is this kind of work that is going to be the basis of what Mr. Durgin is going to head.

ADDING PROPHECY TO CENSUS HISTORY

Now I want to jump to the Bureau of Census. The Bureau of Census has habitually got out historical figures two years after the time we take them. They are essential and important as records, but not immediately useful. Mr. Hoover says that we don't want history alone from the Bureau of Census, for we also want prophecy. So one of my jobs has been to help put prophecy into the Bureau of Census. But instead of trying to remake the Bureau of Census, with its tremendous machinery, handling over a billion cards for example, to take one population census, we added a little staff of prophets. These men pick out of the Census and other government bureaus those facts that show trends in business, and our *Monthly Survey of Business* shows these trends in industry and production, in stocks, in various lines throughout the country. In that work we have asked and received the co-operation of thirty-five or forty trade associations very freely in getting statistics.

It is utterly impossible to build up any government machinery quickly if you are getting monthly figures. Instead of that, we are looking to the secretaries of associations to function, if you will, as government representatives in handling their end through providing totals of production and stocks from their statistical work which can go into the monthly surveys. Our sole purpose is to find, first, whether that association represents enough of the industry to be indicative of the trend, and whether it represents enough of the volume of that industry.

When we talk about statistics we talk about things that are usually uninteresting. So most of us make up our minds on opinion instead of facts, and most of us talk about the button on the coat instead of the coat itself. But before we make decisions about the distribution problem in this country, for instance, before we make up our minds too much on who ought to sell electrical goods, we should find out who they are. For fifty years in this country we have made a study of production, and in those fifty years we have eliminated certain wastes and have developed a certain kind of thinking about production, and we call it "industrial engineering." We have a type of man known as the "industrial engineer," but only in the last ten years have we begun to talk about distribution at all. We are now beginning to approach that subject in the same way we approached production. There is a type of man at work in industry that can have the same professional relation to the problems of distribution that the industrial engineer has to the problems of production, and that is the advertising man. But that is a story all by itself and one too long to enter into here.

MUST FIRST GET FACTS

What I want to say is that the distribution problem depends, first, on getting facts to talk about, and that we must not base our ideas and our policies on opinion only. The Department of Commerce hopes to help to get those facts on the matter of distribution.

There are no real statistics of retailing or of jobbing in the electrical industry. There are no real statistics in this country. I know that because I have been trying to find them for three months. There are a lot of pieces of statistics, but there are no real, comprehensive statistics, and that applies not only to one but to all industries. Every time a man gets hold of a piece of it he builds up a great, big case on that piece. But before we start building up cases on distribution, let's be sure we have all the pieces. Before we put the contractor-dealer out of business, let's be sure we are talking about the right pieces and about all the pieces. Before we talk about who is the right man to merchandise, let's see who is merchandising today. And before we begin to reorganize our businesses let's see what is actually being done today.

DISTRIBUTION SURVEY SUGGESTED

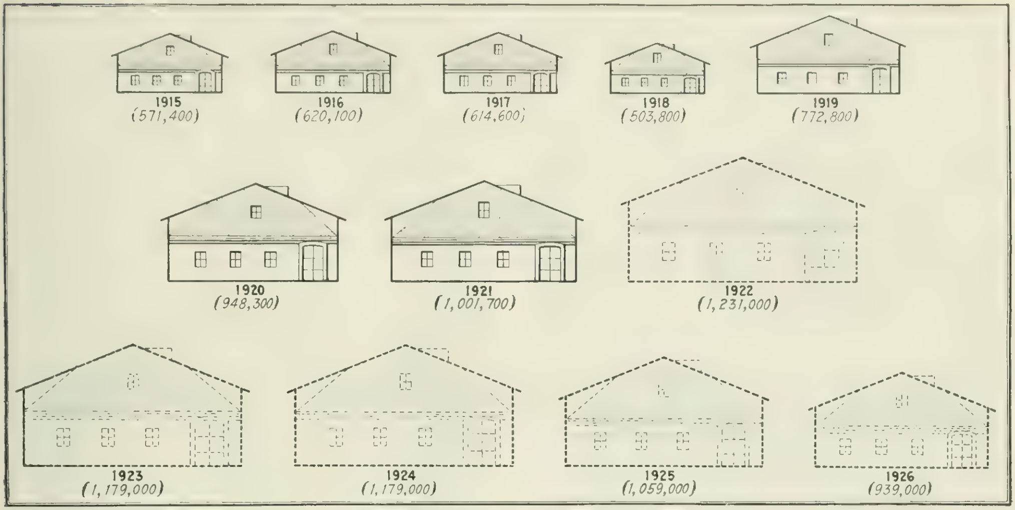
Now, so far as the Department of Commerce is concerned, the problem is tremendously broader than the work that the intimate association or any individual can do. But if some electrical association would undertake to make a real survey of the distribution elements it would be a practical start that would get somewhere. We should have something to put up on the wall and to talk about that wasn't the buttons on the coat but the coat itself. Until we do that we are never going to answer the question.

I have attended electrical meetings for six years and heard discussions about distribution and who is the right man to sell. A lot of us have a tremendous amount of individual knowledge, but all of us haven't the common knowledge or the common belief, which is much the same thing. We have to have in that knowledge, first, the fact and then the belief in the fact. Now, the one way to get belief in facts is to add the government stamp of approval to those facts. That is the contribution the Department of Commerce is trying to make in this work, to add a stamp of approval on facts which in themselves will carry the moral support so that everybody can organize around them and will then go and get something done on the facts.

Residential Lighting Customers Served by Electric Light and Power Companies

State and Sections	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number (Thousands)	New Customers During 1915 (Thousands)	Per Cent Gain During 1915	Total Number (Thousands)	New Customers During 1916 (Thousands)	Per Cent Gain During 1916	Total Number (Thousands)	New Customers During 1917 (Thousands)	Per Cent Gain During 1917	Total Number (Thousands)	New Customers During 1918 (Thousands)	Per Cent Gain During 1918	Total Number (Thousands)	New Customers During 1919 (Thousands)	Per Cent Gain During 1919	Total Number (Thousands)	New Customers During 1920 (Thousands)	Per Cent Gain During 1920	Total Number (Thousands)	New Customers During 1921 (Thousands)	Per Cent Gain During 1921
United States	4,006.3	571.4	16.7	4,626.4	620.1	15.5	5,241.0	614.6	13.3	5,744.8	503.8	9.6	6,517.6	772.8	13.5	7,465.9	948.3	14.5	8,467.6	1,001.7	13.4
SECTIONS																					
New England	384.2	66.3	20.9	462.4	78.2	20.4	536.3	73.9	16.0	572.7	36.4	6.8	649.4	76.7	13.4	748.8	99.4	15.3	828.8	80.0	10.7
Middle Atlantic	596.5	122.5	25.8	674.8	78.3	13.1	796.8	122.0	18.1	902.9	106.1	13.3	1,085.0	182.1	20.2	1,259.0	174.0	16.0	1,522.0	263.0	20.6
South Atlantic	320.9	28.4	9.7	360.0	39.1	12.2	386.6	26.6	7.4	424.5	37.9	9.8	476.3	51.8	12.2	547.3	71.0	14.9	620.6	73.3	13.4
East North Central	968.4	123.7	14.6	1,160.0	191.6	19.8	1,331.5	171.5	14.8	1,471.2	139.7	10.5	1,686.8	215.6	14.7	1,955.0	268.2	15.9	2,237.8	282.8	14.5
West North Central	526.0	98.8	23.1	604.5	78.5	14.9	685.0	80.5	13.3	740.9	55.9	8.2	835.6	94.7	12.8	936.5	100.9	12.0	1,014.0	77.5	8.3
East South Central	160.2	12.2	8.2	181.0	20.8	13.0	198.0	17.0	9.4	212.3	14.3	7.2	237.8	25.5	12.0	285.7	47.9	20.1	330.5	44.8	15.7
West South Central	196.1	37.4	23.6	242.4	46.3	23.6	296.6	54.2	22.4	335.5	38.9	13.1	374.8	39.3	11.7	452.7	77.9	20.8	499.7	47.0	10.4
Mountain	226.4	20.1	9.7	264.2	37.8	16.7	289.8	25.6	9.7	304.1	14.3	4.9	316.0	11.9	3.9	327.0	11.0	3.5	346.7	19.7	6.0
Pacific	627.7	62.1	11.0	676.8	49.1	7.8	720.5	43.7	6.5	780.7	60.2	8.4	856.0	75.3	9.7	953.9	97.9	11.4	1,067.5	113.6	11.8
NEW ENGLAND																					
Maine	47.7	8.9	23.5	53.3	5.6	11.7	66.3	13.0	24.4	74.5	8.2	12.4	78.5	4.0	5.4	90.5	12.0	15.3	100.0	9.5	10.5
New Hampshire	18.5	1.9	11.4	22.2	3.7	20.0	23.9	1.7	7.7	25.4	1.5	6.3	30.0	4.6	18.1	34.6	4.6	15.3	38.3	3.7	10.7
Vermont	29.7	2.3	8.4	31.1	1.4	4.7	32.1	1.0	5.5	32.8	0.7	2.2	36.5	3.7	11.3	42.1	5.6	15.4	46.0	3.9	9.3
Massachusetts	197.0	36.2	22.5	241.3	44.3	22.5	279.5	38.2	15.8	292.7	13.2	4.7	338.9	46.2	15.8	393.8	54.9	16.1	436.5	42.7	10.8
Rhode Island	24.1	4.5	23.0	30.1	6.0	24.9	34.5	4.4	14.6	36.1	1.6	4.6	42.5	6.4	17.7	49.0	6.5	15.3	57.8	8.8	18.3
Connecticut	67.2	12.4	22.6	84.8	17.6	26.2	100.0	15.2	17.9	111.3	11.3	11.3	123.0	11.7	10.5	138.8	15.8	12.8	150.2	11.4	8.3
MIDDLE ATLANTIC:																					
New York	222.3	40.5	22.2	272.6	50.3	22.6	336.0	63.4	23.2	392.0	56.0	16.7	480.0	88.0	22.5	552.0	72.0	15.0	686.0	134.0	24.3
New Jersey	136.7	16.7	13.9	156.4	19.7	14.4	177.0	20.6	13.2	190.2	13.2	7.5	220.0	29.8	15.7	254.0	34.0	15.5	293.0	39.0	15.4
Pennsylvania	237.5	65.3	37.9	245.8	8.3	3.5	283.8	38.0	15.5	320.7	36.9	13.0	385.0	64.3	20.1	453.0	68.0	17.7	543.0	90.0	19.8
SOUTH ATLANTIC:																					
Delaware	5.3	1.0	23.2	6.1	0.8	15.1	7.8	1.7	27.9	7.9	0.1	1.3	9.3	1.4	17.7	10.7	1.4	15.1	12.1	1.4	13.1
Maryland	33.5	3.6	12.1	38.1	4.6	13.7	41.8	3.7	9.7	45.1	3.3	7.9	53.2	8.1	18.0	67.2	14.0	26.3	77.6	10.4	15.5
District of Columbia	20.6	2.2	12.0	23.4	2.8	13.6	24.7	1.3	5.6	28.4	3.7	15.0	30.8	2.4	8.5	31.2	0.4	1.3	36.5	5.3	17.0
Virginia	62.0	6.2	11.1	71.3	9.3	15.0	77.1	5.8	8.1	81.4	4.3	5.6	92.0	10.6	13.0	98.3	6.3	6.8	112.2	13.9	14.1
West Virginia	15.7	3.3	26.6	19.5	3.7	23.6	23.8	4.3	22.0	32.2	8.4	35.3	38.0	5.8	18.0	44.1	6.1	16.0	51.3	7.2	16.3
North Carolina	35.4	4.3	13.8	38.0	2.6	7.3	39.5	1.5	4.0	44.4	4.9	12.4	50.0	5.6	12.6	57.4	7.4	14.8	65.1	7.7	13.4
South Carolina	35.0	2.1	6.4	37.6	2.6	7.4	39.0	1.4	3.7	44.5	5.5	14.1	51.0	6.5	14.6	58.7	7.7	15.1	66.5	7.8	13.3
Georgia	63.3	1.5	2.4	71.7	8.4	13.3	72.6	0.9	1.3	76.3	3.7	5.1	84.0	7.7	10.1	88.2	4.2	5.0	91.3	3.1	3.5
Florida	50.0	4.0	8.7	54.4	4.4	8.8	60.4	6.0	11.0	64.4	4.0	6.6	68.0	3.6	5.6	91.5	23.5	34.6	108.0	16.5	18.0
EAST NORTH CENTRAL:																					
Ohio	188.2	26.8	16.6	233.3	45.1	24.0	281.2	47.9	20.6	322.8	41.6	14.8	385.0	62.2	19.3	471.0	86.0	22.3	534.0	63.0	13.4
Indiana	124.7	5.2	4.4	141.0	16.3	13.1	156.4	15.4	10.9	169.7	13.3	8.5	191.8	22.1	13.0	221.8	30.0	15.6	248.0	26.2	11.8
Illinois	387.0	45.7	13.4	462.4	75.4	19.5	526.5	64.1	13.9	572.5	46.0	8.7	640.0	67.5	11.8	730.0	90.0	14.1	858.0	128.0	17.5
Michigan	172.7	33.7	24.2	214.8	42.1	24.4	251.0	36.2	16.9	275.8	24.8	9.9	320.0	44.2	16.0	371.2	51.2	16.0	425.0	53.8	14.5
Wisconsin	95.8	12.3	14.7	108.5	12.7	13.3	116.4	7.9	7.3	130.4	14.0	12.0	150.0	19.6	15.0	161.0	11.0	7.3	172.8	11.8	7.3
WEST NORTH CENTRAL:																					
Minnesota	105.8	19.6	22.8	126.3	20.5	19.4	149.0	22.7	18.0	163.5	14.5	9.7	192.0	28.5	17.4	233.5	41.5	21.6	261.5	28.0	12.0
Iowa	70.0	10.6	17.9	81.3	11.3	16.2	90.2	8.9	11.0	96.0	5.8	6.4	110.0	14.0	14.6	123.3	13.3	12.1	131.8	8.5	6.9
Missouri	161.0	29.0	22.0	172.4	11.4	7.1	180.2	7.8	4.5	191.3	11.1	6.2	212.0	20.7	10.8	237.5	25.5	12.0	250.7	13.2	5.6
North Dakota	29.9	6.2	26.2	34.6	4.7	15.7	40.3	5.7	16.5	40.7	0.4	1.0	42.3	1.6	4.0	47.5	5.2	12.3	51.5	4.0	8.4
South Dakota	28.6	4.7	19.7	30.8	2.2	7.7	32.1	1.3	4.2	33.1	1.0	3.1	39.3	6.2	18.8	44.1	4.8	12.2	46.3	2.2	5.0
Nebraska	61.5	8.7	16.5	67.9	6.4	10.4	75.2	7.3	10.8	81.0	5.8	7.7	90.0	9.0	11.1	96.9	6.9	7.7	101.2	4.3	4.4
Kansas	69.3	20.0	40.6	91.3	22.0	31.8	118.0	26.7	29.2	135.3	17.3	14.7	150.0	14.7	10.9	153.7	3.7	2.4	171.0	17.3	11.3
EAST SOUTH CENTRAL:																					
Kentucky	60.6	5.4	9.8	68.4	7.8	12.9	76.7	8.3	12.1	82.2	5.5	7.2	91.0	8.8	10.7	118.0	27.0	29.7	144.2	26.2	22.2
Tennessee	34.9	2.8	8.7	40.7	5.8	16.6	44.1	3.4	8.4	47.7	3.6	8.2	57.0	9.3	19.5	65.0	8.0	14.0	71.6	6.6	11.5
Alabama	38.4	1.9	5.2	43.3	4.9	12.8	45.4	2.1	4.8	48.5	3.1	6.8	54.0	5.5	11.3	65.1	11.1	20.6	75.8	10.7	16.5
Mississippi	26.3	2.1	8.7	28.6	2.3	8.8	31.8	3.2	11.2	33.9	2.1	6.6	35.8	1.9	5.6	37.6	1.8	5.0	38.9	1.3	3.5
WEST SOUTH CENTRAL:																					
Arkansas	29.9	3.9	15.0	34.7	4.8	16.1	39.0	4.3	12.4	42.6	3.6	9.2	48.3	5.7	13.4	57.0	8.7	18.0	62.1	5.1	9.0
Louisiana	28.1	3.7	15.2	32.6	4.5	16.0	36.7	4.1	12.6	40.1	3.4	9.3	45.5	5.4	13.5	54.5	9.0	19.8	59.5	5.0	9.2
Oklahoma	41.7	2.2	5.6	45.4	3.7	8.9	49.6	4.2	9.2	54.2	4.6	9.3	61.0	6.8	12.5	68.5	7.5	12.3	71.6	3.1	4.5
Texas	96.5	27.7	40.2	129.8	33.3	34.5	171.2	41.4	31.9	198.6	27.4	16.0	220.0	21.4	10.8	272.7	52.7	24.0	306.5	33.8	12.4
MOUNTAIN:																					
Montana	36.3	1.5	4.3	41.7	5.4	14.9	42.8	1.1	2.6	50.9	8.1	18.9	52.0	1.1	2.2	47.3	— 4.7	— 9.0	46.6	— 0.7	— 1.5
Idaho	26.7	3.8	16.6	29.5	2.8	10.5	32.1	2.6	8.8	34.6	2.5	7.8	38.5	3.9	11.3	40.2	1.7	4.5	42.5	2.3	5.8
Wyoming	9.3	1.3	16.2	10.2	0.9	9.7	11.3	1.1	10.8	12.2	0.9	8.0	13.6	1.4	11.5	15.7	2.1	15.5	18.8	3.1	19.8
Colorado	75.8	5.4	7.7	83.0	7.2	9.5	94.0	11.0	13.3	100.0	6.0	6.4	103.0	3.0	3.0	107.7	4.7	4.6	114.2	6.5	6.0
New Mexico	10.7	0.3	2.9	11.3	0.6	5.6	12.5	1.2	10.6	12.5	0.0	0.0	13.3	0.8	6.4	14.0	0.7	5.1	14.9	0.9	6.3
Arizona	8.4	1.7	25.4	10.0	1.6	19.1	11.0	1.0	10.0	11.8	0.8	7.3	12.1	0.3	2.5	13.7	1.6	12.9	15.7	2.0	15.0
Utah	41.2	5.0	13.8	60.8	19.6	47.6	69.2	8.4	13.8	68.7	—0.5	—0.7	69.0	1.3	1.9	73.1	4.1	6.0	78.3	5.2	7.0
Nevada	18.1	1.2	7.1	17.6	—0.5	—2.8	16.9	—0.7	—3.9	13.4	—3.5	—20.7	14.5	1.1	8.2	15.3	0.8	5.5	15.7	0.4	2.8
PACIFIC:																					
Washington	140.4	13.1	10.3	148.0	7.6	5.4	165.7	17.7	12.0	187.4	21.7	13.1	204.0	16.6	8.8	216.1	12.1	6.0	223.0	6.9	3.2
Oregon	61.3	5.5	9.9	63.8	2.5	4.1	66.8	3.0	4.7	75.3	8.5	12.7	82.0	6.7	8.9	87.8	5.8	7.1	92.5	4.7	5.4
California	426.0	43.5	11.4	465.0	39.0	9.2	488.0	23.0	4.9	518.0	30.0	6.1	570.0	52.0	10.0	650.0	80.0	14.0	752.0	102.0	15.7

More than 1,000,000 New Residential Customers During 1921



NUMBER OF NEW RESIDENTIAL LIGHTING CUSTOMERS PER YEAR, FROM 1915 THROUGH 1921, AND ESTIMATES FOR NEXT FIVE YEARS

DESPITE the large decrease in revenue from industrial plants in 1921 due to the business depression, it is an outstanding fact that the revenue from residential lighting customers has materially increased. The surplus energy resulting from the decreased industrial load has put the industry on its toes in an endeavor to acquire new load, and in this period of industrial depression the residential lighting customer has assumed a commanding position. The extent to which the residential lighting customer has been cultivated by the industry is clearly indicated by a survey which has just been completed by the ELECTRICAL WORLD.

Returns received from about 70 per cent of the electric light and power industry indicate that 1,001,700 new residential customers were added to the systems of the country during 1921. Of this number 70 per cent can be classed under the heading "old houses wired."

The accompanying diagram shows the comparative increases in residential lighting customers for the various years from 1915 to 1922 and estimates of increases during the next five yiears. In estimating the new residential customer for the years 1922 to 1926 inclusive, the results of a recent survey made by the *Building Age* have been used as a basis. This survey indicated that the equivalent of 1,328,629 new dwellings are needed at once. It appears to be the consensus of opinion that this house shortage will be eliminated by 1927, and the following building schedule has been assumed: 30 per cent of these dwellings to be constructed in 1922, 25 per cent in 1923, 25 per cent in 1924, 15 per cent in 1925 and 5 per cent in 1926.

United States Census figures indicate that an average of 270,000 dwellings were constructed each year from 1910 to 1920 to take care of increased population. By reason of decreased immigration, however, it is assumed that about 200,000 new dwellings will be built each year between 1921 and 1927 to take care of increased population. These figures must, of course, be added to the construction to eliminate housing shortage. It is believed that 90 per cent of these new dwellings will be wired for electrical energy. These new dwellings, however, are not the only source for central-station domestic lighting customers. The ELECTRICAL WORLD survey indicates that of the 1,001,700 new domestic installations added to the various systems during 1921, 700,000, or 70 per cent, can be classed as "old dwellings wired." There appears to be no outstanding reason why this figure of 700,000 old dwellings wired per year should not be maintained, and the figure has been assumed as applying to the years 1922 to 1926 inclusive.

The aggregate of these three sources of residential lighting customers gives an estimated total of nearly 5,000,000 new customers during the next five years, or a total of 13,854,600 residential lighting customers by Jan. 1, 1927. This estimated large increase in high-revenue consumers serves as a basis for prophesying prosperous conditions in the electric light and power industry during the next five years.

The tabulation on the opposite page gives a vivid story of the growth in residential lighting customers. The growth during the past year was at the rate of 13.5 per cent, and it appears that this rate of growth will be increased during the year 1922.

80,000-Volt Cable Being Installed in Italy

Review of Outstanding Features of Development in Underground Practice—Higher Cable Voltages—Kenotrons for Burning Out Cable Faults

BY PHILIP TORCHIO
Chief Electrical Engineer New York Edison Company

THE most remarkable development of the past year, one that will greatly influence future practice, is the use of 60,000-volt cables to supply power to all the Paris suburbs from the new 200,000-kw. Gennevilliers station. Fifteen feeders transmit the output of this plant, each feeder consisting of three single-conductor, paper-insulated, lead-covered cables installed in reinforced-concrete troughs buried in the ground. Another remarkably high-voltage single-conductor cable installation, namely 80,000-volt, is being installed by an Italian company. Since 1914 this company has had in operation nine miles of 50,000-volt single-conductor cable. This cable, which is used on the Catalan transmission line connecting with the Barcelona substation, has had only one failure, ascribed to electrolysis from stray currents of street railways. Two 40,000-volt cables have been in operation for about eight years in Turin, Italy, as underground substation terminals of overhead-transmission lines. However, on account of surges caused by grounds on the overhead lines apparently, numerous breakdowns occurred which necessitated the installation of isolating transformers. Incidentally the pressure was lowered to 20,000 volts.

In this country the New York Edison Company is about to install some 45,000-volt single-conductor cable, and other companies are studying its application.

The highest operating pressure for three-conductor cables is 33,000 volts. Several installations of such cable have been made in Europe and one has been made in Chicago by the Commonwealth Edison Company.

REDUCTION IN LOSSES

Marked improvements by several manufacturers in the reduction of dielectric losses in cables, through the substitution of mineral oil impregnation, have virtually eliminated one of the serious limitations to the safe operation of high-tension cables (over 10,000 volts) at temperatures exceeding 85-E degrees C., E being the pressure in thousands of volts. With the new high-tension cables of negligible dielectric loss, higher temperatures approaching 85 deg. C. for normal loads and perhaps as high as 105 deg. C. for overloads will become practicable and allowable in the case of moderately high-tension cables of 13,000 volts to 18,000 volts. For higher pressures it is questionable whether the elimination of dielectric losses will warrant a material increase in operating temperature because the lead sheaths will then expand, and not reset on cooling, leaving minute air spaces which may cause ionization within the insulation. This danger of ionization will be greater the higher the pressure. Further research is needed.

A large impetus has been given during the year to the study of safe operating temperatures for paper-insulated cables, and special investigations are being actively conducted in this country and abroad. Several papers were presented to the A. I. E. E. giving research and field data for cables in which the dielectric loss is low, tending to show that on "overload rating" such cables should be allowed 20 deg. C. margin over the normal rating of 85 deg. C. Great confusion in electrical engineering standardization has been created by too much generalization of the practice of "single rating" for almost all classes of apparatus, regardless of whether or not, with equal safety, this rating is more advantageous to the users than the old standard of "normal" and "overload rating." Several engineers believe the double rating should be applied to cables.

In the field of subway construction improvements have been made, first, in the study of duct temperatures by elaborate surveys; second, in subdivision of heavy trunk lines into separate banks of limited number of ducts, and, third, in artificial duct cooling, especially by manhole ventilation and sprinklers in an empty duct.

RELIEVING OVERHEAD CONGESTION

Further progress has been made in cable construction at substation terminals for overhead systems of distribution. The practice of running cables underground for several blocks from the substation to the overhead lines, thereby relieving all congestion of overhead wires at the substation, has been extended from the lower-pressure distributing lines to high-pressure feeders operating at voltages as high as 24,000. In some cases the three-conductor cables are brought to the pole where they join the overhead line and are spliced thereto by single-conductor leads each equipped with a pothead. Lately some companies have inaugurated the practice of running the three-conductor cables only part of the way to the overhead junction, using three single-conductor cables for the last 500-ft. or 600-ft. stretch. The insulation on the single-conductor cables is also materially increased to withstand lightning and surges, the relatively large inductive capacity of the cable being intended to absorb the steep wave-front discharges.

In direct-current distribution a novel departure has been introduced by the New York Edison Company in installing circuit breakers in the manholes (see ELECTRICAL WORLD, Jan. 7, 1921, page 30). The circuit breakers are operated automatically upon a burn-out of the cable to which they are connected, the operating impulse being given by the burn-out short-circuiting a pressure wire built in the cable as one insulated strand of the several strands of copper of the cable. The company has also been considering the installation of station circuit breakers on direct-current feeders in series with the present bus-selector switches, which are now manually operated, by a current sent over the pressure wire. Having in mind the desirability of automatic circuit breakers, the company is installing in some new substations, in place of switches, remote-control circuit breakers specially designed in pairs to act also as bus selectors (see ELECTRICAL WORLD, Jan. 7, 1921, page 32).

Another development in underground practice is the use, for the detection of cable faults, of a kenotron with special protective features to safeguard its operation. The units now available, of about 5 kva., are of too small capacity to always burn out the fault when detected. A much larger capacity kenotron than is now available would undoubtedly replace alternating-current outfits rated at 2,000 kva. and over.

Finally, the American Committee on Electrolysis has prepared an outline of the status of the electrolysis problem which represents the unanimous opinion of all delegates of the different associations on the committee, including the owners of underground structures, the A.I.E.E. and the United States Bureau of Standards.

Major Turbine Troubles Diminished

Troubles In Past Year Confined Largely to Blading, Lubrication and Vibration—Some Figures on the Growth in Turbine Sizes—Points of Interest Gathered from Foreign Specifications

FREEDOM from the bigger troubles that have marked the experience of the last few years in the turbine field is the feature of the past year both here and abroad. The tremendous growth of central-station loads in the last ten years has led to a demand for larger and larger units. Combined with this demand, the possible economies with large, high-speed turbines have operated to force a rapid development of large units, particularly in American practice. This has created a difficult problem for the designers, who have not only had to develop the designs but also to supply materials that could be depended on to stand up under the severe service demanded of the equipment. The further complications in material supply incident to the war conditions existing during the greater part of the last decade have probably both retarded the elimination of difficulties that would be normally expected and introduced some that under other conditions might not have appeared.

In natural exasperation at the failure of an important unit, involving a serious loss in the expense of repairs and, under the circumstances, a far more serious loss in the crippling of service, because spare equipment was not available, some operators have gone to the extreme of doubting the practicability of the large-size unit. In a few cases investigations to determine the feasibility of a large number of units of comparatively small rating scattered in a number of moderate-capacity plants for the handling of a transmission system have been made. There has also been some tendency for plant designers to "shy" away from the use of the larger-sized units that manufacturers are willing to supply and fall back on the units of 10,000-kva. to 20,000-kva. rating, with a tendency to keep to the smaller sizes within this limit. Two factors are involved in this tendency, the first of which is distrust of the larger units and the other the fact that there are comparatively few systems developed to a point where the larger units are economically the proper equipment, since with them too large a portion of the system load may be tied up in one unit.

There is a point in the percentage of total system capacity beyond which it is impossible to go in increasing the capacity of individual units without making it economically impossible to provide the proper reserve plant for the protection of service. It is possible that this factor has been a bigger one in operators' criticisms of the larger units than the physical difficulties involved in the design, manufacture and use of the machines. The physical difficulties that were more obvious were, however, a convenient as well as an easier argument to which to point in support of the operators' objections. The record of the past year affords hope that the causes of the annoying experiences of the past are coming rapidly within the control of the designer and the manufacturer and that the experience of all industry is merely being repeated, namely, that no difficulties, however formidable they may appear, are insurmountable when economic pressure is heavy enough to demand a solution.

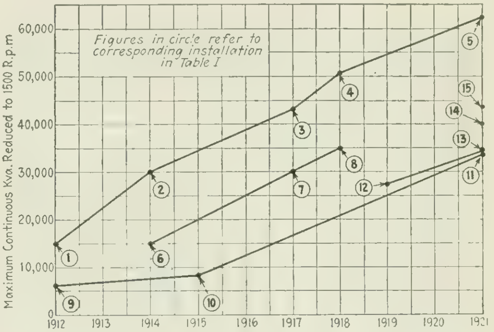


FIG. 1—GROWTH OF TURBINE RATINGS REDUCED TO 1,500-R.P.M. BASIS (K. BAUMANN, BRITISH I. E. E., APRIL, 1921)

GROWTH IN TURBINE RATINGS

In the *Proceedings* of the American Institute of Electrical Engineers for November, 1919, J. F. Johnson showed a curve indicating the present limits of the speed and power of single-shaft steam turbines. This curve was not intended to suggest practical limits of turbine capacities, either present or future, but the physical relations, with given operating conditions, that

TABLE I—CHARACTERISTICS OF SOME TURBINE INSTALLATIONS INSTALLED SINCE 1912
(K. Baumann, B. I. E. E., April, 1921)

No.	Manufacturer	Location	Year Installed	Rating in Kw. Maximum Continuous	Rating in Kw. Economical	Speed, R.P.M.
1	General Electric	Commonwealth—Fisk Street, Chicago	1912	20,000	15,000	1,200
2	General Electric	Commonwealth—Northwest, Chicago	1914	30,000	25,000	1,500
3	General Electric	Windsor power station	1917	30,000	22,000	1,800
4	General Electric	Commonwealth—Fisk Street, Chicago	1918	30,000	22,500	1,800
5	General Electric	Proposed practice for	1921	34,000	. .	1,800
6	Westinghouse	Interborough Rapid Transit, Seventy-fourth Street, New York	1914	30,000	25,000	1,500 750
7	Westinghouse	Providence—Narragansett	1917	40,000	33,000	1,800 1,200
8	Westinghouse	Commonwealth—Fisk Street, Chicago	1918	35,000	25,000	1,500
9	Parsons	Commonwealth—Fisk Street, Chicago	1912	25,000	20,000	750
10	Parsons	Underground, Lots Road, London	1915	18,000	15,000	1,000
11	Parsons & Met. Vickers	Lots Road, London	1921	18,000	15,000	2,000
12	R. W. Met. Vickers	Manchester Corporation	1919	22,000	20,000	1,500
13	Met. Vickers	Manchester Corporation	1921	27,500	25,000	1,500
14	B. T. H.	Rotherham	1921	30,000	25,000	1,500
15	Zoelly type	Paris (Gennevilliers)	1921	35,000	30,000	1,500

exist between speed and capacity with the materials available at the time.

The advantages of the steam turbine at high speeds from the viewpoints of reliability, thermal economy and first cost were declared by K. Baumann, chief engineer of the Metropolitan Vickers Company, Ltd., in a discussion of recent developments of the steam turbine before the (British) Institution of Electrical Engineers in April, 1921, to justify the efforts of the designer to obtain the maximum possible output at the highest possible speed, even though the high-speed alternator is less efficient and its first cost practically the same as that of the lower-speed machine and the advantages of the high-speed turbine are to some extent nullified thereby. Mr. Baumann called attention to the cost of the low-speed high-capacity machine, citing the case of a turbine built for the Rheinisch Westfalische Kraftwerke of Cologne, with a maximum continuous rating of 50,000 kw. and an economical rating of 40,000 kw., and declared that because of the cost of the set future progress will be toward increasing the output of 1,500-r.p.m. machines rather than developing 1,000-r.p.m. sets. The growth of ratings reduced to a 1,500-r.p.m. basis, as analyzed by Mr. Baumann, is given in Fig. 1. Mr. Baumann also discussed the tendency in turbines of even higher speed. Fig. 2 gives the result of his studies reduced to a 3,000-r.p.m. basis.

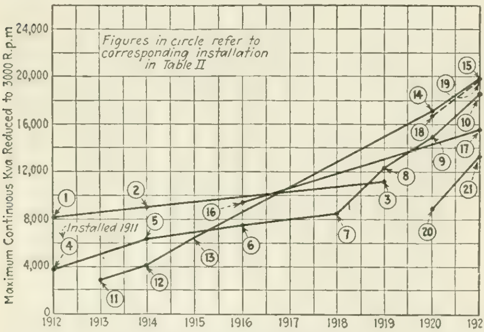


FIG. 2—PHYSICAL RELATIONS BETWEEN SPEED AND CAPACITY FOR SOME INSTALLATIONS

With the two speeds discussed it is interesting to note that the original tables from which the data were taken indicate clearly the difference in conditions in American and foreign plants. The data for the larger-sized machines were taken almost exclusively from American practice, while those for the smaller-size, higher speed equipment were taken from European practice with only one or two exceptions. These data seem to indicate clearly a trend toward the larger capacities and higher speed that has a basis in real demand. Both European and American reports indicate that units of large size are still on the design tables in preparation for a demand that seems to be expected as power requirements in the big industrial centers increase.

The discussions at the various meetings in England at which Mr. Baumann's paper was presented early this year brought out much the same feeling as to the practicability of the use of the large-capacity machines that was voiced by Farley Osgood in the November, 1919, discussion at the New York meeting of the American Institute of Electrical Engineers, when he expressed his feeling of relief that discussions were apparently being confined to an approximate limit of 30,000 kva. and the viewpoints of the operator were indicated as four in number, comprising (1) continuity of service, (2) capacity of unit out of service during periods of repair, (3) investment costs of units out of service or in reserve, and (4) length of time necessary to make necessary housekeeping repairs to the units. The reasons for the English viewpoint are different only in that English conditions apparently will not justify the use of turbines of such large capacity as American conditions permit. The limitation on sizes used would seem to be determined more by the economic conditions the plants must meet than by the ability of the designers.

RECENT OPERATING DIFFICULTIES NOT SERIOUS

The difficulties developing during the last year have been of the minor order and have been concerned largely with lubrication, packing and seals, blading and vibration. There seems to be a tendency toward providing an emergency pump on the oiling system to become automatically operative in case of failure of the pump on any unit in operation. This tendency brings out the need of standardizing oil pressure for the different sizes, types and makes of units. The formulation of standard specifications for turbine oil is receiving strong support as the result of difficulties from this source. There is also a strong demand for a simple method of testing lubricants, so that it will be possible not only to check the purchases but to keep track of the effectiveness of filtration and purifying equipment.

Some changes in the construction and material used for the dummy rings in the reaction type of turbine have been made to improve operation. The sealing of the high-pressure end of the casing is still engaging attention. The rather large amount of steam required and the difficulty encountered in utilizing it by turning it into a lower stage or through the feed-water heater are the principal troubles. That vibration during the starting-up operations may be promoted by the heating of the exhaust end, both by heat conduction from the high-pressure end of the casing and by steam passing through a leaking throttle valve, is the conclusion expressed by the committee on steam turbines and generators of the Association of Edison Illuminating Companies in its report this year. This, in the opinion of the committee, may be the explanation of many otherwise inexplicable cases of unsatisfactory operation, and the hope is expressed that a fuller investigation of the subject may be made for report at the next convention. Only a few cases of blading trouble have come to light, and these have been traced to either poor workmanship or poor materials during the war. The research work caused by these troubles has led not only to increased manufacturing precautions but to improvements in the alloys used by some of the manufacturers. Troubles with labyrinth packing in which the aluminum strips were corroded by free alkali in the steam have occurred in sufficient number to cause a substitution of brass.

IMPROVEMENTS IN DESIGN

The trouble with turbine wheels may be due to several causes, of which the most serious seems to be vibration and excessive stresses due to the uneven distribution of temperature. Excessive stresses due to centrifugal forces and to faulty design and materials fall in the class that is probably least difficult of control, because they are easy of detection by established methods. What happens in the wheels under running

TABLE II—CHARACTERISTICS OF SOME TURBINE INSTALLATIONS INSTALLED SINCE 1911
(K. Baumann, B. I. E. E., April, 1921)

No.	Manufacturer	Location	Year Installed	Rating in Kw. Maximum Continuous	Rating in Kw. Economical	Overload Rating in Kw.	Speed, R.P.M.
1	Westinghouse	Consumers' Power Co., St. Paul, Minn	1912	4,500	3,500	4,500*	3,600
2	Westinghouse	Evansville Public Service Co	1914	5,000	4,000	6,000*	3,600
3	Westinghouse	Sand Springs, Ltd	1919	6,250	5,000	6,250†	3,600
4	B. B. C.	Schlettsstadt	1911	3,000	3,000	3,750†	3,000
5	B. B. C.	For Swiss Federal Exhibition at Berne	1914	5,000	5,000	6,250†	3,000
6	B. B. C.	Geertruidenburg	1916	6,000	6,000	7,500†	3,000
7	B. B. C.	Heerlen	1918	6,800	6,800	8,500†	3,000
8	B. B. C.	Heerlen	1919	10,000	10,000	12,500†	3,000
9	B. B. C.	Amsterdam	1920	12,000	12,000	16,000†	3,000
10	B. B. C.	Proposed practice for 1921	....	15,000	12,000	15,000	3,000
11	Met. Vickers	Singer Manufacturing Company, Glasgow	1913	4,400	4,000	5,000*	2,400
12	Met. Vickers	Vickers-Barrow	1914	3,300	3,000	3,750*	3,000
13	Met. Vickers	Manchester Corporation	1915	5,500	5,000	6,250*	3,000
14	Met. Vickets	Liverpool Corporation	1920	13,750	12,500	15,625*	3,000
15	Met. Vickers	Proposed practice for	1921	16,000	12,500	16,000	3,000
16	Parsons	Newcastle Electric Supply—Carville	1916	11,000	10,000	......	2,400
17	Parsons	Mersey Power	1921	12,500	10,000	......	3,000
18	A. E. G.	Amsterdam	1920	13,500	12,000	16,000*	3,000
19	A. E. G.	Proposed practice for	1921	16,000	12,000	16,000	3,000
20	General Electric	Regina	1920	5,000	4,500	5,000*	3,600
21	General Electric	Proposed practice for	1921	7,500	....	......	3,600

*For two hours. †For one-half hour.

conditions is a matter requiring research work that must be done under rather difficult conditions and requires time to work out.

Tests with rubber wheels, some rather thick, with heavy edges, and some thinner, with rather light edges, were discussed before the A. I. E. E. at New York in November, 1919, by W. L. R. Emmet. The edges were loaded with staples in a manner equivalent to the loading imposed by the turbine buckets. The wheels were marked out with a checkerboard pattern. Holes were also made in them, and the wheels were placed on a shaft which operated a high-potential spark at one point of its revolution in such a manner that, when operated in the dark, the wheel apparently stood still. The result was to reveal the forms a wheel tends to assume under various conditions. Among other things observed was the tendency of the edge of the wheel to work around like a crawling snake. This effect was observable only on the thinner wheels. The heavier ones with thicker edges did not tend to assume this motion. Other distortions that the forces at play tend to make were observable. The conclusions expressed by Mr. Emmet at that time was that all tendency to vibration, and particularly all tendency to injury through vibration, diminish very rapidly as the wheel is made stiffer.

Similar research work was outlined before the (British) Institution of Electrical Engineers in April by F. Samuelson, who added a description of the use being made by the General Electric Company at Schenectady of the oscillograph and other means of research to ascertain the effects of vibration, the conclusion being expressed that the cracks in the wheels are due to fatigue in the metal from repeated bending stresses and are not due to excessive centrifugal stresses. The discussion further asserts that tests with experimental wheels as well as wheels intended for production have demonstrated that even slight increases in the thickness of the web and outer rim of the wheel raise the critical speed of vibration so high that the wheel cannot be set in vibration even at relatively excessive velocity. The statement is also made by Mr. Samuelson that oscillograms taken from actual turbines with modified wheels show no vibration and that the trouble is now fully understood and taken care of in the later designs.

The recent report of the committee on steam turbines and generators of the Association of Edison Illuminating Companies favors definite action toward the preparation of a tentative draft of standard turbine specifications, pointing out that standardization should be confined to matters affecting operating performance, central-station design, operation and maintenance requirements, and should not hinder improvement in design or construction of the equipment. Co-operation between the designer and manufacturer and the central-station designer and operator is emphasized as necessary, and full consideration must be given to all problems of manufacture and operation of the apparatus. The completion of the work in a short time is not expected, and when complete it is recognized that the specifications are subject to amendment as the art progresses.

Methods of standard testing are being developed by the committee on Power Test Code of the American Society of Mechanical Engineers.

The British Engineering Standards Association adopted standard specifications for steam turbines for electrical plants on Oct. 7, 1920, which were presented as Publication No. 132. In June, 1918, the Chambre Syndicale des Constructeurs de Gros Matériel Electrique and the manufacturers of Rateau turbines adopted a specification covering steam turbine and generator units that is being used in France until it can be revised so that it will be applicable to all contracts for steam turbines and generators. Both of these specifications have adopted the kilowatt continuous, full-load rating of the generator at a determined power factor as a basis for the rating of the turbine. The French specifications standardize the rating of single, compound or tandem turbines as shown in Table III.

TABLE III—FRENCH SPECIFICATIONS ON TURBINE RATINGS

Kw.	50-Cycle 3,000 R.P.M.	50-Cycle 1,500 R.P.M.	25-Cycle 1,500 R.P.M.
350	X	0	0
500	X	0	0
750	X	0	0
1,000	X	0	0
1,500	X	0	X
2,000	X	0	X
3,500	X	0	X
6,000	X	X	X
10,000	X	X	X
15,000	0	X	X
25,000	0	X	X

*X indicates that such units exist, 0 that they do not.

The British specifications require the turbine to deliver power at its rated speed and under the specified steam conditions sufficient to enable the generator to deliver an excess of 10 per cent over the rated load.

The French requirements are that the full kilowatt rating of the generator must be developed with a steam pressure variation 20 per cent, plus or minus, of the normal rated, a steam temperature variation of 10 per cent plus or minus of the rated normal, and a vacuum 2 per cent less than the normal. The maximum variations of pressure and temperature must not occur simultaneously.

For a condensing turbine running non-condensing the British requirements are 30 per cent of rated load at the rated speed, steam pressure—not less than 1·65 lb. per square inch (11.5 kg. per sq.cm.) absolute—and temperature for turbines up to a rating of 3,000 kw. The French specification calls for 50 per cent of rated load as rated speed, temperature and steam pressure for short periods only and in cases where it is necessary.

Both the French and British conform with the steam consumption ratings employed in American practice, namely, that the minimum consumption shall be obtained when the generator is operating at 80 per cent of its rating. The French specifications call for guarantees at 100, 80, 60 and 40 per cent of rated load, though, at the option of the purchaser and on specification in the contract, only those for 100 and 80 per cent shall apply. In the British specifications it is required that the average steam consumption be calculated to represent as nearly as possible the normal or average twenty-four-hour running conditions expressed in operation for six hours at 100 per cent, eight hours at 80 per cent, six hours at 60 per cent and four hours at 40 per cent. After determining the average steam consumption the averages are multiplied by three, four, three and two respectively and the sum is divided by twelve to represent the average steam consumption of the turbine under the normal operating conditions generally met with in central-station service, which are assumed as 73 per cent of the continuous full-load output of the unit.

The British specifications require the turbine to withstand during acceptance tests a speed of 15 per cent in excess of the rated speed. For speed regulation the British requirements are that with full load taken off or put on the permanent speed variation shall not be more than 3 per cent and the maximum momentary not more than 6 per cent. For 20, 40, 50, 80 and 100 per cent load variations the French specifications fix a variation for sudden load changes of 1.5, 2.5, 4, 5 and 6 per cent respectively and for gradual changes of 0.8, 1.3, 2.3, 3.3 and 4 per cent.

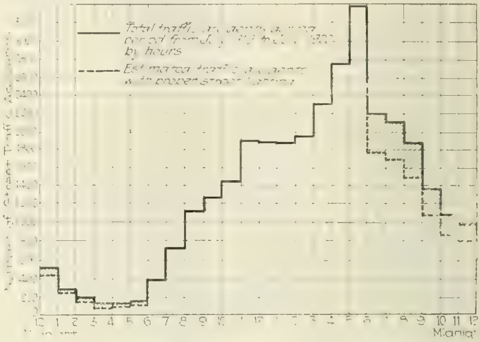
Both specifications require that the speed-control mechanism shall allow the turbine to operate up to 5 per cent above the rated speed when desired. Emergency trips shall operate when speed exceeds the rated speed by 10 per cent in the British and 7 to 10 per cent in the French. To test the operation of the emergency trip the French specifications require that the overspeed mechanism be provided with a means of overspeeding the turbine by manual operation.

Critical speeds in the British requirements shall not be within 30 per cent above or 35 per cent below the rated speed. Oil temperatures measured at the outlet from the oil bearings under normal conditions shall not exceed 140 deg. Fahr. The French specifications go into details in a number of items that concern dimensions, time and durations of acceptance tests, correction factors for steam and water variations during tests, and definitions of responsibilities that are not gone into in the British specifications.

Illumination and Traffic Accidents

The seriousness of accident hazard on the streets of American cities and the prevention of accidents at night by more adequate illumination were discussed with considerable detail in a paper by Earl A. Anderson and O. F. Haas presented at the recent annual convention of the Illuminating Engineering Society at Rochester, N. Y.

The purpose in instituting the survey reported in this paper was to obtain, if possible, some definite measure of the value which should be attributed to the proper illumination of streets as a factor in the prevention of traffic accidents. A representative group of thirty-two cities was selected, and a report of traffic accidents was requested covering a twelve months' period, in general, from the middle of 1919 to the middle of 1920. The total number of street traffic accidents reported in these cities during this period was 31,475, of which 9,534, or 30.3 per cent, occurred during hours of darkness. These figures, plotted by hours, are shown in the accompanying diagram.



PROPER STREET LIGHTING WILL GREATLY REDUCE TRAFFIC ACCIDENTS

To determine how many of the 9,534 accidents which occurred after dark would have been avoided had daylight or its equivalent prevailed, the accidents which occurred during the hours in the evening that are daylight in summer were compared with the accidents during the same hours in winter, when it was dark. It is evident from careful study that 17.6 per cent of all the accidents occurring at night must be attributed to lack of light during the winter months. Applying this percentage to the 9,534 accidents which occurred after dark in the thirty-two cities covered by the survey, it appears that 1,678 of them would have been avoided if there had been adequate illumination. These figures will be found charted in the accompanying diagram by hours.

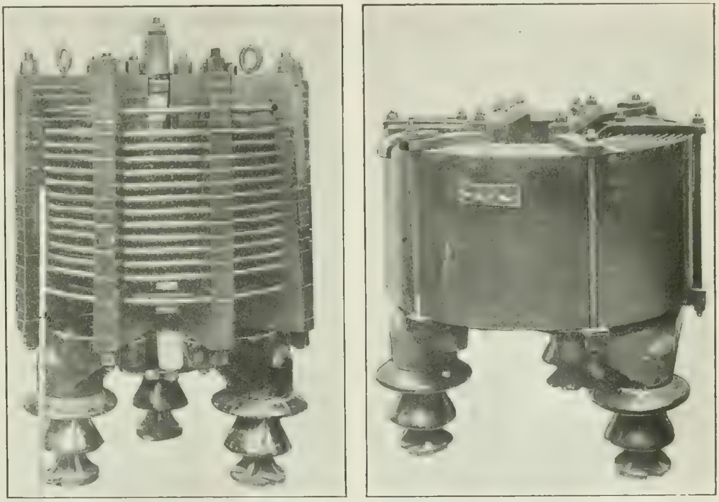
Assuming that the same proportion of day to night accidents which was found to exist in this survey holds in all cities, last year there must have been, out of a total of 10,640 killed, 3,223 deaths from automobile accidents at night, and 17.6 per cent of these, or 567, were directly attributable to lack of sufficient illumination. In addition to this loss of life, a similar computation shows that of the annual billion-dollar street accident loss the very substantial amount of $54,000,000 may also be attributed to lack of light. According to the census report, the total expenditure for street lighting in the United States is not in excess of $50,000,000.

Furnace Reactance Requirements Need Consideration

They Have Become Especially Important in View of the Growing Tendency to Use Higher Operating Voltages and the Importance Which the Public Utilities Are Attaching to Power Factor

By P. B. SHORT
General Engineer Westinghouse Electric & Manufacturing Company

A CERTAIN amount of reactance is desirable in an electric arc furnace circuit, as it provides a means for storing energy during part of the alternating-current cycle, when energy is returned to the circuit during a later part of the cycle and thus aids in maintaining the electric arc when the alternating supply voltage is actually reversing. Reactance is also of benefit in reducing the current surges, which are liable to be particularly severe, especially when melting down a cold charge of metal. The reactance of furnace circuits is becoming of more importance with the growing tendency to operate furnaces at higher voltages, for with higher voltages the current surges may be more severe and thus more objectionable.



FIGS. 1 AND 2—TWO TYPES OF AIR-CORE REACTOR FOR FURNACE SERVICE. THAT ON THE LEFT IS CABLE-WOUND AND RATED AT 250 AMP. FOR 13,200-VOLT SERVICE; THE ONE ON THE RIGHT IS WIRE-WOUND FOR 33 AMP. AND 12,000-VOLT SERVICE

During the melting period the resistance component of the furnace impedance can become comparatively small, especially when the metal caves in around the electrodes and produces virtually a dead short circuit across the electrodes. Under this condition the reactance is that part of the impedance which largely determines the resulting value of the current surge. In the extreme case, where the resistance of the furnace is considered at zero, the maximum value of current that can flow is inversely proportional to the percentage reactance. Thus, if the reactance is 25 per cent, the maximum sustained current cannot exceed four times the normal full-load value; likewise, for 40 per cent reactance the maximum current cannot exceed two and one-half times the normal value.

By running the busbars interlaid and spaced in the same manner as in coming from the furnace transformer the inductance can be kept to a minimum. If a higher inductance is desired, it can be readily had by running the bars uninterlaced and increasing their separation. In any circuit the inductance can be increased by increasing the separation between the outgoing and returning leads, for this creates a greater loop in the circuit and resulting greater magnetic flux. The presence of iron near the heavy-current conductors increases the inductance of the circuit, as iron forms a better path for flux than air does.

Regardless of whether 25 cycles or 60 cycles is used on a certain furnace, the inductance is the same. Reactance, however, does depend on the frequency and varies directly as the product of the frequency and inductance. It is usually expressed in this form: $X = 2\pi FL$, where F = frequency and L = inductance. From this it will be seen that a circuit having a certain amount of inductance has two and four-tenths times as much reactance on 60 cycles as it has on 25 cycles. From this fact it is at once apparent that if the desire is to keep the reactance low, it will be more difficult with a 60-cycle than with a 25-cycle power supply.

In some of the early electric furnace installations a large amount of reactance was placed in the circuit, and the furnaces operated at low power factors, the purpose being to limit current surges and maintain a fairly constant load, for at that time automatic regulators had not reached their present state of perfection. With the present-day regulators current surges are not so severe, for when the current starts to increase in value the regulators immediately act so as to correct this condition by raising the electrodes and returning the current to its normal value. Some of the early furnaces were operated at power factors as low as 70 per cent, whereas power factors as low as this are not required with regulators in order to secure a steady arc and satisfactory operation of a furnace. In most localities power factors as low as this are very undesirable, and many power rates now contain a clause whereby the energy or demand charge is increased if the operating power factor is below 85 or 90 per cent. With any of the commercial frequencies used there is no real reason why an electric arc furnace should operate at power factors below these values. In fact, the power factor of an electric furnace load can reasonably be expected to be higher than that of the ordinary induction motor load. Power companies are giving more consideration to the power factors of the connected loads and are making their rates so that a benefit is secured for high power-factor operation. For this reason no more reactance should be used in an electric furnace circuit than is necessary for satisfactory operation.

There is a growing tendency to operate furnaces at higher voltages, and while previously voltages around 100 and 110 were used, voltages around 150 and even 200 are now being used. With this change to higher operating voltages, it is apparent that with a given furnace layout and inductance the percentage reactance will not be so high on 150 volts as it previously was on 100 volts. Likewise, if the furnace is equipped with a transformer of the same capacity for the higher voltages, the furnace current will be correspondingly less, which will decrease the reactive voltage drop and still further decrease the percentage reactance. It is because of the decreased percentage of reactance accompanying higher voltage operation that more consideration is being given to means of providing additional reactance in furnace circuits.

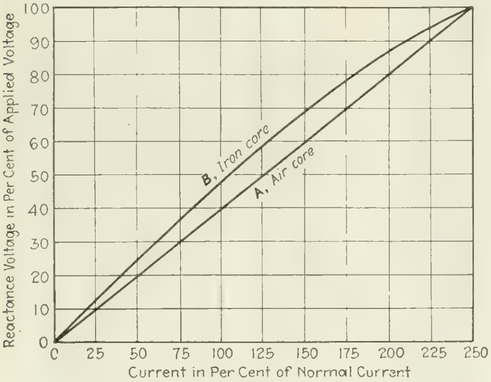


FIG. 3—CHARACTERISTIC CURVES OF AIR-CORE AND IRON-CORE FURNACE REACTORS

In a furnace recently changed over for operation at higher voltages a large iron-core reactor has been installed to insure stable operation at the higher voltages. While the furnace originally operated at 110 volts, it is now equipped with transformers which give secondary voltages of 220, 200 and 180 volts. In series with this transformer on the high-voltage side is placed a three-phase reactor, which permits obtaining additional reactance values of 42, 29, 16, 11, 7 and 4 per cent. The latter three values are obtained by placing the windings of the reactor in parallel. This is an example where it has been found desirable to use a separate reactor where higher voltage operation is employed, whereas on the lower voltage operation additional reactance was not found necessary.

It is often found desirable to provide additional reactance in the form of reactor coils because they can be cut either in or out of the circuit at will. When a furnace is first started up it may be found that a certain percentage of reactance gives most satisfactory operation, and this percentage can be readily obtained by merely connecting to the proper tap of the reactor coil. If at a later time the product being melted is changed or the operating voltage is changed, the percentage of reactance can again be changed to meet the new conditions. If the required reactance is all obtained in the transformer and leads, the reactance is fixed and cannot be changed to meet the new conditions. Likewise, where dual voltage operation is used, it often is found that a smaller amount of reactance is necessary when using the low voltage for refining than when using the high voltage during the melting period. Thus, by using separate reactors, at the same time the transformer taps are changed from high to low voltage the external reactor can be cut out of the circuit.

Most electric furnaces do not operate at a power factor greatly in excess of 92 per cent, and as this power factor corresponds to reactance of 40 per cent, it can readily be seen that maximum short-circuit currents will not be in the nature of ten times, as they may be in power plants, but more in the nature of two and one-half times normal current. It is for this reason that iron-core reactors can be used to advantage in electric furnace service. In any reactor it is essential that the reactor have close to a straight-line characteristic curve over its working range. That is, if the short-circuit current goes up to two and one-half times normal, the reactive voltage drop secured should also be two and one-half times normal. To secure this characteristic in an iron-core reactor, it is merely necessary to provide sufficient iron in the core, so that the iron will not become saturated under the maximum-current condition. Most iron-core reactors built for electric furnace service are provided with this amount of iron, and it is for this reason that their characteristic curve over the extreme working range is similar to that obtained with an air-core reactor. From Fig. 3 it can be seen that the reactive drop at two and one-half times normal current is the same for both types of reactors. However, as there is a certain amount of droop in the iron core characteristic curve, the reactive drop for normal current is slightly higher. After the iron becomes saturated there is very little increase in voltage drop with increasing currents. Thus, if curve B of Fig. 3 were extended beyond the 250 per cent current point, it would be found to droop very decidedly. If the short-circuit current ran up as high as ten times normal value, it would be out of the question to use an iron-core reactor, as the necessary iron cross-section area would make the cost prohibitive.

From this it will be seen that the selection of either an air-core or iron-core reactor depends largely upon the maximum current that will be encountered during a short circuit. For currents of the magnitude of ten times normal air-core reactors are always used, but where the current is in the nature of two and one-half times normal, iron-core reactors often offer advantages from a cost and installation standpoint.

Reactors may be placed in either the high-voltage or low-voltage side of the furnace circuit. The effectiveness of the reactors does not depend upon their location in the circuit. If placed in the high-voltage side, they are placed in the incoming leads between the line circuit breaker and the furnace transformer. If placed in the low-voltage side, the reactors are placed in series with the heavy current leads, between the furnace transformer and the furnace. The former location possesses an advantage in that the currents are much smaller on the high-voltage side than they are on the low-voltage side, and thus the leads running to the reactor can be smaller and are easier to install. If the reactors are provided with taps and tap-charging switches the advantage will generally lie with the high-voltage reactor. Except for very high voltages, where circuit-breaker costs are high, the tap-changing switches for the high-voltage reactor will be found more desirable than the heavy-current knife switches, which are required for tap changing with low-voltage reactors. Heavy-current knife switches require considerable maintenance, which often cannot be given around a furnace.

It has been mentioned that the primary requirement of a reactor is that it must have a straight-line characteristic curve over its working range. In this connection it can be mentioned that a reactor whose reactive voltage drop would go up at a rate even greater than in direct proportion to the load current would be very desirable. This would be the ideal form of reactor, for under normal conditions a high operating power factor could be secured, and still the necessary percentage reactance would be available when surges existed, so that the maximum current would be held at a fixed value. While no reactors having this characteristic have been built, some steps have been taken along this line.

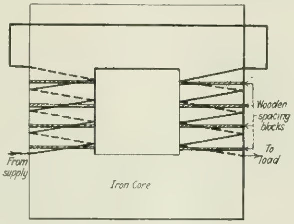


FIG. 4—RELUCTANCE OF MAGNETIC CIRCUIT INCREASED IN ONE TYPE OF IRON-CORE REACTOR BY WOODEN SPACING BLOCKS

If it is definitely known before a furnace installation is made that some reactance is going to be required in addition to the inherent reactance of the busbars and leads, this can often be taken care of by using a high reactance transformer. While normally furnace transformers are built with a reactance of from 4 to 8 per cent, it is possible with a slight increase in cost to obtain reactances as high as 15 per cent within the transformer. If it is known that this additional reactance is always going to be needed in the circuit, this method will be less costly than using separate reactors.

Since the voltage drop through the reactor does not subtract directly from the transformer secondary voltage, it is apparent that increasing the reactive component a certain amount does not result in an equal reduction from the resistance component. The energy available for the furnace is proportional to the resistance component of the transformer voltage. In the installation cited above it does not mean that 42 per cent of the available power is wasted in the reactor. The only real power loss in the reactor is that required to supply the copper and iron losses; as iron-core reactors are normally worked at low flux densities, the latter part of this loss is comparatively low. Even with the large reactor used in this case, when operating on the maximum-percentage reactance tap, the losses are the equivalent of approximately only 1 per cent decrease in the efficiency of the main furnace transformer.

Time and Position Ascertained by Radio

ALTHOUGH the most extensive field of radio transmission is the exchange of speech and information, there are also two lesser fields in which increasing use is being made of other possibilities of radio equipment. These are the broadcasting of time signals and the fixing of the relative location between a fixed station and a moving station, as, for example, a ship.

Three general methods of direction finding are in use, one in which the direction-finding equipment is installed in a fixed station on land, the ship being equipped only with the ordinary wireless outfit. The disadvantage of this arrangement is the confusion which results in case several vessels should require attention at one time. In a second arrangement the vessel is fitted with direction-finding apparatus and to certain fixed, or beacon, stations on shore is assigned the duty of sending prearranged signals on certain wave lengths at definite times during each hour. This arrangement has the advantage that any number of ships can obtain their bearings simultaneously from one station or set of stations. In the third method a rotating directional wireless beam having a fixed angular velocity is transmitted by a specially equipped fixed transmitting station. The rotating beam has a sharply defined zero position which passes through north and south at given times.

The importance of direction finding was emphasized during the war, thus stimulating the development of proper equipment. Recently further improvements have been announced and account is given by J. J. Bennett in a recent number of *Engineering* of operating methods and equipment including a simplified radiogoniometer. This is used in direction-finding stations having two aërials in planes at right angles to each other. These aërials are connected with two corresponding right-angle coils in the radiogoniometer, thus giving a resultant field in which a secondary coil with pointer attached indicates the direction of the sending station.

The ultimate value of direction-finding equipment will obviously depend upon its accuracy in operation. The article referred to states that under favorable conditions the maximum error with practiced operators is about 2 deg. Other reports on this subject, however, indicate errors of much greater magnitude. It appears that errors are larger at night than in the daytime and are greater for long than for short waves. An interesting account of these errors is given by Dr. E. Bellini in a recent number of the *Electrician*. He arrives at the conclusion that most of the errors which have been observed in direction-finding equipment are due to the horizontal portions of the sending antenna in conjunction with reflection from an upper conducting layer of the atmosphere, and that they may be reduced to negligible values by the use of simple vertical antennæ. If his theory and conclusions are justified, it would appear that direction finding may be placed on a definitely accurate basis. Of the several methods mentioned above the direction transmitting station with its rotating beam adaptable to all ships is apparently the most satisfactory. The only obvious disadvantage seems to be the special form of transmitting antenna required and its consequent cost. The probability of a wider use of direction-finding equipment is thus reduced to the question whether the service rendered is worth the necessary outlay.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Venezuela as a Field for Electrical Development

To the Editors of the ELECTRICAL WORLD:

Having had the opportunity to observe and study economic and industrial conditions in the Republic of Venezuela during a residence of two years, more or less, I am prompted to call the attention of your readers to the extraordinary field that country offers for electrical exploitation and development from both a power and a supply-merchandising viewpoint. The coast line is almost a solid barrier of mountains, which, like all the mountains and hills of the republic, are literally seamed with cataracts and shallow, non-navigable rivers of sharp declivity. On the northward slopes of the mountains they flow, or rather tumble, to the sea, and on the southward slopes to the broad, fertile *llanuras*, upon which the capital city, Caracas, and the principal industrial centers are situated.

Where English, German and, rarely, native capital has essayed to "tap" these sources of power and of riches, the results have brought immediate and enduring profit. Stockholders in England and on the Continent of Europe have enjoyed comfortable dividends which have been earned for them by these waterfalls and streams.

Almost all of the Venezuelan cities—and, indeed, many small interior communities—are equipped with electric light and power plants. Many of these are operated from nearby waterfalls. It is estimated that there are in the vicinity of Caracas, the capital city, waterfalls capable of generating 30,000 hp. Of late years these have been availed of for a total production of no more than 9,000 hp. daily. The most potential of these are the falls of Naiguatá, which produce an available head of 1,020 m. and supply 515 liters per second, even during the dry season. They are capable, however, of a daily production of 8,000 hp. The Encantado electric light plant, also situated 16 km. from Caracas, generates 400 hp. daily in the rainy season and 100 hp. daily in the dry season. In Caracas, Maraçay, Valencia, Puerto Cabello, La Guaira, San Cristobal and Barquisimeto there are power plants employing steam as motive power.

Considering that 350,000,000 bolivars (about $70,000,000) is invested in the manufacturing industries of the republic, and that many of these have commenced to use electricity as a motive power only since the war, there are excellent opportunities for electric installation and the introduction of electric tools, machinery and other devices.

Two railway companies—one operating between Maiquetía, La Guaira and Macuto, on the coast near the port city named, and another operating between Caracas and Petare, a suburb of the capital—have since the war converted their rolling-stock and other equipment to electric operation and have electrified their lines, steam being no longer used, principally owing to the prohibitive costs of Cardiff coal briquettes for locomotive uses.

At no time in the history of the republic has the scarcity of fuel presented such a grave economic problem as at present, not only for power purposes in factories and other industrial establishments, but even for domestic cooking uses. Dr. Estéban Gíl Bórges, the Minister for Foreign Relations, has stressed the very great need existing in Venezuela for a greater volume and a greater variety of electrical apparatus and devices, particularly for household cooking purposes. He has outlined the exhaustion of fuel that resulted from the indiscriminate cutting of wood throughout the country, the government having been forced to restrict sweepingly the sources of fuel available at anything like economic cost to the capital city. Charcoal is used for cooking fuel in the 100,000 homes in Caracas, and with the reduction of wood supply to the very minimum, charcoal has become not only prohibitive in cost but scarce at any price.

Although the country is one of the world's producers of petroleum, because of the unsatisfactory physical qualities of the product for domestic fuel and the high cost of even crude oil—3 bolivars (60 cents) is a low price for "gas" per gallon in Venezuela—this has not proved to be the solution of the problem, although it has been the salvation of the automobile owner and dealer. Electric stoves and washing and kitchen apparatus designed to conserve and to save charcoal, some imported from the United States, but many more from England and the Continent, have begun to meet the economic and social needs of the larger urban populations.

Taking the ratio of area and population of Venezuela to our own country into consideration, the nothernmost South American republic appears to me to present, per capita, opportunities equal to those at home for the introduction and sale of electrically motivated instruments and household apparatus and devices.

Brooklyn, N. Y. HARRY CHAPIN PLUMMER.

Utility View of Commercial and Industrial Electric Heating

To the Editors of the ELECTRICAL WORLD:

Owing to the climatic and fuel conditions existing in California and judging from the inquiries being received, it is believed that a large load will be developed in this territory in the heating of buildings. This would be very desirable for the reason that a large portion of the California load is used in pumping water for irrigation, and as this is a summer load it would not coincide with the heating load, which would come in the winter. Judging from recent progress, it would seem reasonable that eventually the heating load could be made to surpass the motor load.

From the central-station viewpoint the heating load is more desirable than the motor load on account of the high power factor as compared with induction motors. With the exception of arc furnaces, welding machines and induction heaters, all heating applications operate at virtually unity power factor, while induction motors vary from 30 per cent to 90 per cent lagging power factor.

The time of day at which a heating load would be applied can probably be largely controlled by rates so designed as to encourage its use at the desired time.

Under present conditions, anything that could be added to the load between the hours of 10 p.m. and 7 a.m. should be entitled to a better rate than if it were on during the day and early evening. If it were possible to fill in the night valley, other rates could be reduced.

Pacific Gas & Electric Company, A. STRAUCH.
San Francisco, Cal.

Feasibility of Radio Communication to Mars Questioned

To the Editors of the ELECTRICAL WORLD:

I was much interested in a letter which appeared in your issue for Sept. 24 last from Nikola Tesla on the possibilities of telegraphing to Mars and hope you can find space for the following extract from Dr. James Erskine-Murray's book on wireless telegraphy. I think it will be interesting to your readers, especially since Dr. Murray's idea is that there is a conducting shell around the earth through which no electric currents can pass. In the chapter on the theory of transmission he says:

> The electrical properties of air at various pressures are well known. At 15 lb. to the square inch it is, except for extremely high voltages, a nearly perfect dielectric or non-conductor—that is to say, lines of electric force can travel through it without appreciable loss by dissipation of energy.
>
> At a low pressure such as exists at about 35 miles above the earth it becomes suddenly conductive, and at the pressure which must exist a few miles higher up its conductivity for high-frequency currents without electrodes is as great as that of a 25 per cent solution of sulphuric acid, so great, in fact, that a layer half an inch thick forms a complete screen through which electric waves do not pass.[*] At lower pressures, about 80 miles up, it becomes such a non-conductor as we know it in "hard" X-ray tubes, and farther up still, as perfect a dielectric as is known. There is a critical value of the pressure, which occurs at about 35 miles, below which height the air is practically a non-conductor, and above which its conductivity rapidly attains that of the best electrolytes.
>
> The non-conducting shell of air which surrounds the earth is therefore only about 35 miles thick—less than one-hundredth part of its radius—and is bounded below by earth, which has a resistance of about 6,600 ohms per cubic centimeter, or sea, with 373 ohms per cubic centimeter,[†] and above by a layer having a resistance of not more than 10 ohms per cubic centimeter. The upper shell then conducts at least 660 times as well as damp earth and nearly forty times as well as the sea.

To prove his contention Dr. Murray refers to the experiments of Mr. Tesla which took place in California, and at the end of the chapter on "World Wave Telegraphy," which he has copied in his book by the courtesy of your journal, he goes on to say:

> If Mr. Tesla's statement that the fundamental electrical vibration of the earth has a frequency of six per second is founded directly on experimental evidence, and not merely on theoretical considerations, it is a proof that the earth is surrounded by a conducting shell, for if this were not so its lowest frequency of variation would be seventeen per second, as mentioned by Professor Fitzgerald.
>
> We can also make an estimate of the height at which the conductive layer commences, for calculation shows that since a height of 60 miles corresponds to a frequency of ten per second, and a height of 6 miles to three per second, a frequency of six requires a height of about 35 miles, which is the same as that found from other data in Chapter XVI.
>
> Thus we should have an entirely independent proof of the existence of a conducting layer in the atmosphere, and of the fact that the dielectric with which we have to deal in wireless telegraphy is a layer of air about 35 miles thick between the two concentric spherical conductors.
>
> Professor Fessenden has noticed in working between America and Scotland that there are apparently two impulses received for every spark, and has suggested that the second may come the longer way round the earth. The interval between them is approximately a fifth of a second, which would indicate the height of the upper conducting layer to be about 30 miles. Professor Fessenden, however, does not agree with this explanation, but has not, as far as I am aware, suggested another.

I would like Mr. Tesla's opinion of the above, because if Dr. Murray's idea is right, then it is impossible to send messages outside this sphere, at least by wireless. Whether Mars can telegraph to us is another question as its inhabitants may have means which we have not.

Liverpool, England. CHARLES RETTIE.

Rudiments of Hyperbolic Functions Should Be Discussed Repeatedly

To the Editors of the ELECTRICAL WORLD:

In looking over the ELECTRICAL WORLD of Nov. 26, I was interested by the comments on page 1086 relative to Professor Kennelly's "Tables of Complex Hyperbolic and Circular Functions."

While it is desirable to have complete tables of such functions, it is still essential that the rudiments of hyperbolic functions be discussed repeatedly in their simplest terms until electrical engineers become so familiar with their meaning that they will have no hesitation about applying them, especially in making the final determinations of important power-transmission lines. Then they will demand tables to facilitate their computation.

Among some of even the most skillful electrical engineers as well as students, there persists a justifiable doubt as to whether the above-mentioned functions are hyperbolic or diabolic. The hyperbolic transmission-line formulas are concise and therefore elegant in the eyes of mathematicians. But safety razors are compact, yet they would not be used universally if each one came in a box whose lock was so intricate that hardly one person in a million could be induced to put forth the effort required to open the combination. So I was pleased that the reviewer emphasized the desirability of quoting transformation formulas and definitions.

Until convenient tables are accessible, the following relations seem most useful in interpreting the transmission-line formulas:

1. The transformation formulas

$$\sinh (u \pm jv) = \sinh u \cos v \pm j \cosh u \sin v$$

and $\cosh (u \pm jv) = \cosh u \cos v \pm j \sinh u \sin v$.

2. The definition

$$\sinh u = (\epsilon^u - \epsilon^{-u})/2 \text{ and } \cosh u = (\epsilon^u + \epsilon^{-u})/2$$

where $\epsilon^u = \log_\epsilon^{-1} u = \log_{10}^{-1} (0.434294u)$ and $\epsilon^{-u} = 1/\epsilon^u$. For, with these and a good table of common logarithms and trigonometric functions, any electrical engineer who knows how to perform the ordinary operations of multiplication, division and evolution of complex numbers is fully equipped to determine the performance of a transmission line in accordance with these exact formulas (E and I being vectors):

$$E_G = E_R \cosh \sqrt{ZY} + I_R \sqrt{Z/Y} \sinh \sqrt{ZY}$$

and $$I_G = I_R \cosh \sqrt{ZY} + E_R \sqrt{Y/Z} \sinh \sqrt{ZY}$$

Stone & Webster, Inc., LLOYD N. ROBINSON.
San Francisco. Assistant Electrical Engineer.

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[*] J. J. Thomson, "Recent Researches in Electricity."

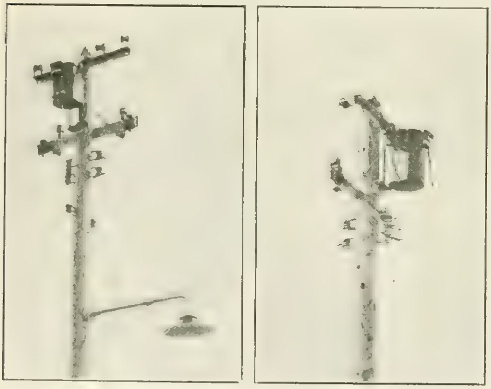
[†] Brylinski, *Soc. Internat. Elect. Bulletin*, Vol. 6, p. 225, June, 1906.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Economical Construction for Distribution Circuits

USE of galvanized-steel cross-arms and fittings has been found to pay good returns in the distribution system of the village in which the accompanying photographs were taken. The cost of the steel arms and fittings is a small proportion of the total cost of the system, and they have proved to be well justified by the permanence and lack of maintenance expense which characterize them. Two sets of cross-arms are used, angle irons for carrying the 2,300-volt primary lines and flat bars for mounting lightning arresters and transformer cut-outs. The angle iron measures 3 in. x 3 in. x ¼ in., and is cut into 48-in. lengths. The flat pieces are of ¼-in. x 5-in. steel and are 48 in. long. A large number of the pieces are made up at a time, and holes are punched suitable for mounting insulators and similar apparatus and for attaching braces.



GALVANIZED-STEEL FITTINGS AND SPOOL-TYPE INSULATORS MAKE NEAT AND PERMANENT LINE CONSTRUCTION

Spool-type insulators supported on forks or racks are used throughout. For the primary wires the forks are mounted on top of the upper cross-arm by means of individual insulators on forks. It was found when constructing the lines that the wire could be pulled much easier than when pin-type insulators were used by resting it in the groove on the spool insulators, which either turn or allow the wire to slide without difficulty. Deadending is accomplished by means of the same type of insulator mounted upon the side of the angle-iron cross-arm. Primary cut-outs and lightning arresters are mounted on the opposite sides of the flat cross-arm, lower down on the pole.

Secondary conductors are supported by the same type of insulator held together in groups by means of racks made for the purpose. Series lighting circuits are deadended against each side of the pole by spool insulators.

This type of construction is quick to install, presents a neat appearance and lasts indefinitely. One system using galvanized-steel fittings has been in operation for nine years and today shows almost no depreciation.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Care of Electrical Instruments

THE great majority of repairs on electrical measuring instruments are necessary because of two or three things which may have happened. The most common cause of failure of electrical instruments is the burning out of the hairsprings which control the action of the moving coil and also carry the current. This, of course, applies only to direct-current or dynamometer-type instruments. Such instruments will usually stand an overload of several hundred per cent, but when an ammeter is connected in as a voltmeter, or some similar mistake is made, where the current flowing is a great many times normal, it is usually the hairsprings which burn out first. There have been many attempts to put fuses in instruments to protect them against this sort of a burn-out, but they have not as yet been very satisfactory, and general practice is against their use. Of course, burn-outs of this sort are due to carelessness, and it merely takes a little thought before using an instrument in a circuit to eliminate this sort of accident. Where an instrument is put into a circuit and it is not known what current or voltage exists, an instrument of such a high range should be chosen for the first test that there will be no possibility of overloading it. The reading on the high-range instrument can then point out the proper range to be used for accurate reading, if the reading itself is low on the higher range and the proper meter selected.

It is a good rule to think twice before putting an instrument on any circuit and to check, if possible, the capacities which will be necessary against what is expected in the circuit. For instance, in testing a 50-hp., 440-volt, direct-current motor an ammeter of 100 amp. full scale should be used in any case at the start, and this should preferably be short-circuited with a heavy knife switch during the starting period; then if any heavy load comes on the motor, causing it to take full-load current, the ammeter will take care of the current and will not be burned out. If it is found that the circuit is carrying considerably less than 100 amp., owing to a very light load on the motor, a lower-reading ammeter may be substituted for the higher-range instrument so that the reading may have a higher degree of accuracy and show the results in a clearer way.

The moving elements of all instruments are swung on hard steel pivots resting on high-grade sapphire jewels. The bearing pressures on these pivots run quite high, and a little figuring will show them to be of the order of several thousand pounds per square inch. As might be expected, a severe jar or a drop of several feet on a hard floor will cause these fine steel pivots, resting against the hard jewels, to bend or flatten and perhaps break off if the material is too hard to stand up properly. The net result of this is an increase in the friction of the instrument, which, of course, makes it unfit for use where fine readings are to be taken. The only remedy in this case is to replace the pivots.

Care should be taken that instruments are not dropped and that they are not subjected to jars. For instance, no hammering should be done on a bench on which instruments are standing, as the jar from this will cause the pivots to flatten and increase the friction error of the instrument.

By far the greater majority of instrument troubles are caused by improper handling and by carelessness. Instruments occasionally get out of adjustment because of some defect in manufacture, although with present methods such defects should be very few and far between. Accidents, of course, will happen, and the glasses in instruments are frequently broken when handled improperly in the stockroom or by workmen when assembling. As soon as the glass on an instrument is broken care should be taken to keep foreign material out of the inside of the instrument, as otherwise it may be necessary to rebuild the entire instrument because parts of the interior are damaged by particles of glass and by dust entering into the bearings.

Instruments should not be opened by the user. Almost all commercial instruments are now sealed with a wax or lead seal by the manufacturer, and if this seal is broken, the responsibility rests with the user and he is always charged for repairs. If the seal is unbroken, the manufacturer then knows that he has only overloading and rough handling to contend with and can proceed accordingly in the repair of the instrument.

JOHN H. MILLER,
Electrical Engineer.
Jewell Electrical Instrument Company,
Chicago, Ill.

A Labor-Saving Pole Yard

A LARGE pole yard requiring the services of only two men in addition to the two men required with each rig hauling poles represents real labor saving. This result has been accomplished by the Denver Gas & Electric Company in its pole yard, in which poles are shaved and treated as well as stored. The yard is 130 ft. long and consists of two sections with an aisle down the middle (see Fig. 2). An "A" frame is erected at each end of the yard to support the cable carrying the hoisting and handling equipment, which runs the entire length between the two halves of the yard. This equipment consists of an ordinary trolley-type rig operated by a motor-driven double-drum hoist without swinging gear. A 7½-hp. motor drives the hoist. The incoming cars are shifted under the trolley (at the right of the drawing), where the poles are unloaded and shaved. They are then carried to the treating tank (Fig. 1-A) and from there to the storage piles. Storage is on poles raised on concrete pillars to which they are fastened by steel straps (see Fig. 1-B). The poles are thus placed high enough to be rolled directly onto a wagon or truck if desired, though they are sometimes picked up and loaded with the hoist. The concrete

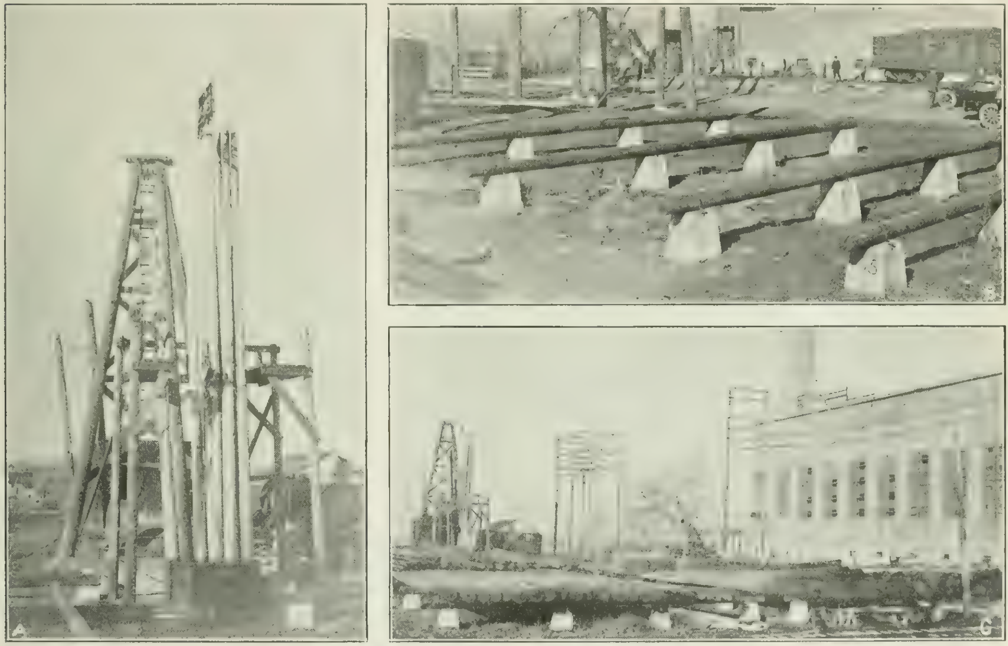


FIG. 1—ARRANGEMENT OF POLE STORING AND TREATING YARD

A—Several poles are dipped in the treating tank at the same time. B and C—Supports placed high enough to permit ready loading of poles onto trucks or wagons pillars are marked to show the length of poles stored in each section.

The treating plant consists of a tank 9 ft. in depth, with a steel storage tank and a pump for handling creosote oil in a concrete pit at the rear. The oil level may be maintained at any desired height and heat is provided by steam pipes fed from the steam plant across the street. The two men in the yard unload, shave, treat and store the poles, the assistance of others being required only when poles are being loaded and hauled.

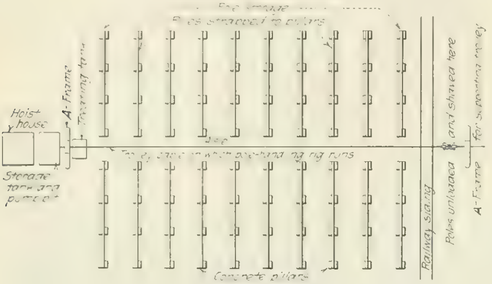

Poles strapped to pillars
Hoist house
A-Frame
Treating tank
Storage tank and pump pit
Railway siding
Poles unloaded and shaved here
A-Frame
Concrete pillars

FIG. 2—LAYOUT OF POLE YARD ARRANGED TO SAVE LABOR

R. A. HAMMOCK,
Superintendent Electrical Distribution.
Denver Gas & Electric Company,
Denver Col.

Costs of 22,000-Volt and 13,000-Volt Transmission Lines

Costs of transmission lines recently constructed in the South are given in the accompanying tabulation. Line *A*, which is probably the most typical example of standard practice, is a 22,000-volt, three-phase line having 21 miles of No. 4 and 4 miles of No. 2 copper conductors. The cost of this line in the spring of 1920 was $2,000 per mile. In the summer of 1921 this cost would have been about $1,800. Neither of the cost figures includes the expense of clearing right-of-way.

COSTS OF RECENT TRANSMISSION LINES

LINE A

Twenty-five miles through rolling country of a 22,000-volt, three-phase line with stranded copper conductors, 21 miles of No. 4 and 4 miles of No. 2, on 35-ft. chestnut poles having 36-in. "Bo-Arrow" arms and a $\frac{5}{16}$-in. static wire and with an average span of 150 ft. to 175 ft. Cost per mile, $2,000 (not including clearing). Line completed June, 1920.

LINE B

Sixteen miles through low, flat country of a 22,000-volt, three-phase line, with No. 0 aluminum conductor and a $\frac{3}{8}$-in. static wire and 40-ft. Western red cedar poles having two Washington fir cross-arms and with an average span of 225 ft. Cost per mile, $2,880 (not including clearing). Line completed January, 1920.

LINE C

About 4½ miles of extra-heavy line on rolling ground through railroad yards and towns and involving many crossings and turnings. Line constructed for 13,000 volts, three-phase, with 250,000-circ.mil aluminum conductors and a $\frac{5}{16}$-in. static wire on 35-ft. to 60-ft. chestnut poles having 36-in. "Bo-Arrow" arms and with an average span of 125 ft. Cost per mile, $4,400 (no clearing). Line completed April, 1921.

Line *B*, completed in January, 1920, was for 22,000 volts, three-phase. The higher poles, conductors of larger current-carrying capacity and other causes made the cost higher than that for line *A*. The cost per mile, not including clearing, was $2,880.

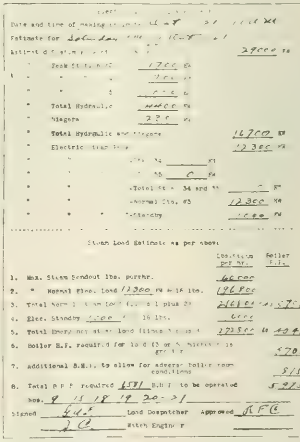
Line *C* carries a circuit through railroad yards and towns and has numerous crossings and turns. The conductor, however, is large—250,000 circ.-mil aluminum. The cost, therefore, is unusually high, $4,400 per mile in the spring of 1921.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Load-Dispatching System for Working Correct Number of Boilers

A load dispatcher's chart which is of great help in keeping the proper number of boilers under fire has been developed by the Rochester (N. Y.) Gas & Electric Corporation. The purpose of the chart is to let the dispatcher know when more boilers should be fired up and when boilers should be banked.

In order that there shall be a sufficient number of boilers available to carry each day's peak load, an estimate is made on the day previous. This estimate tells how much boiler-horsepower will be required to carry the next day's peak. Knowing this, the dispatcher can say what boilers should be kept ready for service. In making such estimates the load dispatcher must determine both the probable peak load and the probable time of its occurrence. He estimates these from records of previous days on the same day of the week and at the same time of the year, making allowance for any special condition. From this total system load (in kilowatts) the load which can be carried by each hydroelectric station by an interconnection with the Niagara Falls Power Company and by means of any other outside connection is deducted. The difference is the electric load which must be generated by steam power. This gives the amount of steam peak load, and to this is added the kilowatts power which may be needed for standby service. This final result gives the total amount of power which will be required to meet the estimated maximum load on the steam-driven generators. These data are now translated into the number of pounds of steam required per hour. As the steam plant of the company produces steam for industrial and heating services, the first item of the steam estimate is the send-out steam in pounds per hour. To this is added the number of pounds of steam per hour required to carry the normal electric load at the peak. This is found by multiplying the kilowatts by sixteen, as it is estimated that 16 lb. of steam is required for 1 kw.-hr. The next step is to find out how many boilers are necessary to give this output of steam when the boilers are operating at the most efficient point. It has been found that the boilers are operating most efficiently at an average rating of 150 per cent, at which rating


Date and time of making
Estimate for Saturday
29000 KW
Peak
1700 KW
Total Hydraulic
Niagara
Total Hydraulic and Niagara 16700 KW
Electric 12300 KW
Normal Sta. #3 12300 KW
Standby 1000 KW

Steam Load Estimate as per above

	Lbs. Steam per hr.	Boiler H.P.
1. Max. Steam Sendout lbs. per hr.	66000	
2. Normal Elec. Load 12300 kw × 16 lbs.	196800	
3. Total Normal Steam Load (lines 1 plus 2)	[illegible]	5706
4. Elec. Standby 1000 × 16 lbs.	16000	
5. Total Emergency Load (lines 3 plus 4)	[illegible]	[illegible]
6. Boiler H.P. required for load (3 or 5 whichever is greater)		5706
7. Additional B.H.P. to allow for adverse boiler room conditions		[illegible]
8. Total B.H.P. required		[illegible]

Nos. 9 15 18 19 20-21
Signed Load Dispatcher Approved
Watch Engineer

SHEET FOR ESTIMATE OF DAY'S ELECTRICAL LOAD they give 45 lb. of steam per hour per nominal boiler-horsepower. Therefore by dividing the pounds of steam required per hour by forty-five, the result obtained will be the boiler-horsepower required for carrying the normal load.

This gives the number of boilers necessary for normal operation, but it may be necessary to carry a higher load in an emergency. It has been found that 60 lb. of steam per boiler-horsepower may be generated each hour when necessary. To get the total number of boilers required in an emergency, the amount of steam sent out and the normal peak-load steam are added together and to this sum is added the amount of steam required per hour for the estimated standby electric load. The steam required for each kilowatt of standby load is found by dividing the kilowatt load by sixteen, as was done before. After these three amounts of steam have been added together the sum is divided by sixty, giving the emergency boiler-horsepower which may be required. After these two calculations have been made, whichever result is the larger is taken as the boiler-horsepower required for the day. From this the number of boilers to be used is determined, taking care to add additional boilers if the boiler-room conditions are so poor as to require it.

After making these tabulations, the line *A* shown in the accompanying cut is plotted on the load dispatcher's chart to represent the full load on all boilers which may be placed in service, working at an average of 60 lb. of steam per boiler-horsepower. This line is a limit beyond which the dispatcher cannot load the steam plant. In order to follow the course of the load throughout the day hourly readings are plotted, showing the system load in pounds of steam per hour. Curve *E* is the steam send-out and curve *B* is the electric load carried by steam superposed on the steam sent out. This curve *B* represents the steam load in pounds of steam per hour which the boilers carry. Even the hydro-electric load is converted to equivalent pounds of steam per hour and superposed on curve *B*, so that curve *F* represents the total system load.

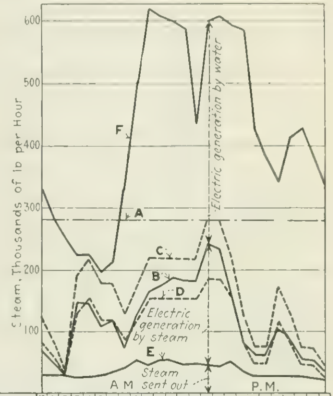
To keep the boilers operating efficiently and yet to allow sufficient margin to pick up suddenly increasing loads, two guide curves *C* and *D* are plotted hourly. The upper guide curve *C* shows the available power which may be drawn from the boilers which are delivering steam. From tests it was found that about 60 lb. of water evaporated per boiler-horsepower was the maximum output. Therefore the curve is plotted showing 60 lb. of steam per hour for every boiler-horsepower carrying the load. The lower guide curve *D* is plotted for 40 lb. of steam per hour per boiler-horsepower. This is slightly lower than the most economical point, which is 45 lb. per boiler-horsepower.

The object of the chart therefore is to keep the steam-load curve *B* between the two guide curves *C* and *D*. If curve *B* falls below curve *D*, there are too many boilers steaming and one or more should be banked until there is need for more steam. Likewise, if curve *B* approaches or crosses curve *C*, the demand is such that additional boilers are necessary and should be started to steaming. Of course, judgment must be used; for instance, if it be known that a very heavy load is coming on the system, more boilers will be added without waiting for the curve to cross *C*, and line *E* represents steam furnished to customers as steam. Line *A* represents the full-load output of all boilers working at 60 lb. per boiler-horsepower.

At the bottom of the curve sheet is a table to show the total boilers under fire in each boiler house and also the boilers that are actually in steaming service, the difference between the two sets of figures being the boilers that are banked but not actually working. For example, on this particular day there were two boilers in the old house and four boilers in the new house under fire and ready for service. At 2 a.m., the low point of the day, there was only one boiler actually steaming and five banked, while at 2 p.m. the load required the working of all six boilers to produce the required amount of steam. **CHARLES E. HAGUE.**

Rochester Gas & Electric Corporation,
Rochester, N. Y.

HOURLY
CHART
OF
ELECTRIC
LOAD
IN
TERMS OF
POUNDS
OF
STEAM
PER HOUR



		Time	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Boilers Available	Steaming	Old Station	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		New Station	1	1	0	3	3	2	2	1	2	3	3	3	3	3	4	4	3	1	0	0	2	1	0	0	0
	Total	Old Station	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		New Station	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Electric Vehicle Operation Cheaper than Gasoline Truck

THE accompanying table comparing operating costs of electric and gasoline-engine vehicles summarizes the figures given in four tables of the article by Walter R. Metz in **ELECTRICAL WORLD** for Dec. 10, 1921, page 1173.

It is referred to as Table V in this article, from which it was inadvertently omitted. As will be seen, the daily cost of operation in all sizes covered was considerably less for the electric vehicle. In case of the 5-ton trucks the electric vehicle costs only one-third the cost of the gasoline-driven machines. In the 2½-ton and 1-ton sizes the operating expenses for the electric truck are respectively 45 per cent and 54 per cent of the expenses of the gasoline type.

COMPARISON OF ELECTRIC AND GASOLINE TRUCK OPERATING COSTS* PER DAY

Size Truck, Tons	Electric	Gasoline Range	Gasoline Average	Difference
1	$3.77	$5.33 to $11.36	$8.35	$4.58
1½	....	13.76	13.76	..
2	..	5.15 to 7.83	6.19	.
2½	4.34	8.00	8.00	3.66
3		9.13 to 15.04	12.08	.
3½	.	11.20	11.20	....
4	5.74			
5	4.97	18.49 to 11.30	14.89	9.92
6	. .	....	....	.
7½	....	21.39	21.39	

* Exclusive of driver's wages

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Two Views of the Central-Station Merchandising Policy

The Obligation of the Electric Light and Power Company to Lead the Way in Ethical Merchandising Practices

IN THE merchandising of electrical appliances the central-station company's attitude should be that of the leader in its territory according to C. S. Michel, sales manager of the Union Electric Light & Power Company of St. Louis. Pointing out that an electric light and power company has a duty to itself, its customers and the industry in showing the way in merchandising practice he says:

"The kilowatt-hour sales per kilowatt connected in the case of residence lighting is so sharply below that experienced in the other classes of electric light and power consumers that the residence business becomes a more or less undesirable load. We look on it as the duty of the central-station company to improve this condition and feel that we should strive to increase the use of electric energy in the home in a manner that will not add appreciably to our station and distribution expenses.

"Public utilities have the responsibility of serving the public and should so conduct their business that they do this fully, efficiently, economically and in a manner calculated to protect the interest of their stockholders, and the development of their market in all legitimate ways is consequently one of their important duties. It is our opinion that the majority evidence points to the fact that the maximum results in merchandise sales and consequently appliance consumption are achieved in those cities where the central-station company leads the way in the progressive merchandising of appliances; that in those cities the electrical development of the territory has been speeded up and the retail outlets for electrical merchandise have enjoyed a larger business than would have been the case had the utility been dormant.

"Our conception of our merchandising responsibility is that we should conduct that branch of our business with due regard to business ethics and the general welfare of the industry; that we should vigorously prosecute the sale of electrical merchandise for a profit, vigorously competing for every dollar's worth of the business offering on a fair and equitable basis."

W. S. Heald, manager of the commercial service department of the Duluth (Minn.) Edison Electric Company believes that the merchandising problem can be solved best by asking another question. He says:

"The question that always comes to my mind whenever this subject is discussed is this. Is there another manufacturer of any line that entirely throws away his sales department and leaves the building up of his business to outside agencies that have no interest in his welfare whatever and over whom he has absolutely no control? I believe that all will agree with me that there is no one so foolish as to do this, and yet that is exactly what the central station is doing when it leaves all sale of appliances to contractors, who in the final analysis have little in common with the central station company.

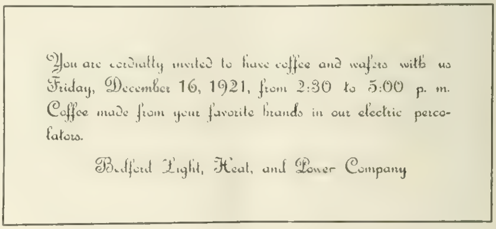
"I believe that the central station should merchandise appliances extensively and fully and that the methods pursued should be of such a high grade type that any electrical merchandising firm could compete on an equal footing. No legitimate retail merchant fears clean-cut competition of the right kind and I can see no reason why the electrical retailer desires to have the field to himself unlike any other line of business. If the central station will sell on a basis that any other retail merchant can compete, I believe that he will control the sale of these goods in a way that they should be controlled for the protection of his own interests."

An Experience in Coffee and Wafers

WHAT a courteous invitation to its customers to visit a demonstration in its office will do to promote good will and make appliance sales is found in the recent experience of the Bedford (Iowa) Light, Heat & Power Company. The invitation to "coffee and wafers" shown here was sent to all of the company's customers. How the idea was conceived and the results are most interestingly told by O. R. Toman, manager of the company, who says:

"We happened to have a very large stock of percolators. Christmas trade had scarcely commenced when one of our customers dropped the remark that the 'light company' never put out anything.

"It occurred to me that we could put on this percolator demonstration with seemingly no strings attached to it and at the same time not spend a great amount of money. The people came long before we were ready and *continued* to come and continued coming until after closing hours. The number of people who did not know that electric percolators even existed was surprising. No effort was made by the young ladies in charge to sell anything. Their instructions were to make the best coffee possible and show how the use of the electric percolator was better than the 'ordinary way.'



You are cordially invited to have coffee and wafers with us Friday, December 16, 1921, from 2:30 to 5:00 p. m. Coffee made from your favorite brands in our electric percolators.

Bedford Light, Heat, and Power Company

INVITATION TO VISIT PERCOLATOR DEMONSTRATION

"Before the week was over, we were out of percolators.

We think it paid, not only from the financial side but from the inspiration of a better feeling toward the company. We have utilized numerous means for improving good will in this property, and as we look over the year's progress we are very well pleased with the results."

Billboards to Boost Electric Vehicle Transportation in Chicago

THE Commonwealth Edison Company has had a number of billboards erected at advantageous locations throughout the city for the express purpose of advertising electric transportation. The intention is to bring home to the public the thought that electric transportation, the electrification of trucking, is coupled up closely with Edison service.

These billboards are in sections of the city where they will be seen by those passers-by who will be most usefully influenced, namely, the executives and professional men, as it is men of this class to whom the electric passenger car appeals.

ELECTRIC VEHICLE ADVERTISING IN CHICAGO

The posters used are in line with the Commonwealth Edison Company's policy of encouraging the electric vehicle load upon its lines. They measure about 50 ft. in length and 12 ft. in height and show an electric commercial truck, an industrial truck or tractor, and an electric passenger car in comparison with a horse-drawn dray.

Utility Service Defined

JUST what constitutes the service rendered by an electric light and power company is told by George S. Williams, general manager of the Central Maine Power Company, in an open letter to employees. Mr. Williams says:

"Personal friendship, between utility employees, officials and the public is essential to enable them to grow and operate successfully.

"Good public relations depend on satisfactory service. The term 'service' should be considered in a very broad sense. It is too often considered as applying only to voltage and continuity of supply. It should be extended in all cases to include the attitude of the utility representatives, their treatment of the public and their general conduct. A retail establishment, selling good material and not misrepresenting it, might in a narrow sense be selling satisfactory service, but in a broad sense the service to be satisfactory requires a congenial atmosphere and one conducive to the attraction of business to the establishment.

"The voltage on the lines of a public utility may be held within reasonable limits and there may be no service interruptions, but satisfactory service from the public relation's view includes also an attitude of officials and employees which makes the public glad to do business with the utility and certain of the justice which will be accorded individual complaints.

"Your job and my job can only grow as the company grows—and it is entirely up to you."

What Other Companies Are Doing

Detroit, Mich.—Miss S. M. Sheridan, vice-president of the Detroit Edison Company, has estimated that the company's business for 1922 will show an increase of 12 per cent over 1921. Miss Sheridan looks for small increases in January, February and March, better business in April, May and June, and a very marked increase in business from July to December.

Hammond, Ind.—The Northern Indiana Gas & Electric Company is helping the contractors in its territory in the wiring of old houses on existing lines by taking over partial payment contracts, thus financing these campaigns. This company is co-operating with the local electrical trade in every possible way in the development of co-operative publicity such as weekly electrical pages in local newspapers. Several meetings of the local contractor dealers have been held, at which the company's policy of "live and help live" was outlined.

Manchester, N. H.—Within the past year the Manchester Traction, Light & Power Company has installed several electrically operated refrigerators which have given absolute satisfaction. The cost of energy for operating these refrigerators has varied from less than one-half up to as high as two-thirds of the cost of ice. George H. Sander, commercial superintendent of the company, states that a vigorous campaign for refrigerating business will be started this spring in addition to special attention which will be given to electric range business.

Newark, N. J.—The net gain in lighting customers on the lines of the Public Service Electric Company in 1921 was approximately 44,000, or an increase of about 20 per cent over the number on the company's lines on Dec. 31, 1920. The company states that present prospects indicate a net gain during 1922 in excess of that of last year.

Spokane, Wash.—In this city, with a population of 105,000 people, the Washington Water Power Company is serving 22,000 residential customers. There are now approximately 2,000 electric ranges and water heaters connected to the company's lines within the city. The company expects to continue its work of popularizing these appliances during the year 1922 and expects to install within that period approximately 500 additional electric ranges.

St. Louis, Mo.—The Union Electric Light & Power Company is utilizing a rather unusual but perfectly logical adjunct in promoting the sale of its preferred stock to customers. The Clarkson Specialty Company, electrical manufacturers' agents in St. Louis, has been duly authorized to accept orders for and payments on sales of the company's preferred stock. Coming in contact as it does with men in the electrical industry who might not be reached by the regular salesmen of the Union Electric Light & Power Company the Clarkson company has been successful in making a number of stock sales in the electrical trade.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Design of Induction Motors for Textile Service.—O. C. SCHOENFELD.—A description of the various types of drives and the motors suitable to these drives. The progress through the single-motor drive, the group drive and the individual drive is outlined.—*Electric Journal,* November, 1921.

Heating of Armature Coils in Slots.—OTTO BÖHM.—The author investigates mathematically the effect of ventilating slots in the armature laminations upon the heating of the copper and iron. Considering the conduction of heat across the laminas as very much poorer than along them, the problem of coils in a ventilated armature is reduced to a solidly embedded coil winding. A practical example illustrates the author's deductions. The investigations showed that it is very desirable to ventilate the armature by a large number of ventilating ducts and to resolve the necessary width of the iron into a number of narrow iron packages separated by six spaces.—*Elektrotechnische Zeitschrift,* Dec. 1, 1921.

Generation, Transmission and Distribution

The Hydraulic Turbines of the Walchensee (Bavaria) Plant.—G. TROELTSCH.—This article is a preliminary report of the hydraulic equipment of the unfinished Walchensee plant in Bavaria. Turbines of a total output of 168,000 hp. are being installed, a yearly output of about 160,000,000 kw.-hr. being looked for. It is of interest to note that in the same station two different types of turbines will be used, viz., four 24,000-hp., 500-r.p.m. Francis spiral turbines and four 18,000-hp., 250-r.p.m. Pelton wheels, both types operating under a head of about 195 m. The author illustrates his paper with drawings and photographs of turbines of a similar character and compares the Francis type with a 17,500-hp. wheel operating at 105 m. head at the Sorocaba station in Brazil, and the Pelton type with a 16,400-hp. double-runner wheel operating on 250 m. head at the Rjukamfes plant in Norway.—*Elektrotechnische Zeitschrift,* Nov. 24, 1921.

Electrical Characteristics of Transmission Circuits.—W. NESBIT.—One of a series of articles on this subject. It describes phase modifiers for voltage control. With alternating-current transmission there is a voltage drop due to resistance and one due to reactance. By employment of phase modifiers the direction of the resultant induced voltage may be controlled so that it will be exerted in a direction that will result in the desired end voltage. A method of determining what characteristics such a phase modifier must have is given in this article. —*Electric Journal,* December, 1921.

Canadian Automatic Converter Substation.—Refers to the first Canadian automatic converter station to be placed in successful operation. After a comparison with hand operation, the equipment, including the switchboard and wiring, is described in detail. The sequence of operation is then explained, with the occasion for the operation of the various equipment.—*Engineering (London),* Dec. 2, 1921.

Copper-Cadmium Wire for Electrical Transmission.—W. C. SMITH.—Gives properties of such wire, the results of laboratory tests to determine the effect of annealing, and indicates the effect of including cadmium in the wire.—*Chemical and Metallurgical Engineering,* Dec. 28, 1921.

Hydraulic Power Development in South America.—THEODORE STEVENS.—A description of some features of the Victoria Falls and of the Falls of the Yguazù, along the border between Argentina and Brazil. The Victoria Falls has a drop of 400 ft., while the Yguazù has a spillway 10,000 ft. long, with 210 ft. drop and a further fall of 50 ft., making 260 ft. available.—*Electrical Times,* Nov. 24, 1921.

Traction

Electric Traction on the Mont Cenis (Italy) Road.—G. HULSCHINER.—This road is built according to Italian standards, as a three-phase system, operating at 3,300 volts and 16 to 17 cycles per second, and has a length of 84 km., which includes the 14-km. Mont Cenis tunnel. The electrification of the road was considered so urgent that there was no time to erect a power plant, but a contract was closed with the municipal electric supply department of the city of Turin to deliver 50-cycle, three-phase, 50,000-volt energy from its plant in Chiomonte. This power house limited the energy available to the railway to only 3,500 kw., which was not sufficient to cover the peak loads of the expected traffic. A clause was also inserted in the contract to avoid sudden load changes so as not to disturb the power supply of Turin. Of greatest interest therefore is the chosen equipment of the frequency-changing substation, erected near the road at Bardonecchia. Three frequency-changer sets were installed, consisting each of the following units, all on one shaft: One three-phase generator, 2,000 kva., 3,700 volts, 16.7 cycles, designed for 100 per cent overload for three minutes; one three-phase induction motor, 2,200 kva., 7,000 volts, 50 cycles, 500 r.p.m.; one three-phase commutator motor, 600 kva., 500 r.p.m. to 400 r.p.m.; two flywheels, 3.6 m. diameter, 0.66 m. width, peripheral speed 104 m., capable of delivering 750 kw. for one minute, while their speed slows down from 500 r.p.m. to 400 r.p.m. The commutator motor is a series motor connected in cascade with the main motor. During overloads the commutator motor together with the flywheels supports the output of the main motor. At the same time the frequency of the generator drops from 16-17 cycles to 13-14 cycles, which, however, does not affect the locomotives to any appreciable extent. Even during periods of very heavy peaks on the road very slight variations occur in the 50-cycle Turin supply system. This fact is shown plainly in a number of curves drawn by registering instruments. Surplus energy from regenerative braking of the trains on down grades is primarily stored in the flywheels. If this energy amounts to more than what would correspond to a highest speed of 500 r.p.m. of the flywheels, it is absorbed in an automatically adjusting water resistor. The substation also contains three small water turbines of a total of 500 kva. to add to the power supply and to improve the power factor by overexcitation. A few details are given on the overhead construction of the three-phase road in the open stretches and the tunnel. Two comparative traffic graphs before and after electrification show that the electric trains save as much as forty-five minutes' time on a distance of 40 km.—*Elektrotechnische Zeitschrift*, Nov. 24, 1921.

Installations, Systems and Appliances

Present Status of Mine "Explosion-Proof" Electrical Apparatus.—W. PHILIPPI.—After comparing the rules governing the use of electric machinery in mines of Germany, Austria, France, England and America, the author describes motors, switches, lamp armatures and controllers for use in mines containing explosive gases. If motors are used which are completely inclosed the inclosure must be mechanically strong enough to withstand safely an overpressure of 8 atmospheres from within; or the motors may be ventilated through openings which are covered by two layers of metal mesh of a certain fineness or with a so-called plate protector consisting of a great number of closely spaced thin-metal plates. These devices cool any flame passing through them to a harmless temperature. A number of such constructions are illustrated.—*Elektrotechnik und Maschinenbau*, Dec. 4 and 11, 1921.

Mercury-Vapor Rectifiers.—The problems which have to be overcome before larger rectifiers become practicable are briefly outlined. The manner in which these problems have been approached so far is briefly discussed, and attention is called to the fact that mercury-arc rectifiers are now being built in units up to 500 amp. and 1,000 volts, while the near future promises 2,000-volt to 3,000-volt units. Comparisons with converters and motor-generator sets are made, and the performance of three rectifiers rated at 750 kw. and operating at loads ranging from one-quarter to 150 per cent normal rating is given.—*Beama*, December, 1921.

A Motor Installation in a Large Textile Factory.—J. T. RANDLES.—Description of the driving and distribution equipment in a modern electrically driven cotton mill at Rochdale, England.—*English Electric Journal*, Vol. I, No. 7.

Electrophysics and Magnetism

What Matter Is Made Of.—W. R. WHITNEY.—A brief discussion in semi-popular form of the electronic construction of matter as applied to every-day problems. —*Sibley Journal of Engineering*, January, 1922.

Electrochemistry and Batteries

Electrolytically Produced Calcium-Barium Lead Alloys. —W. A. COWEN, L. D. SIMPKINS and G. C. HIERS.—Illustrates equilibrium diagram and microstructure of barium-lead and calcium-lead alloys, pointing out that ternary alloys harden and strengthen on aging, are hard at moderate temperature, can be melted without change in analysis and constitute a very fine bearing metal.—*Chemical and Metallurgical Engineering*, Dec. 28, 1921.

Units, Measurements and Instruments

Research on Insulating Oils.—E. B. WEDMORE.—A study of the best form of spark gap for breakdown-voltage tests on insulating oils which leads to the conclusion that spherical electrodes should be employed and the recommendation that they should be 0.5 in. in diameter and 0.15 in. apart. Such electrodes appear to be very sensitive to the presence of contaminating particles of moisture and fiber and other material. They admit of an accurate calculation of the maximum stress to which the oil is subjected. The breakdown and preliminary sparking voltage were shown by means of a table which is given in the article.—*Electrician (London)*, Dec. 2, 1921.

BREAKDOWN VOLTAGES OF OIL BETWEEN VARIOUS SHAPES OF ELECTRODES

Average values observed (R. M. S.). B. D = Breakdown. P.Sp. = Preliminary sparking.

Spacing, In.	½-in. Spheres.		½-in. Disks.		Needle Points		Point and Plate	
	B.D	P. Sp.	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.
0.025	3,570	2,940		..		..	8,430	7,075
0.05	5,712	4,354	6,510	4,680	11,950	8,140	12,250	8,256
0.075	...	.	8,950	6,220				....
0.100	13,185	7,583	14,500	7,380	17,760	13,500	15,980	11,810
0.15	19,530	11,140	19,060	11,070	22,090	16,300		.....
0.175							19,660	14,680
0.200	27,160	15,340	27,900	22,080	24,400	18,750		
0.250					26,730	20,390	23,340	17,360

Telegraphy, Telephony and Signals

Tube Sender at Königswüsterhausen.—H. THURN.—After a general explanation of the properties of electron tubes as senders, the author gives a description of the new 10-kw. sending station installed by the Telefunken company in the main radio station of Königswüsterhausen. The station can emit wave lengths of 2,000 m. to 9,000 m. from a surface antenna 125 m. high. Using a wave length of 5,250 m. the average antenna current is 50 amp. Six or eight sending tubes of 1½-kw. output each are used in parallel.—*Elektrotechnische Zeitschrift*, Dec. 8, 1921.

The Avalon-Los Angeles Radio Toll Circuit.—L. M. CLEMENT, F. M. RYAN and DE LOSS K. MARTIN.—Radio telephone service from Santa Catalina Island to the Californian mainland is described, including the mode of connection to the wire telephone networks at either end. Special points discussed are the narrowing of the side frequency bands due to modulation by means of filters, transmitter and receiver circuits, automatic alarm systems, through signaling systems and antenna and ground arrangements.—*Proceedings Institute of Radio Engineers*, December, 1921.

Auxiliary Features in Automatic Telephone Systems. —W. AITKEN.—In automatic systems the calling impulses are distorted and attenuated by the quality of the line just as the speech vibrations are. To avoid this trouble the author proposes an impulse-equalizing device which is shown in detail. With this apparatus the author claims that dial impulses are maintained practically uniform when transmitted over trunks of varying lengths.—*Electrician (London)*, Dec. 9, 1921.

Visual and Photographic Device for Recording Radio Signals.—CHARLES A. HOXIE.—The development of a visual and photographic recorder of a vibrator type. Recent forms of the instrument with its receiving-speed possibilities and behavior toward stray disturbances are discussed.—*Proceedings Institute of Radio Engineers*, December, 1921.

New Books

Reviews of the latest contributions to Technical, Industrial and Commercial literature of particular interest to members of the electrical industry

The Code at a Glance. By Hubert S. Wynkoop. New York: National Association of Electrical Contractors and Dealers. 96 pages.

"The Code at a Glance" is a handy book of convenient size with durable binding, prepared by Mr. Wynkoop at the suggestion of the National Association of Electrical Contractors and Dealers. For twenty-five years Mr. Wynkoop has been at the head of the electrical inspection service of the city of New York, and no one appreciates better than he the need for a concise and easily consulted transcript of the National Electrical Code. He has rearranged in alphabetical order all the code requirements which it is essential for the contractor, the wireman, the estimator and the inspector to have constantly in mind.

Winning the Public. Second edition. By S. M. Kennedy, vice-president in charge of public relations and business development, Southern California Edison Company, Los Angeles, Cal. New York: McGraw-Hill Book Company, Inc. 148 pages.

This second edition of Mr. Kennedy's famous book on public relations has been expanded by the addition of two new chapters and material additions to other sections. It is unquestionably the most interesting, authoritative and useful book that has ever been published on the subject of public relations as affecting the utility.

One of the new chapters now opens the book and bears the title "Transforming Public Opinion." It presents from a broad viewpoint the general background of public relations as an element in utility operation. Because there still lurks in the minds of many a suspicion of big corporations, there is great need for constructive educational work that will build up a truer public appreciation of public service companies. The chapter analyzes the situation and its needs and describes the methods by which a "greater service department" may gradually overcome such prejudice and establish harmony in its stead. The other new chapter is entitled "Over-Complacency" and deals with the evils and dangers of self-satisfaction and the offensive air of superiority that sometimes marks the employee and, worse yet, the official of a utility. How this reflects against the company, through the complaint department and the district manager and in other ways, is described in detail.

The other chapters as revised cover the full range of this exceedingly broad subject. The reaction of different types and classes of people in their contact with the utility, how the public forms its judgments and their influence, the importance of definite informing and educational measures and how they should be organized and applied, and the benefits that come from the further refinement and perfection of good service into a "greater service" system are dwelt upon. The value of courtesy, cheerfulness and loyalty in the utility employee, the impulse of congenial contacts, the effect of proper display room and district office organization and the opportunities for service which different members of the staff may develop are treated in constructive detail. The pages dealing with the power of the art of conciliation, the danger that comes from over-complacency, the need for true commercial instinct and the benefit that can be made to come from cumulative co-operation are particularly interesting. In short, it is a textbook that is invaluable to every public utility man.

The author stands probably without a peer among electric light and power executives in his experience with the actual administration of public relations for a large utility corporation and in the scope and progress of his thinking and his teaching on this subject. Under his guidance the Southern California Edison Company has been a pioneer in the development of a high quality and spirit of service to the public.

It has been the purpose to present in "Winning the Public" a complete picture of the fundamental relationship between the public and the electric light and power company, and to provide by practical suggestion a code of policy and practice for the guidance of the utility executive in all his contacts with the people. By the most precise analysis and thorough detailed evidence the proper course of management and administration is made clear with a balanced judgment and helpfulness that make the book a source not only of information and good counsel but also of definite ideas and recommendations for use in the day's work. It is written with a clarity of expression and an orderly progression that make it easy and interesting reading.

Radiotelegraphisches Praktikum. By Dr. Ing. H. Rein. Third edition, revised and enlarged by Dr. K. Wirtz. 558 pages, 432 illustrations. Berlin.

A very compendious textbook on radio engineering, following the mathematical applications but with ample reference to construction, design and electrical connections. The book is not only well adapted for college classes but also for radio engineers and for electrical engineers interested in radio applications. At the end of the book there are several curve sheets, a good index and an extensive bibliography. The chapters of the book are lettered, and not numbered. They extend to and include the letter V. The book is particularly serviceable as illustrating recent German practice in construction and installation.

Third Report on the Water Powers of Georgia. By B. M. Hall and M. R. Hall. Atlanta, Ga.: Byrd Printing Company.

The Geological Survey of Georgia has recently issued a most comprehensive report on the water powers of that state. This report, which is the third in number, is issued in co-operation with the United States Geological Survey. The greater portion of the report is devoted to stream-flow data collected at gaging stations in the state, but the report attempts also to give a dependable estimate of the magnitude of the water-power resources of Georgia, and a statement of developed water powers is included, describing with considerable detail the more important plants now in operation in the state. A number of profiles are given of important water-power possibilities, and there is also a map showing the location of the transmission and distribution lines.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

N. E. L. A. Convention Scheduled for Atlantic City, May 15-20

ANNOUNCEMENT has been made by the exhibition committee and the officers of the National Electric Light Association that the next convention of the association will be held at Atlantic City, N. J., May 15 to 20. An exhibition of an educational character will be held on the Million-Dollar Pier, and arrangements are being made for one of the most interesting and instructive conventions ever held. The Atlantic City Hotel Association has pledged the N. E. L. A. ample accommodations and every comfort.

Industrial States Will Lead in Building, Says Committee

MOST of the building activity of the coming year will be in the industrial states, according to a report just issued by the committee on statistics and standards of the Chamber of Commerce of the United States. In these states many new business buildings will be erected and there will be extensive programs of enlargement and alterations, but the prospects in the strictly agricultural states are not so favorable because of the low prices for farm products that have prevailed and the inability of the banks to make further loans. The three obstacles to building—high price of materials, high price of labor and difficulty of obtaining funds—continue, though conditions have improved greatly in regard to the first named and are expected to do so in the second with the approach of spring.

California leads the other states with respect to probable construction, the committee says. Prospects are also good in the East and the Central West, and many possibilities exist in the Southern States. Public buildings and additions to colleges and universities are planned in many sections.

Georgia Railway & Power to Complete Tugalo Development

ACTIVE construction work on the Tugalo development was begun in 1917, but owing to war conditions, was stopped until this week, when the Georgia Railway & Power Company announced plans for its completion. The location of the dam will be about 400 ft. below the point where the Chattooga and Tallulah Rivers unite to form the Tugalo. The dam will be one of the largest concrete structures in the South, 155 ft. high, approximately 130 ft. thick at the base, 850 ft. long across the top and containing approximately 225,000 ft. of masonry. The average annual output of the Tugalo plant will be approximately 130,000,000 kw.-hr. The present output of the Georgia Railway & Power Company is 300,000,000 kw.-hr. per annum, from which it can be noted that the Tugalo development will increase the total output of the system about 43 per cent over the present capacity.

The hydraulic equipment will consist of four 22,000-hp. waterwheels comprising the main units and a small auxiliary wheel of 1,000 hp. for station service requirements. The generating equipment will consist of four 12,500-kw. vertical-type generators directly connected to the waterwheels and a small exciter unit rated at 100 kw. Power will be generated at 6,600 volts and stepped up to 110,000 volts for transmission to load centers of the company. Transformer equipment will consist of two banks of 25,000 kw. capacity each, each bank in turn consisting of three 8,333-kw., single-phase, oil-insulated, water-cooled transformers. The low-tension switching equipment will consist of eight 6,600-volt oil switches and the high-tension switching will be accomplished by four 110,000-volt oil switches and a single 110,000-volt air-break, motor-operated switch. A transmission line about 3 miles long will be constructed to connect this station with the present 110,000-volt lines from Tallulah Falls to Atlanta. It is anticipated that the first unit will be placed in service in the early fall of 1923 and that the entire capacity of the station will be available before Jan. 1, 1924.

Nation-Wide Campaign for More and Better Business Launched

AT A LUNCHEON given in the Engineers' Club in New York on Monday by M. R. Bump, president of the National Electric Light Association, and attended by representative men of the industry, a nation-wide campaign for more and better business was successfully launched.

More than forty representatives of the electrical industry were present, including among them A. K. Baylor of the General Electric Company, A. A. Brown of the Westinghouse Electric & Manufacturing Company, S. E. Doane of the National Lamp Works, L. H. Egan of the Union Electric Light & Power Company of St. Louis, W. L. Goodwin of the Society for Electrical Development, C. H. Hofrichter of the National Council of Lighting Fixture Manufacturers, T. I. Jones of the Brooklyn Edison Company, J. W. Lieb of the New York Edison Company, E. W. Lloyd of the Commonwealth Edison Company of Chicago, S. Z. Mitchell of the Electric Bond & Share Company, W. H. Onken, Jr., of the ELECTRICAL WORLD, W. E. Robertson of the Robertson-Cataract Electric Company of Buffalo, E. W. Rockafellow of the Western Electric Company, C. J. Russell of the Philadelphia Electric Company, Frank W. Smith of the United Electric Light & Power Company of New York, C. Stone of the General Electric Company, Schenectady; M. S. Sloan of the Brooklyn Edison Company, James R. Strong, president of the National Association of Electrical Contractors and Dealers; F. S. Terry of the National Lamp Works, R. H. Tillman of the Consolidated Gas, Electric Light & Power Company of Baltimore, L. R. Wallis of the Edison Electric Illuminating Company of Boston, Arthur Williams of the New York Edison Company, R. R. Young of the Public Service Electric Company of Newark, N. J., and P. B. Zimmerman of the National Lamp Works of Cleveland.

It was the opinion that the industry under the direction of the National Electric Light Association should rally around the slogan "More business—better business," and that every activity and agency should be enlisted in co-operation in an earnest and united effort to promote the continued development of the industry.

Frank W. Smith, ranking vice-president and chairman of the lamp committee of the association, gave an excellent epitome of the work which it was sought to accomplish. The impulse for the movement originated with the lamp committee. It was felt, however, that that committee could not best undertake directly as part of its activities the formulation and execution of a broad commercial activity of this kind, but that it would stand sponsor for such a movement and that the Commercial Section of the association should be looked to to carry on the work. In the discussion which took place in the executive committee meeting of the association last month it was emphasized rather forcefully that to some extent the sales departments or commercial organizations of member companies had been very considerably curtailed during the war; that since the war in many instances activities have not been resumed, and that the Commercial Section of the association was anxious and ready to get under way with renewed energy.

SUGGESTED ACTIVITIES

The plan proposed calls for some sort of an organization at headquarters under the general direction of Executive Manager M. H. Aylesworth, in active and direct contact with the Commercial Section, to direct and control the work.

Mr. Smith intimated that the activities of the headquarters organization might include (1) the general announcement of the executive committee's action, suggesting a nation-wide activity sponsored by the association; (2) direct-by-mail communication to central-station executives, explaining the value of the work for the coming year with definite suggestions for co-ordinating their activities not only with other central-station companies throughout the country, but with the different branches of the electrical industry; (3) the preparation of a concise prospectus setting forth in an attractive manner the several activities that might be undertaken in the different communities, sponsored and carried on by the several interests there established; (4) a traveling representative who would do the field work, explaining in detail the entire campaign to executives of the principal central-station member companies. This field activity might be carried on by and with the co-operation of the Society for Electrical Development under the general direction of the executive manager of the National Electric Light Association. In Mr. Smith's opinion a method could be found for consolidating the efforts of the two societies for this particular field activity.

Mr. Smith referred to the splendid work that the National Electric Light Association has done and the results accomplished during the past year through the good-will campaign that has been carried on as a co-operative effort with the manufacturing and other classes of membership in the organization.

President Bump spoke most enthusiastically of the opportunities ahead for the industry and particularly of the favorable financial conditions. In his estimation there is no central-station company in the country that has not a wide-open field to double its output in the next five years. There was every indication that the utilities would be able to finance any extensions necessary for the development of new business and that with a definite plan and the requisite enthusiasm and push the success of the movement was assured.

Talks of the same tenor were made by R. S. Tillman, S. E. Doane, E. W. Lloyd, J. W. Lieb, Arthur Williams, S. Z. Mitchell, R. R. Young and others. J. R. Strong pledged the support and co-operation of the National Association of Electrical Contractors and Dealers in the work, and W. E. Robertson, who represented the Electrical Supply Jobbers' Association, was most optimistic on the outlook. William L. Goodwin offered all the resources of the Society for Electrical Development in furtherance of the scheme, and the hearty support and good will of the manufacturers were indicated in talks by A. K. Baylor, A. A. Brown and F. S. Terry. Mr. Egan, speaking for the St. Louis Electrical Board of Trade, said he was so impressed with the opportunity that he would guarantee that that body would allot the entire time of a competent man to the work.

A steering committee was appointed, headed by R. S. Tillman, chairman of the Commercial Section of the association. The tentative committee at present consists, in addition to Mr. Tillman, of Frank W. Smith, S. E. Doane, W. E. Robertson, A. K. Baylor, Rex Cole, E. W. Lloyd, A. A. Brown, R. S. Wallis, A. J. Hixon, C. K. Nichols, C. E. Greenwood and F. B. Farmer. The committee has had several meetings since Monday and will announce its plans shortly.

Wisconsin Utilities to Meet in March

THE annual meeting of the Wisconsin Electrical Association, the Wisconsin Gas Association and the electric railway group of the Wisconsin Electrical Association will be held at the Hotel Pfister, Milwaukee, on March 22, 23 and 24. The following tentative program has been arranged:

WEDNESDAY, MARCH 22

Afternoon.—Transmission line, substation and distribution group; inductive interference troubles, high-voltage lines in cities, costs of lines, etc.; leader, G. A. Mills, Eau Claire. Electric railway group leader, W. G. Brooks, Chicago.

THURSDAY, MARCH 23

Morning.—Address by president and reports of officers and committees, including steam-road-crossing committee, street and interurban committee, legislative committee and safety code advisory committee.

Afternoon.—"How Rates Are Made," by Commissioner Lewis E. Gettle; "Taxation of Public Utilities," by E. J. Brabant of the Wisconsin Tax Commission; "The Wisconsin Public Utilities Bureau," by Franz Herwig, director.

FRIDAY, MARCH 24

Morning.—Auditing group; leader, C. E. Kohlhepp, Wisconsin Public Service Company, discussion on machine billing, etc. Safety group; leader, C. B. Hayden, Railroad Commission, explanation of new electrical safety and fire code. Sales group; leader, F. A. Coffin, Milwaukee; kilowatt-hours consumed by lighting and appliances, power-factor, coal and labor clauses, electrical merchandising.

Afternoon.—"The Field of New Business" (speaker to be announced later); rural-extension committee report, Chairman G. C. Neff; "Rural Line Studies," by Alvin Meyers and F. T. Singer, University of Wisconsin.

Motor Industry to Regain Vitality Quickly, Says W. A. Layman

IT REQUIRED "the greatest economic cataclysm of history," according to W. A. Layman, president Wagner Electric Manufacturing Company, St. Louis, to interrupt the rapid growth of the electrical industry of the United States. "Minor trade recessions of the last thirty years," Mr. Layman said to a representative of the ELECTRICAL WORLD this week, "simply impeded it for brief intervals. An industry so fundamentally contributing to civilization's progress is certain to regain its vitality promptly as the world swings back to normal living. President Bump, in his recent stimulating letter to the N. E. L. A. membership, says conditions now make possible the financing of immediate sound central-station expansion, and that the next five years will witness the doubling of central-station production. This means unquestioned prosperity for the motor industry. The year 1922 will be one of intense competition in general business, compelling the maximum possible efficiency of production. The electric motor is absolutely essential to industrial efficiency, and keen competition will help revive the motor industry. With all economic conditions steadily improving, courage in all business lines reviving, paralysis of initiative disappearing, fanciful social mirages dissolving into good old-fashioned common sense, I confidently believe 1922 will see a steady return toward a complete and greater prosperity in our industry."

President Bump's Optimistic Forecast

MILAN R. BUMP, president of the National Electric Light Association and chief engineer of the Cities Service Company, in reviewing the central-station industry of the United States for the past year and commenting on the outlook for 1922, said, recently:

"The electric light and power industry has come through the trying conditions of 1921 with a remarkable record of progress toward readjustment. While in certain industrial centers demands for power service fell off materially in the early part of the year, it is noteworthy that in almost every instance these losses were overcome before the end of the year. A large portion of the gains are, of course, attributed to the resumption of the industries previously served, but there has also been a marked gain in new customers. Domestic consumption continues to show gains and the field for electrically operated household appliances is constantly expanding.

"The change in the investment markets in the later months of the year has had a most beneficial effect, and for the first time in several years money is obtainable at rates which regulated utilities can afford to pay. The result is that a general program of expansion is now under way, and I am confident that 1922 will break all previous records for development of plants and systems.

"The fact that the electrical utilities have successfully come through both the war and the subsequent reconstruction period without an important failure has increased the standing of these securities as investments immeasurably. The coming year will be marked by many new and important bond issues to finance improvements, but a very large portion of the new funds needed will come from the sale of junior securities to the customers of the various local companies.

"The industry is not overbuilt for present conditions. This means that it must expand enormously to be prepared for the increased business which the gradual though unmistakable return toward normal industrial growth will demand of it. The electrical industry is progressing, and in my opinion 1922 will prove a banner year from every viewpoint, because the vision of the leaders of the industry is such as to lead it both wisely and aggressively."

Incandescent-Lamp Business Investigated by Lockwood Committee

ON JANUARY 6 the Lockwood legislative committee of New York began an investigation into the electric incandescent-lamp business. This committee has for some months been delving into the building trades industry and related associations and combinations of manufacturers, jobbers, contractors and dealers in New York, and has succeeded in exposing many offenders against the Donnelly anti-trust law and bringing about their indictment. A number of the combinations that have been exposed, representing in all probably 500 or more corporations and individuals, have disbanded their organizations and have in good faith resumed competition as the law requires. In turning its guns on the incandescent-lamp industry the Lockwood legislative committee signaled out the General Electric Company for its attack, and testimony against the company and its practices was given on Jan. 6 by Harvey Wilson Harper, head of the Miniature Incandescent Lamp Company of Newark, N. J.

Mr. Harper, who said that he was at one time a member of the National Electric Lamp Association, told how he was forced to sell his business, which on an investment of $169,000 netted him and his partner $20,000 a year each. As a condition of the sale he was given a position with the General Electric Company, so he testified, at $3,500 a year to manage his old plant. It was while he was conducting this plant—namely, the Howard Miniature Lamp Company—he testified, that the General Electric Company suggested the desirability of his becoming a licensee of that concern in order to avoid patent litigation. He said he agreed to do this and also to maintain the prices fixed by the General Electric Company. When he subsequently applied for a license he said he was refused. He thereupon went to Germany, where he obtained tungsten.

According to his testimony, the General Electric Company then offered to license him to make tungsten lamps. After that he bought tungsten filament from the company and canceled his Berlin order. He agreed to maintain a resale price based on that of the General Electric Company and said he was required to fix the price at which the jobbers were to sell the lamps to the retailer and the price at which the retailer was to sell to the public. When this particular method was declared illegal, Mr. Harper testified, it was abandoned and a new method involving sale by consignment was followed.

In addition to the Howard Miniature Lamp Company. Mr. Harper said that the Ferguson Company of St. Louis and the Independent Lamp & Wire Company were also forced to sell to the General Electric Company. When the General Electric Company took over his company and that of the Independent Lamp & Wire Company, in both of which W. C. Durant, the automobile promoter, was financially interested, he went to work for the General Electric Company, but subsequently resigned and bought the miniature-lamp business of the Independent Lamp & Wire Company and planned to manufacture miniature lamps under the patent owned by it. The witness said that when Mr. Durant got into financial trouble he sold the stock of the Independent company to the General Electric Company for $181 a share, although it was worth $300 a share. As one of the conditions of the sale of the Independent concern to the General Electric Company, the latter was required to give Harper a limited license for making miniature lamps. He said he received a license to manufacture $480,000 worth of lamps a year, but that nevertheless he had done a business of $1,400,000 in 1920. He also testified that he further disregarded the license provisions by selling for export.

Under examination by Samuel Untermyer, counsel of the Lockwood legislative committee, Mr. Harper said he negotiated with Mr. Burrows of the General Electric Company for a license and when the latter was asked why the General Electric Company would not grant Harper permission to do a larger business he answered "among other things that he was going to clip my wings."

Q.—You are questioning the right of the General Electric to interfere with your business? A.—Yes, sir.

Q.—Have you had any more intimations about wing clipping since this talk with Mr. Burrows? A.—Only when the production of this Ford lamp came up and Mr. Burrows made the statement that he would spend a million dollars to stop my making Tulite lamps, which, up to date, I still continue to make.

Q.—He hasn't spent the million yet, has he? A.—Not yet. Possibly he has started.

Q.—You think he has started? A.—Yes.

Then Harper explained that the General Electric cut his price and contracted to make 100,000 lamps for Ford, but the contract was canceled when the General Electric refused to guarantee the life of the lamp. The witness said he gave a guarantee.

LITTLE COMPETITION IN LAMP FIELD

Q.—There isn't much in the way of competition in the field, is there. A.—No, sir.

Q.—What has become of it all? A.—I think you ought to ask the General Electric Company that question.

Q.—Has it been absorbed or forced out? A.—One way or another.

Q.—What per cent of the total production of miniature lamps in the United States do you say the General Electric controls? A.—I would say 95 per cent.

Q.—That includes the Westinghouse, doesn't it? A.—Yes, sir.

Q.—How many concerns, with the exception of the General Electric, the Westinghouse and yourself, make miniature lamps? A.—Ten or fifteen small concerns.

Q.—Amounting altogether to less than 5 per cent, with yourself, of the whole business? A.—I think I would be correct in that statement.

Q.—Do you know whether your customers are being interfered with now by the General Electric by rumors that you are going to be put out of business this year? A.—Not that I am going to be put out of business, but a number of their salesmen have been to see my customers, advising them that, owing to my limited quota, I would not be able to take care of them.

Q.—You mean with your $480,000 quota? A.—Yes, sir, and suggesting to them that they sign up with the General Electric Company.

Q.—Is that very general now? A.—It is done pretty thoroughly.

Q.—If you were unlimited, how much business could you do? A.—I suppose I could do about $2,000,000 a year with my present capacity and finances.

Q.—I mean if you were free from these shackles and had the necessary financial backing and factory facilities. Could you do an unlimited amount of business? A.—I believe I could get my fair proportion of business.

Taking up lamp costs, Mr. Untermyer developed that a headlight lamp that cost 15 or 16 cents was sold by manufacturers to jobbers for 52 cents, and side and tail lamps for automobiles costing 6 cents to manufacture were sold for 28 to 35 cents.

Q.—Do you know whether there is a price agreement between the General Electric and the Westinghouse? A.—I know that they maintain the same prices.

Q.—Does the Westinghouse use the word "Mazda"? A.—Yes, sir.

Q.—Do the other licensees? A.—No, sir.

Q.—Do you mean to say that these other people who are making lamps under the license cannot use the trade name? A.—No, sir.

Q.—What is the idea of that? To make it look as if there were more competition, isn't it? A.—I would say so.

LAMP PROFITS CARRY OTHER LINES

Q.—Isn't it a fact that the General Electric is able to sell its other electric products on the back of these bulbs? A.—I would say so; yes, sir.

Q.—In other words, their competitive products are ridden to market on the back of this electric bulb? A.—I believe that is correct.

Q.—So apart from the direct profit there is a very large indirect profit? A.—Yes, sir.

The miniature lamps, Mr. Harper explained, are made by special machinery, the patents on which have expired. A large quantity of such machinery is made by the General Electric Company. Certain machinery, he said, was quoted by manufacturers at a much lower price than the price fixed by the General Electric Company.

A spot-welding machine for making lamps is sold by the General Electric for $160 and for $27 by others.

Q.—How do they manage to get six times as much for a machine? A.—Probably they do not want to sell the machine. That may be the answer.

Q.—So that a higher price on the machine would tend to restrict production, wouldn't it? A.—Yes.

Harper said that the General Electric Company was attempting to bar him from selling candelabra and decorative lamps, but that he was defying its order.

Mr. Untermyer took the witness through a history of lamp making in the last forty-five years and a description of the foreign patents used by American lamp makers as a basis for their work.

"Is it not a fact that the General Electric acquired these competing patents, bought them all in and thereby killed competition in the development of the electric lighting business by owning all these various styles of patents?" asked Mr. Untermyer.

"That would be my opinion," said Harper.

"That is what happened, isn't it?" counsel asked.

"Yes, sir," said Harper.

"The question is whether they can monopolize all the competing patents," commented Mr. Untermyer. "We will take that up with one of the other witnesses."

COMPANY DENIES MONOPOLY

The General Electric Company issued the following statement on Mr. Harper's testimony:

"The General Electric Company has no monopoly in the manufacture and sale of incandescent lamps. The company does a large part of the incandescent-lamp business only because the public demands the efficient tungsten lamp which is the result of the extensive work of the General Electric laboratories. These lamps produce about three times the light of the old lamp from a given quantity of current. In view of this, Mr.

Harper, who testified today, and certain other manufacturers prefer naturally to make this type of patented lamp rather than the older types which are not infringing.

"As to the charge that the General Electric Company is extorting $100,000,000 from the public for light bulbs, it is sufficient to say that in the year 1920 its profit from all of its manufactured products, including lamps, was $26,460,057.57. This profit was further reduced by the payment of federal taxes. The total receipts from the sale of lamps were less than one-quarter of the receipts from sales of all its manufactured products. The profit from the sale of lamps was higher than the average rate of profit on the rest of its business."

PROBABLE LINE OF INVESTIGATION

On Monday the following inspired statement from the Lockwood legislative committee was issued as indicating the line of attack to be followed by Mr. Untermyer in his further investigation of the lamp business.

Accountants attached to the Lockwood legislative committee said that they had not been impressed with the statement issued by the General Electric Company in denial of the committee's charge that the company enjoyed a monopoly in the manufacture and sale of incandescent lamps from which it reaped enormous profits.

The company's statement said that its total profits from all manufactured articles, including lamps, for the year 1920 were $26,460,057. Samuel Untermyer, chief counsel to the committee, has charged a greater profit on bulbs alone.

When the committee convenes again Mr. Untermyer will embark on an analysis of the company's statement. He will try to prove that despite the decree of consent entered in the federal court at Toledo in 1911, by which the company agreed to abandon its control of resales of its products, the actual effect has been to tighten the monopoly through the establishment of the consignee system of distribution.

It was testified on Jan. 6 that 17.2 per cent of the business in lamp bulbs was allotted to the Westinghouse company by the General Electric. Allowing for a deduction of this proportion from the admitted profits of $26,460,057, as declared in the company's statement, Mr. Untermyer will analyze the figures on the basis of a report of the company's affairs for 1920.

This report has been submitted to the committee by Price, Waterhouse & Company, certified public accountants. It shows that, exclusive of the Westinghouse company's business, the net sales billed or total business of the General Electric Company for 1920 was $275,758,487.57. The total profits available for dividends are shown as $22,132,287. The total sale of bulbs was $57,892,580, and the net profit on bulbs is set down as $19,700,738, or 34 per cent on the total bulb sale. According to the figures, the difference between the profits on bulb sales and the profit available for dvidends is only $2,431,549, or slightly more than 1 per cent on the difference between the bulb sales and the total other business, which amounts to $217,865,907.

What Mr. Untermyer wants to know is why the company takes a profit of 34 per cent on one-fifth of its business and approximately 1 per cent on four-fifths of its business.

Before putting the officials of the General Electric on the stand the committee will call several other manufacturers in an effort to establish the theory that an enormous profit made in the manufacture and sale of standard size bulbs is concealed in the admitted profits of the company. It is Mr. Untermyer's contention that huge profits which pyramid in almost direct ratio to the size and watt consumption of the bulbs are reaped by the retailing agents, but that these in the end inure to the benefit of the company through providing a channel for the output of its other products.

The charge is made that the bulb business carries the load of the company's other output; that the consignees of the bulbs are allowed to collect a generous margin of profit on the bulbs as an inducement to carry other electrical appliances and accessories on which the retailer's margin is exceedingly narrow owing to the competition in this field.

Lamp Patents Sustained by Higher Courts

ALTHOUGH frequently attacked, the basic lamp patents of the General Electric Company have been sustained in the courts. The right of the company to license other manufacturers to make "Mazda" lamps under these patents has never been questioned. In order to safeguard the quality of the product, keep down the cost of distribution and maintain the various factories in economical operation, a system of consignment through agents, who for the most part only are persons engaged in the electrical business, is followed.

The General Electric Company owns the Just & Hanaman United States patent issued Feb. 27, 1912, for a tungsten filament for incandescent electric lamps. The filament, while more efficient than any other filament, was brittle and therefore unsuitable for many important uses. The research laboratory of the General Electric Company set to work to improve it.

Dr. Coolidge of the research laboratory promoted a line of investigation and research in tungsten metal that covered a period of several years and resulted in the invention of drawn tungsten wire, a ductile, practically non-breakable filament. This advance in the art was patented Dec. 30, 1913.

Dr. Irving Langmuir of the research laboratory of the General Electric Company during the course of experiments that he was making developed and invented the modern gas-filled lamp, which resulted in a patent being issued on April 18, 1916.

PATENT DECISIONS

All of these patents have been sustained in the courts. Judge Mayer of the United States District Court for the Southern District of New York, speaking of the Just & Hanaman patent in the case of the General Electric Company against F. Alexander and N. Fabian and Alpha Laboratories, Inc., decided Oct. 29, 1921, said: "Notwithstanding the ingenuity and ability with which the Just & Hanaman American patent has been attacked, it remains where it was and where it should be—the embodiment of an impregnable invention of the highest order." The same judge sustained the Langmuir patent at the same time and had previously sustained the Just & Hanaman patent in the case of the General Electric Company against the Laco-Phillips Company. The Langmuir patent was also sustained in the case of the General Electric Company against the Nitro-Tungsten Lamp Company in the United States Circuit Court of Appeals for the Second Circuit on an appeal from a decision by Judge Mayer in the United States District Court for the Southern District of New York. The Coolidge patent contest was decided in favor of the General Electric Company as against the Independent Lamp & Wire Company, Inc., in the United States District Court, District of New Jersey, on June 29, 1920, Judge Morris saying: "The ductile tungsten filament has gone into general use and has in large measure, if not entirely, supplanted all other filaments, including that of Just & Hanaman, for incandescent electric lamps. It is less expensive to produce, yet it has far greater durability and utility than the squirted filament. It is a commercially new product of great utility, having properties and characteristics unknown to the natural and normal tungsten, or, in fact, to any other material." It is through these patents that the General Electric Company is able to control the manufacture and sale of "Mazda" lamps.

St. Lawrence River Report in Hands of the State Department

THE report of the International Joint Commission on the proposed canalization of the St. Lawrence River was submitted to the State Department on Jan. 6. A copy was forwarded to the Canadian government on the same date. The State Department expected to submit the report to Congress this week. Neither the International Joint Commission nor the State Department will give out any information as to the contents of the report, but it is probable that it will be made public immediately on its delivery at the Capitol.

Sleet Storm Study Gives No Basis for Safety Code Changes

AFTER a study of the damage done to power lines by the New England sleet storm in November, Bureau of Standards specialists see no reason why there should be any change in the requirements of the electric safety code. The code requires that construction be able to carry a half-inch of ice and be able to withstand a wind pressure of eight pounds to the square foot. Testimony regarded as reliable was taken on the ground by a representative of the Bureau of Standards to the effect that the storm was the most severe since the power lines had been erected.

The most important lesson to be learned from this storm, in the opinion of the Bureau of Standards men, is the necessity of extending the cleared area so as to reduce to the minimum the possibility of damage by falling trees and limbs. Fully nine-tenths of the damage to the New England power lines was from this cause. The bureau officials suggest that closer co-operation could be arranged among the power companies, civic officials and owners of abutting properties. Signal-line service could be safeguarded by similar procedure, although it is recognized that it cannot be carried out to the same extent.

The bureau's specialists see in results of this storm further proof that power lines should be kept up to the requirements of the code and that more attention should be given to angles in the line. The far-reaching effect of angle failure when it unbalances a heavily loaded line was demonstrated in many instances in the New England storm.

Engineering Council Discusses Licenses, Plans Ahead and Fetes Hoover

ROUNDING out a year of improved organization, substantial accomplishment and strengthened purpose, the American Engineering Council of the Federated American Engineering Societies held its first annual meeting at the Cosmos Club, Washington, Jan. 5 and 6, Dean Mortimer E. Cooley of the University of Michigan, president of the council, presiding. The officers were re-elected, the work of the past year reviewed and discussed, action taken on important matters of public and technical service, new financial arrangements put into effect, committees named, new policies sanctioned and old ones reshaped, and a broad and definite program outlined for the next twelve months. The council engaged in a long discussion of the principle of licensing or registering engineers and finally decided to direct the appointment of a committee to make a thorough study of the question.

The council made provision for a continuance of its national publicity work. It voted to continue support of the legislation for the relief of the United States Patent Office as embodied in the Lampert bill and to co-operate in the movement to prepare for cyclical industrial depressions and non-employment by resort to public works projects. Topographic mapping and the establishment of a Department of Public Works were other legislative matters in which the council decided to continue its support. Considerable discussion was provoked by the plan to establish a federation journal which would be sent to every engineer enrolled in the federation. The publicity committee made no recommendations and the council took no definite action.

On Thursday evening a dinner in honor of Secretary of Commerce Hoover was given at the University Club. The council presented to Mr. Hoover a copy of a resolution passed by it in which he was extolled for "the distinguished success which has followed him in his past services to his profession, his country and mankind."

One of the biggest problems confronting the country, Mr. Hoover thought, was that of electrification. He suggested that the engineers tackle this problem in the form of a waste survey. Such a survey, he said, afforded at this time great possibilities in the direction of effective leadership in the elimination of waste. The proposed superpower system along the Atlantic seaboard in the region between Boston and Washington was the starting point, he said, for prodigious development in consolidating the electrical powers of the country along national lines which would affect every village and hamlet, combine into superpower stations hundreds of thousands of minor electrical plants with millions of horsepower and result in tremendous savings to industry.

Water-Power Rights of New York State in Forest Preserve

AMONG the amendments to the water-power act of New York State that will be recommended by the Water Power Commission, as foreshadowed in Governor Miller's annual message, will be one intended to establish the disputed right of the state to enter upon the forest preserve and make contracts for water power.

The Democratic minority in the Legislature will, it is stated, support a bill based on the provisions of the hydro-electric bill of 1913 and calling for the expenditure by the state of $500,000 for a hydro-electric plant at Crescent Dam and Visscher's Ferry. This action will to some extent steal the Governor's thunder, he having recommended in his message the appropriation for this purpose of $1,000,000. The Democratic measure will carry with it the repeal of Chapter 499 of the Laws of 1921, which created the Water Power Commission to have general supervision over the granting of leases to state-owned water powers.

Boston Edison Offers Short-Term Securities Under 6 per Cent

ANOTHER evidence of the falling price of capital was given this week when the Edison Electric Illuminating Company of Boston offered two new short-term gold-note issues at a price to yield the purchaser less than 6 per cent. These issues were $4,000,000 of one-year 5½ per cent notes at par and $12,000,000 of three-year 5½ per cent notes at 99.15 and accrued interest, yielding slightly over 5.8 per cent.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Opposition to Daylight Saving in France Also.—The French Senate has passed a bill repealing the law setting forward the clocks one hour in the summer months on the ground that daylight saving worked injury to the farmers. On the other hand, a city councilor in Paris is urging that city to maintain daylight saving, declaring that its enforcement from March 15 to Oct. 25, 1921, had brought about a saving of 200,000 tons of coal, representing 100,000,000 francs.

John W. Lieb Will Lecture in Aid of Italian Milk Fund.—John W. Lieb, vice-president New York Edison Company, will deliver his illustrated lecture on "Leonardo da Vinci, the Master Mind of the Renaissance," at Carnegie Hall, New York, on Jan. 20. The lecture will be under the auspices of the American Free Milk and Relief for Italy, Inc., and the entire proceeds will go to this fund. Dr. Lieb's lecture is of especial interest to the engineering fraternity. Tickets may be procured from Frank W. Smith, 130 East Fifteenth Street, New York.

Shanghai's Wireless Towers. — Six towers each 1,000 ft. in height and with mechanical equipment equal in power to the great radio station at Bordeaux, France, form part of the plan for linking the Celestial Republic and the United States by wireless. The Shanghai station, which it is planned to erect within two years, will, it is said, be second to none in the world. Wireless communication through the interior of China will be facilitated by stations at Harbin, Peking and Canton. The building of the Chinese system is to be done by an American corporation, the Federal Wireless Telegraph Company.

University of Wisconsin's Course for Electric Metermen.—The program of the University of Wisconsin's school for electric metermen, to be held, as already announced, at Madison from Jan. 23 to Jan. 27, will be conducted through lectures and graded tests. One-hour lectures will cover the theory of electrical units, single-phase and polyphase meters, instrument transformers and watt-hour meters. Several illustrated lectures by representatives of meter manufacturers will be given on the care and adjustment of meters. The remainder of the time will be spent in the laboratory on actual meter testing. This course was planned in co-operation with the Railroad Commission of Wisconsin and the Wisconsin Electrical Association.

Duty of 20 Cents a Pound on Asbestos Ore and Fiber Asked.—The Association of Asbestos Mines of Arizona has submitted a brief to the Senate finance committee asking that a flat duty of 20 cents per pound be placed on all asbestos ore and fiber. The belief is expressed that the better grades of Arizona fiber, which go into the yarns upon which the manufacturers receive a protection of $168 per pound, cost at least 30 cents per pound more to prepare and deliver than does the fiber produced by Kaffir labor, while the so-called Arizona No. 2 fiber costs at least 20 cents per pound more to deliver than does the African product.

Petersburg, (Va.) Plant Nearing Completion.—Within the next few weeks the hydro-electric plant being erected on the Appomattox River for the Virginia Railway & Power Company will be completed and Petersburg will be independent of outside sources for its electric power. The new dam across the river is complete and work on the plant is being pushed. The plant will cost approximately $75,000 and will generate about 15,000 kw. a day. It is being built on the site of the old power plant of the same company. Petersburg consumes about 60,000 kw. per day, and the plant now in operation there produces about 45,000 kw., the remainder coming from Richmond and Norfolk. The new plant will make this unnecessary.

Rural Development in Utah.—Utah farmers enjoy the comforts of electrical conveniences to a greater extent than do the farmers of any other state in the Union, according to a report of the United States Department of Agriculture which was read recently at a meeting of the agricultural committee of the Salt Lake Commercial Club. Utah heads a list showing the percentage of farms in the various states which use gas and electricity. The table shows that 11,125 Utah farms, or 34.4 per cent, use either gas or electricity. Massachusetts is second on the list with a total of 28.3 per cent. While 30,519 farms in California are benefited, this is only 25.9 per cent of the total number of farms, and that state ranks third.

Pacific Gas & Electric Company's Properties Valued at $119,000,000.—At a rate hearing before the California Railroad Commission it has been brought out that the reproduction cost of the system of the Pacific Gas & Electric Company of San Francisco, estimated on the hypothesis that the system could have been constructed in five years prior to June, 1921, is $119,834,886. The historical cost, based on actual expenditures as shown by the company's records, is set at $94,354,976. Both totals include the Sierra & San Francisco Power Company, which is being operated by the Pacific Gas & Electric Company under a fifteen-year lease. These valuations are for the physical and tangible properties and do not include such items as franchises, water rights and working material.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pennsylvania State Association of Electrical Contractors and Dealers.—The annual meeting of this association will be held in Allentown, Pa., on Wednesday, Feb. 15. Among other events there will be an "electrical industry dinner" at 6 p. m.

Engineers' Club of Philadelphia. — On Tuesday next, Jan. 17, at 8:30 p.m., well-known bankers and engineers of Boston, New York and Philadelphia will address a joint meeting of Philadelphia engineering bodies on the financing of large engineering projects. At the weekly luncheon on the same day L. W. Wallace, executive secretary of the Federated American Engineering Societies, will speak on "The Engineer and National Problems."

Iowa Engineering Society. — The three-day convention of this society to be held in Sioux City on Jan. 17 to Jan. 19 will be divided into a number of engineering sections. At the mechanical-electrical section meeting, on Jan. 18, Charles F. Schoonmaker, chief engineer of the Quaker Oats Company, will present a paper on the proper distribution of power costs and A. B. Campbell, electrical engineer of the Iowa Railroad Commission, one on the function of the commission in the development of transmission lines.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Cleveland, Jan. 14; Pittsburgh, Jan. 21; Chicago, Jan. 27; Birmingham, Jan. 28; Philadelphia, Feb. 4.

Indiana Public Utility Association—Bloomington, Ind., Jan. 14.

American Institute of Consulting Engineers—New York, Jan. 16.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)

Iowa Engineering Society—Sioux City, Jan. 17-20.

American Society of Civil Engineers—New York, Jan. 18-19.

American Society of Heating and Ventilating Engineers—New York, Jan. 24-26.

A. I. E. E. Section Meetings—Baltimore, Jan. 20; New York, Jan. 27; Salt Lake City, Jan. 27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

American Physical Society—New York Feb. 25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Secondary Demand for Mine Hoisting.—In valuation proceedings to fix electric rates for a gold dredging company supplying power for mining operations, the Idaho Public Utilities Commission decreed that a secondary demand for power for hoisting purposes is a proper charge, since the consumer receives the benefit, for which he should pay, and the utility must reserve excess energy for the use of the consumer whenever needed.

Reasonable Extensions of Service.—A rule requiring electric companies to furnish free service connections and a free line extension not to exceed two spans for each consumer was held by the Illinois Commerce Commission to be reasonable in the case of the Centralia Gas & Electric Company, and the utility was ordered to refund to its consumers money collected in violation of this rule. A public service company enjoying a monopoly in a municipality is charged with the responsibility of furnishing electric service in the territory where it is authorized to operate, the commission said, and in the discharge of its lawful duties as a public utility it should provide means of supplying the reasonable needs of individual applicants as they arise from time to time.

Water Rights as an Element in Valuation.—In adjusting the electric rates of the Tomahawk Light, Telephone & Improvement Company, the Wisconsin Railroad Commission made these observations in regard to the value of water rights: "The water-power value should not be considered as the total value of the water power for sale or other purposes. Our engineers find that at present not over one-third of the total firm power of the river is being utilized by the electric department. We cannot include the value of the unused portion in a property value on which the utility is entitled to a reasonable earning at present. For this reason, if we were to fix a value on the total water power belonging to the company, an apportionment of this value between operating and non-operating property would be required. Instead of doing this we have endeavored to determine a reasonable value for the water power used for utility purposes in another way. Our method has been to set a fixed value per kilowatt-hour for all the energy delivered at the switchboard and to obtain the water-power value by capitalizing the difference between the energy value and the costs (including the fixed costs on the utility's physical generating property) to generate this energy."

Municipal Rate Deviations Criticised.—Complaint made to the Wisconsin Railroad Commission against the charges made by the Bloomer municipal electric plant led the commission to say: "The evidence discloses that under its ordinance the village actually eliminated the discount feature from the commercial lighting schedule and that about the first of 1921 it commenced adding the demand charge to the energy charge for installations of less than 20 hp., instead of using this charge as a minimum bill only. There can be no doubt that these deviations result in an increase in revenue to the utility, and under the law we do not feel that the utility is justified in deviating from a standing policy with regard to rates (even though a literal interpretation of the rates on file might warrant such change) without resorting to a formal proceeding. We might therefore order a return to the rates charged prior to the unauthorized changes. However, in this case the interested parties have indicated their desire to have the commission fix rates consistent with the costs of service and this we will attempt to do."

Depreciation Reserve in Its Relation to Continuous Efficient Service.—Reversing a decision of the former commission holding that the reasonableness of telephone rates should be determined upon the basis of property in the local area, the existing New York Public Service Commission has declared that rates should be considered on the basis of the company's statewide activities. In the course of its finding the commission said: "A public utility is under a special and unique obligation to put back in its business and in its structural property every item which becomes necessary from time to time to insure that the consuming public shall receive the most efficient service both in quality and extent. In fact, it must continue to furnish the same service during its life which it does when it is new, and theoretically at its high-water mark of efficiency. This responsibility, it is needless to say, is a special one in that it does not rest on the ordinary business concern. So that it is well said, 'The value of the service of a utility is not measured by the unexpired service, but by the unexpired service plus the additions necessary to furnish the required service.' And in viewing utilities we should regard them as theoretically capable of continuous operation at the capacity mentioned. That is, utilities must maintain intact their capital investment, and when rates of depreciation are estimated and set up in accordance with rules, well defined and tested by experience, the actual sums standing to the credit of depreciation reserve are to be regarded as having been paid by the ratepayer to insure continuance of the required service."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Assessing Damages Caused by Right-of-Way.—In sustaining damages assessed against the defendant in Foley vs. Iowa Electric Company because of the construction of a high-tension transmission line across the plaintiff's land, the Iowa Supreme Court held that neither the overruling of objections to hypothetical questions where the verdict showed that the answers given to these questions were considered of no value nor the admission of cross-examination of defendant's witnesses in regard to the difference as to danger between insulated and uninsulated wires and between substantial and less substantial erection was prejudicial to the appellant company. (185 N. W. 13.)[*]

Bill to Enjoin Rates Fixed by Municipality Must Allege Them Unreasonable.—Affirming the dismissal of a suit in equity to enjoin electric and water rates (Bell vs. Kaye), the defendant being the owner of the utilities but the rates having been fixed by the Mayor and Aldermen of Booneville, the city served, the Supreme Court of Mississippi held that inasmuch as the appellants, although they attacked the ordinance as void, did not allege that the rates complained of were unreasonable or offer to pay a proper rate, they were not entitled to relief, even though the ordinance was not in conformity with statutory requirements, the ordinance not being the foundation of the right of the defendant to collect charges for service furnished. (89 So. 110.)

Commission's Power Over Equipment in Public Streets.—The City of Yakima, Wash., brought suit against the Department of Public Works (formerly the Public Service Commission) to compel it to order the Pacific Power & Light Company, which has a water department, to remove a wooden main from the street. The Supreme Court of Washington, holding that the condition of the main was not such as to make its removal necessary, refrained from passing on the legal question whether the commission has jurisdiction to determine controversies between a municipality and a public service corporation in regard to the character of the equipment the latter must maintain on public streets in order, in the language of the law, "to promote the security or convenience of the public or employees." (201 Pac. 778.)

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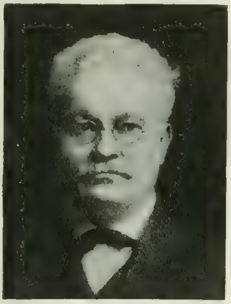
[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Andrew J. O'Reilly has been appointed as a member of the Missouri Public Service Commission, succeeding Edward Flad, who recently resigned. Mr. O'Reilly was born in Montgomery County, Mo., fifty-eight years ago. He is a civil, mechanical and electrical engineer, but has spent the greater portion of his life in construction work in St. Louis. He was supervisor of city lighting from 1900 to 1903, engineer of the St. Louis Fire Prevention Bureau during the World's Fair in 1904 and president of the Board of Public Improvements from 1905 to 1909. He holds membership in the American Institute of Electrical Engineers, the American Association for the Advancement of Science, the St. Louis Engineers' Club and the St. Louis Academy of Science.



A. J. O'REILLY

Alex G. Robb has been appointed assistant to the president of the Niagara Falls Power Company, Niagara Falls, N. Y., and assistant general manager of the Canadian Niagara Falls Power Company, Niagara Falls, Ontario. Mr. Robb has been connected with the Niagara Falls Power Company since 1902 and until recently was superintendent of the Canadian Niagara Falls Power Company and of the Niagara plant of the same company.

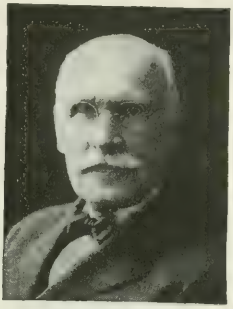
Joseph H. Becker, commercial agent of the United Electric Light & Power Company of New York, was operated on last week for appendicitis and gall stones. His many friends in the industry will be pleased to learn that the operation was successful and that Mr. Becker is on the road to recovery.

A. E. Wishon, who is general manager of the San Joaquin Light & Power Corporation, has been appointed chairman of the committee on amendments to the constitution of the Pacific Coast Electrical Association by the president, A. R. West. The committee will have the important work of revising the constitution to meet the recent change in name of the organization and will consider as well the various other suggestions toward broadening its field which have been brought up within recent months. Mr. Wishon was president of the association last year and is in close touch with its affairs.

H. O. Garman, the newly elected president of the American Association of Engineers, served as chief engineer and consulting engineer with the Indiana Public Utilities Commission and the Indiana Railroad Commission for more than thirteen years. This position he resigned on Dec. 31, to give his entire time to private interests. Mr. Garman, after graduating from the civil engineering course at Purdue University in 1902, began his engineering career as a track apprentice on the Illinois Central Railroad and after three summer seasons was made assistant engineer. Mr. Garman has been closely associated with the public utilities and has written several standards covering the service of gas plants, electric plants and central-station heating plants. He was also instrumental in placing the engineers and surveyors' license law on the statute books of Indiana. Prior to this work he was for ten years a teacher of engineering at Purdue University. He is a member of the American Railway Engineering Society; the American Society of Civil Engineers and the American Institute of Electrical Engineers.

H. O. GARMAN

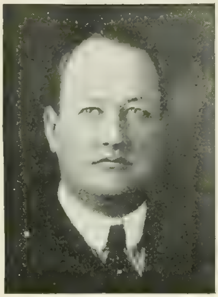
Albert W. Smith, formerly dean of Sibley College, Cornell University, is now connected with the firm of Henry R. Kent & Company, engineers and constructors of New York and Boston, as their consulting engineer. Dean Smith's work will be particularly in consulting on thermodynamics and the mechanical engineering of chemical plants. He took first and second engineering degrees from Sibley College, and after holding a fellowship in Cornell for one year he served as assistant professor in Sibley College for four years. He was then professor of machine design for one year in the University of Wisconsin and the following year became professor of mechanical engineering in Leland Stanford, Jr., University, in California. He held this professorship for twelve years until he was called to Cornell University as dean of Sibley College, which position he held from 1904 until 1920. During the interval between the resignation of President Schurman and the recent inauguration of President Farrand, a period of a year and a half, Dean Smith was acting president of Cornell University.



A. W. SMITH

R. H. Heising of the engineering laboratory of the Western Electric Company has been awarded the Morris Liebman prize of the Institute of Radio Engineers for the most important contribution to the radio art in the preceding twelve months. Soon after entering the radio research field in 1913 Mr. Heising was connected with the Montauk-Wilmington-Washington wireless experiments and later with the Paris-Arlington tests. During the war he was engaged in the development of circuits for aeroplane and submarine-chaser wireless sets. Recently his efforts have been devoted to the study of radio systems for extending existing Bell telephone service to locations which cannot be reached by wire.

W. C. Starkey, formerly chief engineer of the Ohio Brass Company, Mansfield, Ohio, has been named vice-president and directing engineer of the Stevenson Gear Company, Indianapolis, Ind.


F. H. LEGGETT

F. H. Leggett, who has just been made general manager of telephone distribution for the Western Electric Company, is a graduate of Dartmouth College. He joined the clerical force of the Western Electric Company in 1898, being advanced in 1902 to be secretary and treasurer of the company's Japanese subsidiary, the Nippon Electric Company of Tokyo. In 1906 he became manager of the Bell Telephone Manufacturing Company of Antwerp, Belgium, and from 1909 to 1912 he was foreign sales manager for the parent company, his headquarters being in New York City. He was Pacific district manager, with headquarters at San Francisco, until 1917, New York district manager until 1919 and Eastern district manager, with headquarters at New York, until 1921. While at San Francisco Mr. Leggett was active in the affairs of the Electrical Development League in that city, serving one term as president. At New York he has been vice-president of the Electrical League and at the present time he is a director.

H. M. Thompson will represent the Quigley Furnace Specialties Company, New York, in the Chicago territory. He was formerly identified with the Thomas Moulding Brick Company. He succeeds Bell & Gossett, former agents for the Quigley company. His headquarters will be at 105 West Monroe Street.

John J. Murray, for more than four years in the New York district sales office of the Morgan Engineering Company, 129 Broadway, is now associated with K. I. Clisby & Company, 233 Broadway, New York, representatives of the Ohio Electric Controller & Manufacturing Company, the Magnetic Manufacturing Company and other manufacturers.

Nelson S. Moore, who has been secretary of the Electric Power Equipment Company of Philadelphia for the past five years, has severed his connections with that company and entered sales work in Chicago with Nelson S. Moore & Company.

G. G. Thompson, formerly electrical engineer designing control apparatus and resistors with the Cutler-Hammer Manufacturing Company, has become connected with the Ward Leonard Electric Company, Mount Vernon, N. Y. For the present his attention will be largely directed toward the commercial development of the magnetic theater dimmer and other electrical equipment for the theater. He brings to his work eighteen years' experience in electrical engineering effort, having spent three years with F. F. Van Tuil, consulting engineer, Detroit, three years with the American Electric Fuse Company, Muskegon, Mich., as chief engineer and twelve years in design and control with the Cutler-Hammer Manufacturing Company, Milwaukee.

H. A. Brinkerhoff, who for twenty-five years was with Westinghouse, Church, Kerr & Company and their successors, Dwight P. Robinson & Company, Inc., has resigned and entered consulting engineering practice with R. W. Stovel under the firm name of Stovel & Brinkerhoff. In 1893 Mr. Brinkerhoff entered the service of the C. & C. Electric Company as mechanical draftsman and three years later joined the forces of Westinghouse, Church, Kerr & Company. In the years that followed he held the positions of draftsman, chief draftsman, superintendent, general superintendent, engineer in charge and managing engineer. While with the company he was responsible for many large construction projects, having had charge of the installation of all mechanical and electrical equipment in the Pennsylvania Station, New York, the design and construction of United States Nitrate Plant No. 2 at Muscle Shoals, Ala., and the design and construction of the Winnipeg passenger terminal of the Canadian Pacific Railroad. He has also superintended the design and construction of many industrial plants and power plants. He is a member of the American Society of Mechanical Engineers.

A. B. COLE

A. B. Cole, formerly assistant to the manager of the department of publicity, Westinghouse Electric & Manufacturing Company, has resigned this position to become president of Andrews, Brown & Cole, Inc., successor to the Morton Company, Cleveland. Mr. Cole was graduated in 1909 from the School of Electrical Engineering, Purdue University, where he made a specialty of steam and electric railway studies. Upon leaving school he entered the engineering apprenticeship course of the Westinghouse company, completing it in 1911. While taking the course he was engaged, in addition to the regular shop testing, on railway project work in the general engineering division and as a railway sales correspondent at East Pittsburgh and afterward in the Cincinnati district office. During the war Mr. Cole co-operated on publicity matters with the American Electric Railway Association war board at Washinggton.

Obituary

David J. Braun, a pioneer in the lighting-fixture field, died in Chicago, Dec. 26, at the age of seventy-nine. Mr. Braun came to America from Germany in 1866. In 1874 he went to Chicago and in 1889 he formed the David J. Braun Manufacturing Company. Later this was consolidated with the Beardslee Chandelier Manufacturing Company. The factory of the Braun Company is said to have been the first in Chicago to make lighting fixtures.

Walter J. Richards, chief engineer of the National Brake & Electric Company of Milwaukee, Wis., died on Nov. 22, after a long illness. Mr. Richards was born in Dodgeville, Wis., in 1871, and was graduated from the University of Wisconsin in electrical engineering in 1895. The following year he spent at the university as a fellow in engineering. He then went East and was employed at the Westinghouse plant at East Pittsburgh, Pa. Mr. Richards' life work was virtually all with the Westinghouse industries, with the exception of a short period when he was connected with the Bullock works at Cincinnati. He was chief engineer of the National Brake & Electric Company of Milwaukee for many years. While in the service of this company he took out many patents in connection with air compressors, air-controlling devices and electrical appliances.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Hollow-Ware Outlook Excellent

GOOD business in electric appliances for table service is in sight for 1922. A leading manufacturer of these devices states that from coast to coast the holiday trade exceeded expectations and that the stocks of jobbers and retailers were greatly reduced and in many cases practically depleted by the Christmas demand. While many lines of appliances, especially of the more expensive kind, slumped heavily during the latter part of the year, these lighter appliances moved very well indeed throughout the fall. Toasters, irons, grills and percolators were in particularly good demand, and toward the end of the year some manufacturing by night shift was necessary to fill rush orders from distributers. On this class of appliances very little complaint is now heard as to prices, and a gradual healthy increase in buying for distributers' and retailers' stocks is anticipated. Manufacturing for stock is going forward steadily; raw materials are plentiful, and the stage is set for a thoroughly good year's business in the lighter socket appliances valuable in the dining room and kitchen. Some development work is also under way in cooking apparatus, and a larger line of ranges is soon to be placed on the market by one of the representative appliance makers.

Vacuum Cleaner Sales Good with Prospects Bettering

MANUFACTURERS of electric vacuum cleaners are a unit in looking forward to 1922 with optimism, according to a survey of that field just completed by the ELECTRICAL WORLD. They agree further that instead of merely taking orders every salesman will have to work hard for almost every sale, but by doing this, by training the men more thoroughly and by developing more effective selling methods they expect to continue increasing sales.

General business conditions, of course, will have their effect on retail sales. It is here that a ray of hope is found by some manufacturers, who believe that most sections of the country have passed the worst of the depression and that conditions will improve gradually. One manufacturer believes that general conditions will be about the same in 1922 as in 1921, but expects to bring sales during the coming year up to the 1920 level by sheer sales effort.

The condition of jobbers' stocks is another encouraging factor in the situation. It is noticeable that distributers have been carrying very low stocks during the last six months and have been ordering hand-to-mouth. Thus, jobbers start the new year with little carry-over, the very opposite of the condition in January, 1921. Frequent orders for small lots have been coming in from both distributers and retailers during the last four months, and any sort of improvement in business will react immediately on the manufacturers. The increasing number of wired homes is another consideration. It is estimated that between four and five million wired homes are without vacuum cleaners and that this number is being added to at the rate of one million annually. Each of these homes is a prospect for a vacuum-cleaner sale.

Total sales during 1921 for various companies run from 75 per cent to 85 per cent of 1920 sales. Some companies report greater business than last year, but this is accounted for by the extension of distribution into territories not covered before. These percentages are below current sales, which have shown much improvement in the last four months. One company reports that November, 1921, sales equaled those in December, 1920. The average for the year is pulled down, however, by the dull months of last spring and summer.

Prompt shipments are the rule, the time running from one day to a week. There have been no startling price reductions on cleaners in the past few months, though there have been some drops. Several manufacturers are including a set of attachments free with each cleaner and state that they have increased sales in that way. Practically all manufacturers declare there is little likelihood of a price cut soon and some even state that they do not intend to make any change in price during all of 1922.

Year's Construction Only 8 per Cent Under 1920

THE total amount of construction contracts let in the twenty-seven Northeastern states during 1921, according to figures compiled by the F. W. Dodge Company, was only 8 per cent under the 1920 total. It is doubtful if any other business fared so well in 1921 as the construction industry as a whole has, even though the volume of construction has been so unevenly distributed as to classes of projects and as to locality.

The predominating factor in the year's program was residential building, which amounted to $880,052,000, or 37 per cent of the 1921 total, and represented an increase of 54 per cent over 1920 residential construction. Public works and utilities took second place, amounting to $459,184,000, or 19 per cent of the year's total. Other important items were: Business buildings, $336,920,000, or 14 per cent; educational buildings, $242,562,000, or 10 per cent (this figure representing a very considerable increase in a number of projects and in total value over 1920), and industrial buildings, $173,325,000, or 7 per cent of the year's total.

December building contracts amounted to more than for any previous December with the exception of December, 1919. The total amount of these contracts was $198,518,000, an increase of 3 per cent over the November figure, whereas December usually shows a decline from November. The closing month of 1921 showed an increase of 98 per cent over the corresponding month of 1920.

Beech-Nut Decision Creates Further Confusion in Resale Situation

JUDGING by the comment heard from all sides on the decision of the United States Supreme Court in the Beech-Nut Packing Company resale case, the situation is as badly snarled up as before. In the decision, largely important to other lines of business, the court upheld a ruling of the Federal Trade Commission that the resale price maintenance policy of the Beech-Nut company constituted an unfair method of competition. At the same moment the court declared the company to have the right of refusal to sell to dealers who fail to observe suggested resale prices.

The Beech-Nut case was brought under the federal trade commission act, empowering the commission to issue orders compelling the discontinuance of "unfair methods of competition." The Supreme Court holds that the Beech-Nut system goes far beyond the simple refusal to sell goods to persons who will not sell at stated prices, which in the Colgate case was held to be within the legal right of the producer. The court expressed the opinion that the order of the Federal Trade Commission was somewhat too broad and suggested that the commission should have required the company to cease and desist from the co-operative methods by which the company and its distributers, customers and agents undertake to prevent others from obtaining the company's products at less than stated prices.

These co-operative methods, which constitute the illegal act, include the reporting of names of dealers who do not observe resale prices, enrolling of dealers upon lists of undesirable purchasers who will not be supplied with products of the company unless they give satisfactory assurance of their purpose to maintain such prices in the future, employment of agents to report dealers who do not observe resale prices, and utilizing numbers and symbols marked upon goods containing the company's products with a view to tracing dealers who may have sold at less than the suggested prices. As described in the daily press, the decision is a complete defeat for the Beech-Nut company and for the practice it followed.

However, counsel for the Beech-Nut company has issued a statement to the effect that the right of the company to decline to sell to dealers who do not observe the fair resale prices suggested has been sustained and that such refusals to sell, *per se*, are without any purpose to create a monopoly and do not violate Section 5 of the federal trade commission act. Thus two dissimilar views are presented with uncertainty still present.

Clarifying legislation is being urged by manufacturers, and a bill, known as the Stephens-Kelly bill, has been presented to Congress. Meanwhile Joseph E. Davis, counsel of the American Fair Trade League and former chairman of the Federal Trade Commission, is preparing an opinion on the scope of the decision.

Tax Law Allows for War Machinery Loss

A CLAUSE in the new tax bill which so far has been little commented upon will save American manufacturers large sums in taxes, estimated at as high as $1,000,000,000. Subsection 8 of Section 234 of the new tax law provides that in the case of buildings, machinery, equipment or other facilities constructed or acquired for the production of articles contributing to the prosecution of the war deduction may be made from the income tax to the extent of the difference between the cost of that equipment and its value today. Those who wish to take advantage of this provision, however, must file their claims not later than March 15, 1922. The provision has been in the tax law since 1918, but could not become effective until the state of war was officially ended.

Dealers and Consumers' Lamp Stocks Almost Liquidated

THE most important factor in the lamp business of the last six months and that of the coming six months, according to a large lamp manufacturer recently interviewed, is the liquidation of stocks in the hands of dealers and particularly of consumers. The situation in the middle of 1920 was that of large stocks in the hands of industrial consumers and some residential consumers. Use of individual lamps became less, of course, with night shifts not working and their life became relatively longer. Thus industrial concerns were not forced to replenish their stock as often as before and in most cases followed the policy of having on hand about 25 per cent of their ordinary replacement supply. With the lessened use of the individual lamps it took some time to reduce their stocks to this extent. Agents are beginning to report better sales to industrials and this would indicate that surpluses have been about used up. While demand for industrial lighting will continue to be considerably less than in 1920, it should improve from now on.

Dealers also have been conservative and have followed the same policy of carrying small though complete stocks. The "Mazda" companies can maintain a close check on agent stocks and it is reported that they are small. Thus the livening of industrial demand will react at once on the manufacturers.

Another indication of good business ahead is the residential construction going on. The large building total of the months since September has been largely residential. In addition, the wiring of old houses has proved a source of good business for the contractor and through him for the lamp manufacturer.

Production during the fall for various companies ranged between 50 and 75 per cent. It is improving now, most of the companies being in a position to increase it the moment they feel demand bettering.

Cut Freight Rate to Pacific Coast on Electrical Goods

REDUCTIONS in freight rates from Eastern territory to Pacific Coast points on electrical appliances and supplies and electrical machinery and several other commodities have been announced by the Southern Pacific Railroad. The old rates on electrical appliances, electrical machinery and supplies, including empty electrical storage and battery boxes, range from $3.25½ per 100 lb. from New York to $2.66½ from Kansas City. The new rates will range from $2.89 to $2.40 from these points. Changes will become effective as soon as the tariffs can be published.

Reports come from the Intermountain territory that the electrical jobbers there are considerably agitated over this reduction of through rates to the Pacific Coast without corresponding reductions in the rates to interior points. It is believed there, according to interviews given a representative of ELECTRICAL WORLD by large jobbers, that if the Interstate Commerce Commission cannot be persuaded to make concessions to the Mountain States, the jobbing territory commanded by Salt Lake City and Denver will be materially reduced and business in general seriously damaged. Strong and concerted effort is being exerted to bring about the realignment of rates, and the governors of five mountain states are preparing data to put before the commission to show the damage likely to be brought about by the differential between the interior and the coast.

Metal Market Situation

BUYING of copper has been light since the first of the year, and dealers who were willing to shade prices have been able to take all the orders which have come into the market. Thus consumers have been able to place their contracts at as much as ⅛ cent under the quotations of the leading interests.

The leading selling agencies have done all in their power to hold up quotations and are refusing to sell under 13⅞ cents to 14 cents per pound, delivered, for the first quarter. Admittedly little business is being done at these prices.

The available surplus has been largely reduced, amounting on Jan. 1 to about 500,000,000 lb. The total supply during the year was 1,655,000,000 lb. Exports during the year amounted to 587,000,000 lb., while domestic withdrawals amounted to 572,000,000 lb.

NEW YORK METAL MARKET PRICES

	Dec. 31, 1921	Jan. 10, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	66 2 6	66 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.87½	13.75–13.87½
Electrolytic	13.75	13.62½
Casting	13.00	13.00
Wire, base	15.00 15.25	15.00–15.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.50	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.50	8.50
Zinc, spot	5.15–5.20	5.12½–5.17½
Tin, straits	33.12½	32.37½
Aluminum, 98 to 99 per cent	19.00	19.10
OLD METALS		
Heavy copper and wire	11.50–11.75	11.25–11.50
Brass, heavy	5.25 5.50	5.25–5.37½
Brass, light	4.87½–5.00	4.87½–5.00
Lead, heavy	4.00–4.12½	4.00–4.12½
Zinc, old scrap	2.50–2.75	2.50–2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS, as might have been expected with so many forces pulling and pushing, has been spotty the last week. Inventories and the reaction from the holidays continued to curtail activity; lower stocks, firmer markets on a few materials and active building joined in helping sales. Boston reports good movement of transformers and weakness in some wiring materials. Jobbers there have low appliance stocks. Chicago notes good movement of high-tension equipment, but trouble over the Landis decision is still affecting building. In St. Louis residence construction is taking a good deal of wiring materials, but other lines are sluggish. Air heaters in Atlanta are dormant, while sales of safety switches are very good. In the Intermountain region cold weather has halted building. Mining, however, has been partly resumed there.

Some price changes are reported, fir cross-arms going up thirteen points and insulators being cut 10 per cent. Rubber-covered wire has become firmer in San Francisco and in the Northwest.

NEW YORK

Although the electrical trade looked generally for a quiet period after the first of the year, business has not been entirely dull. In fact, buying has been more active than had been expected, which is a very encouraging sign. Jobbers report that wiring supplies are moving steadily and there is a tendency on the part of some contractors and dealers to buy in quantities somewhat in excess of their immediate requirements. More inquiries for material in large quantities are appearing. This would indicate that building operations are on the increase.

There has been a good demand for the unit-type lighting fixtures from merchants and commercial houses. While a number of these are being installed in newly constructed buildings, jobbers' salesmen state that at least one-half of their sales have been made to replace old-type fixtures. Another indication of the improvement in general business conditions is the increase in incandescent lamp sales. In addition to the usual sales to replenish stocks, jobbers report that industrial companies which have been partly or wholly shut down are buying lamps in large quantities.

The general attitude of the trade is one of confidence and satisfaction with the gradual improvement in business. There is little inclination to quarrel with present conditions, which are really better than was anticipated two months ago, and the most conservative look for a steady increase.

Conduit.—Stocks are good and there is a fair demand, although sales are mostly in small or moderate size quantities. Prices remain about the same as last reported. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $45 to $46; ¾-in., $58 to $59, and 1-in., $83 to $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $50 to $51, $65 to $66 and $92 to $94 per 1,000 ft

Rubber-Covered Wire.—There is little change in conditions in the wire market. A moderate but steady demand prevails. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks are good.

Heavy-Duty Cord.—The manufacturers of Duracord have announced an increase in the price of this material of from 20 to 25 per cent, depending on the size. This increase has been caused, it is stated, by the higher cost of raw materials and the fact that former prices were out of line with the cost of manufacture.

Flexible Armored Conductor.—Demand for this material continues to be very active, and jobbers have only small reserve stocks on hand, although deliveries from manufacturers are better. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft. and double-strip at $47 per 1,000 ft. in lots of that quantity.

Lamp Cord.—Demand is only fair and jobbers' stocks are good to large. Prices remain unchanged. No. 18, cotton, twisted is quoted at $12.90 per 1,000 ft., and the parallel at $15.60 per 1,000 ft. in that quantity.

Heaters.—There has been a fair demand for air heaters of the reflector type. Colder weather and the recent drop in prices seem to have stimulated sales.

Heating Appliances.—Jobbers report that household devices have been fairly active since the first of the year as the dealers are filling up broken lines which were depleted during the holiday rush.

Lamps.—Sales have been exceptionally good since the first of the year. Part of this, of course, is after-inventory buying, but large orders have lately been received from industrial companies whose factories have been idle.

CHICAGO

The merger of several Chicago banks has affected the electrical industry but slightly, the smoothness of the operation seeming to quiet rather than to startle business. The general sentiment appears to be one of approval. Another event of interest was the action taken by the Building Trades Council in rejecting the Landis wage award and deciding to stand by the "outlawed" unions. Although this controversy is slowly being threshed out, it can have little effect on the small seasonal building going on, and very little in the way of results can be expected until spring.

Considering the time of the year, the slump of wiring materials is causing little worry. Most of the jobbers feel that with another week devoted to analyzing 1921 sales figures and estimating 1922 business, they will be ready to start forward again. Electrical materials in general have slowed down like other merchandise at the present time, even with newly lowered prices. The only active commodity at present seems to be high-tension equipment, which is moving well.

Wire.—Buying of No. 14 rubber-covered wire has slumped somewhat during the past week and the stiffened prices have not stimulated trade to any noticeable degree. It still sells for $6.85 to $7 per 1,000 ft. in 5,000-ft. lots. However, jobbers report fairly active sales of weatherproof and bare wire. Weatherproof is quoted at 16¾ cents and the bare-wire base is the same. Stocks of these materials are ample.

Flexible Armored Conductor.—A few jobbers report fairly good activity, but considering the trade as a whole the movement has been sluggish. Jobbers have sufficient stocks on hand to supply demand. No. 14, two-wire, double-strip, in lots of 5,000-ft. sells at $47.50 per 1,000 ft. The same size in the single-strip sells for $45 per 1,000 ft.

Heating Appliances.—Slight price reductions have gone into effect on appliances built by two manufacturers. However, this has produced very little buying on the part of the public during the past week, and dealers state that the people still interested in appliances are looking around for bargains.

High-Tension Equipment.—A sale of a 2,400 kw., 22,000-volt outdoor substation has been made to an automobile plant during the last week by a manufacturer. In addition a sale of a 1,500-kw., 66,000-volt outdoor substation for a copper mine was reported. This company shipped orders during the week for 66,000-volt outdoor substation fittings to China and 22,000-volt substation fittings to Honolulu.

Lamps.—The demand for lamps is still continuing, and jobbers report that the 25-kw. mill type is selling well. The movement of higher voltage lamps is fair.

BOSTON

Business in the electrical field continues with little change, following the opening of the year. Jobbers' stocks were pretty substantially reduced last year, but as yet there has been insufficient quickening in demand to cause active buying, purchases continuing on a hand-to-mouth basis. Prices are holding firm, barring a weakness in attachment plugs said to be due to accumulated factory stocks. Building operations are going forward on a better scale than some time ago, but nothing spectacular is reported in new contracts. Central-station outputs are holding up remarkably well and in not a few cases increased substantially during 1921. Easier money conditions tend to release more distribution system construction as time passes. Industrial heating equipment is in better demand, and a large transformer order from Japan has been received at the Pittsfield works of the General Electric Company, with some increased domestic orders from Southern transmission companies. Manufacturing in New England is doing well on the whole, except in the metal fields.

Motors.—Small-order business dominates the market, with some activity in proposition work. Deliveries are prompt, with some variations among manufacturers as to ability to make immediate shipments from stock. Prices reflect no changes of importance.

Lamps.—Fair sales are being made, with stocks easily meeting requirements. Sales efforts on lamp-using devices have resulted in a healthy growth of business.

Wire.—Routine orders are about all that are going through at present. No. 14 rubber-covered wire sold Monday at $6.75 per 1,000 ft. in 5,000-ft. lots, and weatherproof was moving slowly around 16½ cents base. For some months increased wire installations will be in progress on Massachusetts distribution systems, as the companies gradually overcome the effects of the great November storm. Interior wiring is under way with better volume.

Transformers.—Distribution transformers are not moving very actively, but there is some improvement in demand for large power transformers for hydro-electric developments. A slow revival in the former class of apparatus is anticipated, but better rather than poorer business is looked for henceforth.

Appliances.—Post-Christmas trade in vacuum cleaners showed some signs of life in retail circles. Considerable interest in retail appliance sales was apparent before the old year ended, apart from holiday trade. The washing-machine market continues dull, but the lighter appliances are in fair demand and a good outlook for the year is generally expressed. Jobbers' stocks are so low that replacement buying is not likely to be long deferred.

Industrial Heating Equipment.—A better demand is reported on immersion heaters for tank service. Interest in flat-type heaters is good and central-station power engineers are working on extending the applications of both standard and special equipment for process heating.

Loom.—Ample stocks are still reported and sales are moderate. In 5,000-ft. lots, $\frac{7}{32}$-in. loom sells at $16 per 1,000 ft., and ¼-in. loom at $19.

ATLANTA

All electrical dealers report a very satisfactory business during the holidays, though a general slumping off is in evidence now owing to inventory. That conditions are on the upward trend is evidenced by the fact that bank clearings for the week ending Dec. 24 were approximately $2,000,000 in excess of those for the same period last year. Building permits in Atlanta for the year 1921 amounted to approximately $12,000,000, $2,000,000 below the figure set for 1920. This drop is due, however, to the decline in the cost of building materials and labor and not to a lesser activity in construction, and all indications are that a new high mark will be reached in 1922. Building reports from all cities in this section compare favorably with that of Atlanta.

Non-employment continues to be a problem, although some improvement has been made in some parts of the Southeast, statistics showing the decrease of non-employment in Atlanta to be 4 per cent and in Birmingham 1½ per cent. Work on certain hydro-electric developments that had been stopped during the past few years has started again, and this will tend to absorb some of the unemployed in this section.

Lighting Fixtures.—One of the largest jobbers reports a very fair volume of business in both the residential and commercial lighting fixture lines, though most of the orders are coming from Atlanta. Prospects, however, are bright as regards business in the section as a whole as soon as spring building gets under way. All jobbers report satisfactory stocks on hand.

Portable Lamps.—All dealers report excellent sales in the mahogany-stand and silk-shade types, though the metal lamps are selling only fairly well. Stocks of the former type are depleted. No change in prices is anticipated for some time to come.

Air Heaters.—This line continues dormant on account of the very mild weather in this section and jobbers are anticipating little movement even should cold weather materialize, due to the lateness of the season. Stocks are very heavy, and consequently there will be a large carry-over.

Poles.—No unusual activity is to be noted in the movement of poles, such orders as are received being for maintenance work. While there is a fair demand for all varieties, cypress leads in popularity. A price reduction of 5 per cent on Northern white cedar poles was announced several weeks ago. Producers have excellent stocks and shipments are prompt.

Safety Switches.—As has been the case for some time, the sales in this line are on the increase, and while all sizes are going well, the 30-amp., two-wire switch leads in demand. Stocks are on hand to satisfy normal requirements.

Vacuum Cleaners.—All jobbers report good sales of this specialty during the holidays, and consequently stocks are low. There are no changes in price reported.

ST. LOUIS

A comparison of the building permits for 1921 and 1920 for new work and alterations in the city of St. Louis is of interest in studying the present opportunities for the sale of electrical goods in that field and the changes which must occur in the construction program to improve the sale of electrical materials. The total volume of work authorized in 1921 was slightly less than that in 1920, the respective values being $16,631,305 and $17,694,078, but the volume of strictly new work was slightly greater, the values being $13,805,464 and $13,321,778. Construction of new dwellings and hotels was very much heavier in 1921, amounting to $7,236,695, as compared with $2,281,070 in 1920. The construction of store buildings took a decided slump, amounting to only $787,858, as compared with $1,757,900 in 1920. The biggest decrease occurred in the construction of new manufactories and workshops, which amounted in 1921 to only $668,900 and in 1920 to $3,112,740.

At the present time construction work is divided in about the same proportions as shown above. It is therefore easy to see why it is that rubber-covered wire in small sizes, schedule materials and equipment used by central stations in the distribution of electricity have been experiencing a good demand, while motors and other industrial equipment have had dull movement. Expansion on the part of the industrials is necessary for any material improvement in the sale of electrical goods, and it is very encouraging to note increased activity on their part. Their operations are not much greater than they have been for several months past, but they are apparently anticipating early improvement, for they are making active inquiries regarding the costs of electrical equipment.

Cross-Arms.—A thirteen-point advance in price was made effective Jan. 1 on fir arms. New representative quotations on 3¼-in. x 4¼-in. fir arms, f.o.b. St. Louis, per 100, are: 3-ft., $51.38; 4-ft., $68.31; 6-ft., $102.77; 8-ft., $137.03; 10-ft.,

$152.25. St. Louis stocks are in good shape. Movement is fair, orders being for small lots. Utility stocks are in general low.

Poles.—Prices are slightly higher, representative quotations for Northern white cedar poles, 7-in. tops, f.o.b. St. Louis, in carload lots, being: 30-ft., $8.90; 35-ft., $14.60; 40-ft., $18.65; 45-ft., $21.75. Prompt shipment can be given. Movement is very slow and orders are small.

Insulators.—A price decline of about 10 per cent is announced. Sales have been reasonably good and fair stocks have been built up locally. Central-station stocks are conservatively low. A much-used form of 4,000-volt insulator is selling for $65.28 per 1,000 in lots of 1,000.

Pole Line Hardware.—Prices have remained virtually constant for several months. Conservative stocks are maintained by both jobbers and utilities, and sales have been reasonably satisfactory. Judging by inquiries received, considerable pole-line construction is under consideration.

Packing-House Cord.—The railroads have been good buyers recently, and the total movement is good. No. 14 cord, in lots of 5,000 ft., is selling for $29.36. Stocks are in line with market requirements.

Street-Lighting Cable.—Sales have been very light, and stocks are being maintained on a low basis. No. 8, solid single-conductor, 3,500-volt, is being sold for $140 per 1,000 ft., f.o.b. factory.

SEATTLE—PORTLAND—SPOKANE

A review of conditions at the close of 1921 indicates unmistakable progress on the road to recovery, and the program which is forming for the new year points to a continued forward movement. Bank clearings, postal receipts, building and shipping all show increases over 1920 or compare very favorably with that year's figures. One large oil company of Seattle finds it necessary to increase its storage facilities and will spend $1,000,000 on a new addition. The county in which Seattle is situated is beginning a building program which calls for the expenditure of over $500,000. A Portland lodge has begun construction of a new million-dollar home, and a large number of apartment houses are either started or projected for the near future. In addition many other buildings of considerable size, amounting to millions of dollars, are planned. Thus prospects for building are excellent.

In the electrical trade business has been rather slow during the past week as was expected. However, nothing but optimism prevails as to prospects for 1922. Portland jobbers report that although business is quiet compared with December it is better than it was a year ago. Inventories have been completed and show that overstocks have been practically eliminated and there is a much better balance of stock, although in the active lines quantities are greater than they were a year ago. Small discount changes have been arranged on electrical appliances so as to give the dealer buying smaller quantities the advantage of a larger discount. There is no longer any difficulty in getting stocks in from the East. Dealers of Portland report business good for this time of the year. Store sales are comparatively active and fixture installations are good. Contracting is largely a matter of finishing up work, but the outlook for the coming year is very promising. Dealers report very little overstock at the present time, and for the most part inventories are the order of the day.

Wire.—The demand for rubber-covered wire in Seattle remains fairly good with no pronounced change from previous weeks. Prices on both rubber-covered wire and weatherproof wire have advanced slightly during the past week. No. 14 rubber-covered advanced from $7 to $7.40 and No. 12 from $9.80 to $10 per 1,000 ft. in 5,000-ft. lots. The base price of weatherproof advanced from $17 to $17.50 per 1,000 lb.

Tape.—A steady demand for this material exists according to Seattle reports. No recent price changes have been made. Friction tape is quoted at $28.75 per 100 rolls in small lots. Rubber tape sells at $25.95 per 100 rolls.

SAN FRANCISCO

The new wage schedule for electricians was recently put into effect in San Francisco and the bay cities without opposition. It is $8 per day, the previous schedule having been $9.25 per day. Building prospects for 1922 are declared to be excellent. A feature of the work that is noticeable is the number of office and apartment buildings of from six to ten stories. There is also a considerable amount of theater construction which is now ready for the electrical work. The value of the building permits for December in the principal California cities is as follows: Los Angeles, $9,168,851; San Francisco, $2,007,705; Oakland, $2,149,756; San Diego, $1,775,711. The corresponding figures for December, 1920, are: Los Angeles, $3,803,838; San Francisco, $1,581,945; Oakland, $629,779; San Diego, $1,220,463. It will be noticed that Los Angeles and Oakland rank high. The total value of the building permits in the largest two cities for 1921 was: Los Angeles, $82,447,624; San Francisco, $22,244,672. San Francisco has suffered severely from its sixteen weeks of building strike.

Heating Devices.—New discounts from various manufacturers are now effective, their feature being the decreased number of appliances necessary for the maximum discount. Local stocks are good. Generally speaking, the stocks left over from last year are not so great as those carried over from the previous year, but this was due to careful buying on the part of the dealer because the Christmas just past was not so good as that of the previous year. A feature of 1922 sales is expected to be the waffle iron, on which improvements have been made.

Vacuum Cleaners. — Sales are increasing, remarkably good results being reported from window and entry demonstrations. Daily sales averaging five to ten machines are reported by several dealers in the big cities through stationing their demonstrators at their front entrances. Prices seem to be steady based upon cash prices of $55 to $60.

Rubber-Covered Wire.—No. 14 single-braid, solid, is now selling for approximately $7.50 per 1,000 ft. in 5,000-ft. lots, a slight advance over previous quotations. This commodity is expected to be steadier from now on with a constant upward tendency.

SALT LAKE CITY—DENVER

The past week has been characterized by a sluggish movement of stocks. Inventorying has been the chief concern of most retail houses, and hence there is little disappointment in the small volume of sales. The ready cash available was absorbed by the holiday trade, and this too is reflected in the general slow-up of business now. The Intermountain region has been in the grip of a cold spell which has halted building activities and depressed merchandising generally. The new year has started with the realization that collections are coming about as hard as ever. The old rule maintains—everybody waiting on everybody else. The banks, however, are showing more leniency and not insisting so much on immediate liquidations. Electrical jobbers report fairly heavy stocks in most lines with dealers still buying with utmost caution. The metal situation is much improved. The demand for electrical supplies is showing a gradual revival with the resumption of operations in various states. The construction jobs under way are rather scattered, and most of them are small. Colorado is reported to be in a fairly good condition. Idaho is passing through a period of extreme money stringency, with many bank failures reported. Montana is staging a good "come-back" with the revival of her copper mines and mills. Lack of money in circulation is conceded by all competent to judge to be the one big handicap to business.

Pole-Line Material.—Stocks are good, with demand at a low ebb. A dearth of construction work is responsible for the scattered and small orders. There has been no recent change in price schedule.

Copper Wire.—The market has shown a slight pick-up recently. A few small construction jobs have afforded the outlet. Prices are at a low level.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution
and Sales, News from Jobbers and Foreign Fields and a
Record of New Devices and Trade Literature

General Electric Gets Large Transformer Orders

The International General Electric Company starts the new year with one of the largest foreign power-transformer and lightning-arrester orders in its history. The order was received from Japan, according to word which has been received from the Pittsfield works, where all the company's power transformers are built. The order calls for machines of 350,000 kw. and is said to represent a value of $1,250,000.

The General Electric Company has received an order from a Southern power company for some very large transformers to be used on a 350-mile transmission line. Another good order was received from the Indiana Service Corporation for three large transformers for use at the Spy Run station of the Corporation.

New Pittsburgh Jobbing House Opened

The Peerless Electric & Fixture Company, a subsidiary of the Bluestone Incandescent Light Company, Ltd., Pittsburgh, Pa., has opened an establishment at 409 Smithfield Street, Pittsburgh, to deal at wholesale in electrical supplies, fixtures and radio material. A retail department also is to be conducted by the company.

Allis-Chalmers Bookings Show Slight Decrease

The bookings for December of the Allis-Chalmers Manufacturing Company, according to officials, dropped slightly below those for November, which had been announced as somewhat in excess of $1,500,000. The incoming business based on December orders would be at the rate of $18,000,000 annually.

Confidence in the outlook was expressed by officials of the company, who look for steadily improving conditions.

Black & Decker Announce Freight Allowance

The Black & Decker Manufacturing Company, manufacturer of portable electric tools, has announced that, effective Jan. 3, a freight allowance on shipments of 100 lb. or over to points in the United States and Canada will be made by the company.

This allowance will make it possible for jobbers to sell the company's product in the United States and Canada without adding anything to the price to cover freight.

The move has been advocated by the American Export Association in behalf of its jobber members.

Windmill Farm-Light System in Production

A farm-light plant, consisting of a generator, driven by a wind wheel, and storage cells, has been placed on the market by the Perkins Corporation, Mishiwaka, Ind. Engineers of the Perkins Corporation, which has made windmills for the last sixty years, have been working on the plant for two years in conjunction with those of the Westinghouse Electric & Manufacturing Company and the Hyatt Roller Bearing Company. The plant charges in any wind of greater velocity than 6 miles per hour. A governor on the wheel prevents it from turning any faster than 60 revolutions per minute. According to figures obtained by the Perkins Corporation from the government the greatest length of time a dead calm prevailed in any locality was not long enough to fully discharge the storage batteries of the plant.

House Organ for Contractor-Dealers Started

The Arrow Electric Company, manufacturer of wiring materials, Hartford, Conn., has started to issue *Chained Lightning*, a monthly house organ, for distribution to electrical contractor-dealers. The December issue was the second number of the magazine and contained helpful suggestions for the increase and improvement of the electrical business and a number of news items interesting to contractor-dealers and their customers.

Industrial Electrical Supply Jobber Moves

The Manufacturers' Supplies Service has moved its office from the Pennsylvania Manufacturers' Association headquarters in Allentown and Easton, Pa., to the Wil-Bor Theater Building, Seventeenth Street and Washington Boulevard, Easton. The company handles electrical and mill supplies for coal mines and industrials exclusively, covering the northwestern Pennsylvania territory.

George W. Roddy, who was formerly with the Westinghouse Lamp Company, is manager of sales and H. W. Ecker is in charge of the engineering service department.

Northwestern Electric Making Aluminum Rotor

A new development in motor construction has been announced by the Northwestern Electric Company, 408 South Hoyne Avenue, Chicago, which is building a squirrel-cage induction motor having an aluminum-alloy die-cast rotor. A feature of the motor is that it has twelve symmetrically distributed short projecting blades on both ends of the rotor in order to increase the circulation of air. The company has been working on the characteristics of this motor for more than a year, and the rotor is now perfected to give maximum starting torque for the power consumed. A resistance type electric furnace has been used in melting the aluminum alloy, which is poured into the casting at 1,400 deg. Fahr.

Milwaukee Engineering Company Formed

The Associated Engineers, Inc., has been formed for consulting engineering work by F. W. Ullius, Jr., W. E. Skinner and Ralph M. Kibbe. Mr. Ullius is president of the company, while the active management will be in charge of Mr. Skinner. Mr. Kibbe is secretary and treasurer.

Domestic and Fullerton Announce Merger

The Domestic Electrical Supply Company, Inc., 38 Park Place, New York, has been merged with Fred W. L. Fullerton, Inc., 15 West Twentieth Street, New York, effective Jan. 1. The new house will be known as the Fullerton Electric Company. Offices and stockrooms of the company will be at 230 West Seventeenth Street, New York, with a branch at 232 Market Street, Newark, N. J. Fred W. L. Fullerton is president and general manager of the company, and G. V. Weir is treasurer and assistant general manager.

Motor Outlook Encouraging, Says Boston Manufacturer

"Recent sales of motors in this country and abroad, coupled with inquiries now being received, warrant an optimistic view of this year's operations," declared M. F. Fitch, sales manager motor department, S. A. Woods Machine Company, Boston, last week to a representative of the Electrical World. Mr. Fitch stated that in response to the demand for this product improved machinery is being installed at the factory to increase its production and that a full line of motors up to and including 25 hp. rating is now being marketed. The Woods company is bringing out a line of individually driven woodworking machinery which is the first in the country to represent a co-ordinated unit built complete with motor by a single manufacturer.

Recent sales include ninety ¼-hp. motors for Cluett, Peabody & Company, Troy, N. Y.; eighty motors for the complete electrification of the L. B. Marble Chair Company, Bedford, Ohio; about sixty motors for the Colored Worsted Company, Providence, R. I., and about twenty-five motors for the new Manchester (N. H.) Arts School. Shipments have been made to Mexico, Japan and England, and foreign inquiries have increased materially of late. Agents on the Pacific Coast and in the Middle West report an improved outlook. Although the company has been manufacturing motors barely eighteen months, several thousand horsepower have already been placed in service.

Crane Award Goes to Cleveland Firm

The Department of Docks, New York City, has awarded a contract to the Wellman - Seaver - Morgan Company, Cleveland, manufacturer of electric cranes, for thirty-four cargo-handling cranes. This installation, the company says, will be the largest of its sort on this side of the Atlantic Ocean. The cranes are to be in operation within one year from the date of the award and will be installed on Piers 12 and 13 at Stapleton, Staten Island. The cranes are all of the semi-portal gantry type. Twenty-six are of 2½-ton to 5-ton capacity and eight are of 1½-ton to 2½-ton capacity. The smaller ones, the company has announced, will be of the Hamburg type, a type new to this country.

Form Westinghouse-Church-Kerr Alumni Association

The Westinghouse - Church - Kerr "Alumni Association" was formed recently at a dinner in New York, attended by 140 former employes of Westinghouse, Church, Kerr & Company, who met to renew the friendships made during their years of service with the company. The association was formed for the purpose of keeping that friendship alive, and the method of obtaining this result agreed upon was to meet every Wednesday for lunch at 180 Fulton Street, New York. All who worked for the company as many as three years are eligible for membership and are invited to get in touch with the secretary, A. H. Tummel, 131 Warwick Street, Brooklyn.

National Stamping Expands Factory Facilities

The National Stamping & Electric Works, 424 South Clinton Street, Chicago, have purchased the property and business of the Lindstrom-Smith Company, 3212-38 West Lake Street, Chicago, and also the land adjoining the latter's plant. When the proposed new extension is finished it will give a frontage of 405 ft. to the plant. The National Stamping & Electric Works have added a new line of appliances, among which are a combination stove and toaster and electric iron. It will also continue to manufacture the "White Cross" electrical household appliances.

Officers of New York Credit Association for 1922

Officers of the New York Electrical Credit Association were elected for the coming year at a meeting of the board of directors held at the Arkwright Club, New York, Dec. 21. F. A. Booth, Westinghouse Electric & Manufacturing Company, was elected president; H. P. Litchfield, Western Electric Company, was elected vice-president, and G. H. Potter, Sprague Electric Works, was elected treasurer. C. A. Kane, Atlantic Insulated Wire & Cable Company, was appointed viewpoint representative. The board of directors, before the meeting, attended a farewell luncheon given in honor of W. R. Conklin, retiring president, and A. F. Thatcher, retiring treasurer.

Sales Representatives Expand

The American Service Company, Pittsburgh, Pa., commercial engineers, has announced that it will expand its correspondence and office facilities to include the sale of household, factory and automobile electrical appliances. C. E. Burroughs is president of the company and I. V. Conneely is general manager.

Used-Machinery Company Opens at Fort Wayne

Articles of incorporation were filed with the Secretary of State recently by the R. & D. Electric Company of Fort Wayne, Ind. The capital stock is $100,000 and the company will engage in the sale and purchase of new and second-hand electrical equipment and machinery. The officers are Rhys Davies, president; W. Charles Dickmeyer, vice-president, and Leonard S. Scott, secretary and treasurer. All the officers are residents of Fort Wayne, and the company is prepared to start operations at once.

Ohio Brass Completes Malleable Iron Foundry

Operations have been started in the recently completed malleable-iron foundry of the Ohio Brass Company at Mansfield, Ohio., according to announcement of the company. The addition to the plant is on land adjoining the older Mansfield works, but has its own receiving and shipping facilities. There are three buildings in the addition, including a foundry, a powdered-coal plant and a compressor building. The foundry proper has 100,000 sq.ft. of floor space with provision for seventy-two machine molders. A feature of the plant is the use of powdered coal as fuel for the core ovens, melting furnace and annealing furnaces. For the coal-powdering operation a building 35 ft. x 70 ft. x 55 ft. has been erected, and a 4-in. pneumatic tube is used for blowing the coal to the various points where it is used in the foundry. In the first test run three tons of powdered coal were blown to the furnaces in less than five minutes. A vacuum cleaning system is to be used to keep the coal building free from coal dust and dirt.

New Philadelphia Supply Jobber

The Colonial Electric Company, Inc., has opened a wholesale electrical supply house at 932 Arch Street, Philadelphia. The company has taken over the complete stock of J. F. Buchanan & Company, Philadelphia, and is prepared to ship orders from stock. Those interested are Edward J. Coyle, Martin T. Nice and Earl A. Wilson, all formerly with the H. C. Roberts Electric Supply Company, and Roy W. Grosset, formerly with the Frank H. Stewart Electric Company.

The Cote Brothers Manufacturing Corporation, Chicago, manufacturer of "Simplicity" refillable fuses, has removed its general offices to 1425 First National Bank Building, 38 South Dearborn Street, Chicago, where it has larger quarters. Thomas F. Cote is president of the company.

The Coffin-Perry Company, Huntington Bank Building, Columbus, Ohio, has been appointed representative of Edwards & Company, New York City, for the entire States of Ohio, Kentucky and West Virginia and for western Pennsylvania.

The Kimble Electric Motor Company, Chicago, has appointed the Electric Sales Agency, 367 Second Street, Albany, N. Y., as its district sales agent.

The O'Brien Machinery Company, formerly at 119 North Third Street, Philadelphia, now occupies new offices and showrooms at 113 North Third Street. One floor of the five-story building purchased at that location will be devoted to the display of motors, dynamos and generators, while another floor will be given over to the repair and testing of electrical equipment.

The A. I. Bennett Company, Chicago, has been appointed exclusive district sales representative for the Ajax Electric Specialty Company, St. Louis, in Indiana, Illinois, the Michigan upper peninsula, Wisconsin, North and South Dakota and Minnesota.

The Randolph - Perkins Company, 1,210 First National Bank Building, Chicago, has been formed to carry on a general engineering business specializing in hydro-electric development, land, drainage, flood control, etc.

F. H. Scarborough, who represents the Electrical Sales Company, the E. H. Freeman Electric Company and the Trenton Porcelain Company in Philadelphia, has moved his office to 810 Heed Building, 1215 Filbert Street.

The Rome Wire Company, Rome, N. Y., has opened district sales offices in New York City at 50 Church Street. H. S. Hammond, who has represented the company in the Eastern territory for the past twenty years, is in charge of the new office.

Foreign Trade Notes

PROPOSED WATER-POWER DEVELOPMENT AT TIVOLI, ITALY.—A project for utilizing the waterfalls at Tivoli, Italy, for generating electricity, the *Electrician* states, has been approved by the Municipal Council of Rome.

ELECTRIC RAILWAY PROPOSED BETWEEN PEKING AND TIENTSIN.—Application has been filed with the Chinese Ministry of Agriculture and Commerce by a Tientsin merchant, according to the *Electrician*, for permission to form a company for the construction of tramways between Peking and Tientsin. A hydro-electric plant will be installed at Hwaila, where water power from the Yungting River will be utilized. The proposed plant, it is expected, will supply electricity to factories and industrial plants along the route. The Fu Sin Electric Company of Shen Tseh, Kiangsu, and the Changsu Electric Company of Changsu, Kiangsu, have been registered by the Ministry of Communications.

INCREASED SUPPLY OF ELECTRICITY FOR CHRISTIANIA, NORWAY.—To meet the rapidly increasing demand for electricity for domestic purposes, according to a report from Consul-General Alban G. Snyder, Christiania, Norway, additional energy was expected to be transmitted to the municipal electric light works from Raanaasfossen by the first of the new year, later from Rjukan, and in 1924 from Solbergfoss. The problem of receiving and distributing the extra power is progressing rapidly. At the present time there remains only one-fifth of the city to be exempted from all power restrictions, and this, it is expected, will be released in the spring.

RESOURCES OF HUMBER VALLEY, NEWFOUNDLAND, TO BE DEVELOPED.—Contract has been awarded by the Reid Newfoundland Company, St. Johns, Newfoundland, for the development of the resources of Humber Valley in that island, including the construction of paper mills with a capacity of 1,000 tons daily, aluminum works and other industries, and water-power development.

WATER POWER IN CATANIA, ITALY, TO BE DEVELOPED.—A loan of 200,000,000 lire ($10,000,000) has been authorized by the Italian government to a society which has been organized to utilize the water power available in Catania, in southern Italy. It is planned to develop about 300,000 hp. by utilizing natural basins along the rivers. About 500 communities are expected to derive benefit from this hydro-electric project, which eventually will require about $25,000,000 capital.

HYDRO-ELECTRIC POWER FOR SANTIAGO AND VALPARAISO, CHILE.—The project of the Cia Nacional de Fuerza Electrica providing for the transmission of electricity generated at a hydro-electric plant on the Maipo and Colorado Rivers in the Province of Santiago, according to reports to the Department of Commerce, is to be carried through promptly. The plant is located on what is known as the Maitenes concession, and it will have an initial capacity of 33,000 hp., with provision for the installation of an additional generating unit. Power will be generated at Maitenes at 6,600 volts, 50 cycles, three-phase, which will be stepped up to 110,000 volts for transmission. The transmission line to Santiago will consist at first of two circuits of aluminum conductors carried on double-circuit steel towers. From Santiago the line will be carried on one set of double circuit towers over the Dormida Pass to Valparaiso. S. Pearson & Son, who hold the controlling interest in the Chilean Electric Tramway & Light Company, Ltd., has subscribed £850,000 to augment the £650,000 of capital of the Cia Nacional de Fuerza Electrica. This contribution to its capital will enable the power company to proceed with the construction of an additional plant.

IMPROVEMENTS TO ELECTRIC SYSTEM IN LIMA, PERU.—Extensive improvements are contemplated by the Empresas Electricas of Lima, Peru, according to cable advices to the Department of Commerce. A loan of 1,000,000 Peruvian pounds offered to the Empresas Electricas by the government for the above work has been approved by the stockholders of the company.

PROPOSED POWER SCHEME FOR ZEEHAN, TASMANIA.—Data are being collected by C. B. Davis, an engineer on the staff of the government Hydro-Electric Department, the *Industrial Australian and Mining Standard* states, preparatory to preparing plans for a scheme to supply electricity to Zeehan, the source of power to be the Lake Margaret power station of the Lyell company.

MUNICIPAL ELECTRIC SYSTEM PROPOSED FOR LISMORE, AUSTRALIA.—The Municipal Council of Lismore, New South Wales, Australia, has approved a report for a municipally controlled electric lighting system for Lismore, according to the *Industrial Australian and Mining Standard*. The proposed plant involves an expenditure of £32,152. The equipment will include two 150-kw. steam-driven alternators. The present plans provide for 110 street lamps.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agencies are desired by a merchant in Brazil (No. 503) for the sale of electrical supplies, etc.

The purchase is desired by a business man in Guatemala (No. 506) of a sulphuric-ether plant for the purpose of manufacturing industrial alcohol from cane-sugar molasses. Prices required on plants using both electricity and wood.

The complete outfit for a new theater is required by an amusement company in Canada (No. 527), including electrical fittings.

Tolnai Vilaglapja, Budapest, Hungary, VII, Dohany-Utca 12, would like to receive catalogs covering lighting fixtures and all accessories, electric dynamos and motors.

New Apparatus and Publications

STREET-LIGHTING UNIT.—A street-lighting unit for ornamental posts designed for use with "Mazda C" lamps, known as the "Reflexto-Lux lantern," has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

MARINE EQUIPMENT. — Circular reprint 106, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., shows the diversity of marine products manufactured by the company.

ARC WELDING.—Leaflet 1825, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes arc welding for repair and reclamation, general applications of arc welding and arc welding for manufacturing processes.

SWITCHES AND PANEL BOARDS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing catalog 12-A, dated 1921-1922, describing its various types of safety switches and panelboards.

FOOD MIXER.—The Reynolds Electric Company, 2,650 West Congress Street, Chicago, has recently developed the "Reco" food mixer, designed for hotel kitchens, restaurants, hospitals, etc. A food chopper can be furnished when desired.

GLUE POTS.—A new folder issued by the Automatic Electric Heater Company, Warren, Pa., describes the temperature-control features of Sepco automatic electric glue pots.

HAIR CUTTERS.—The P. A. Geier Company, Cleveland, is distributing a folder on the place of the Royal electric hair cutter in the modern barber shop.

AIR COMPRESSORS AND PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., is distributing bulletin No. 102, covering the "Pennsylvania" single-stage, straight-line air compressors and vacuum pumps.

MOTOR-GENERATOR SETS. — Bulletin No. 30 issued by the Ridgway Dynamo & Engine Company, Ridgway, Pa., describes and illustrates its various types of motor-generator sets.

TURBINES — Steam turbine-generator units are described and illustrated in circular 1094-B, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OVEN. — The Despatch Manufacturing Company, 116-122 First Avenue North, Minneapolis, is distributing a six-page leaflet describing the "Despatch-Universal" electric oven No. 280, designed to meet the requirements of the electric service station, garage and manufacturer.

SWITCH BOXES.—The Ward Electric Company, Otis Building, Philadelphia, has recently placed on the market a line of pressed-steel flush switch and receptacle switch boxes, arranged for loom, conduit and flexible armored conductor.

GRINDER.—An improved type of pedestal grinder and bench grinder has recently been placed on the market by the Standard Electric Tool Company, Cincinnati, Ohio.

SWITCHES.—Circular No. 52, issued by the Trumble Electric Manufacturing Company, Plainville, Conn., describes its new 600-volt "Snuff-Arc" type A safety switches.

FANS.—"A Breeze That Blows Profits Your Direction" is the title of a booklet distributed by the Robbins & Myers Company, Springfield, Ohio, covering its different types of electric fans, including oscillating and non-oscillating fans, and also fans for farms and country homes.

New Incorporations

THE FAIRFAX & LOUDOUN LIGHT & POWER COMPANY, Fairfax, Va., has been incorporated with a capital stock of $100,000. Thomas R. Keith, Fairfax, is president, and Joseph Berry, Vienna, is secretary.

THE ROCKHOUSE LIGHT & POWER COMPANY, Burch, W. Va., has been incorporated with a capital stock of $5,000 by E. McD. Harmon, B. J. Calloway, both of Burch, and James A. Goble of Matewan.

THE WORTHINGTON LIGHT & POWER COMPANY, Butler, Ohio, has been incorporated with a capital stock of $60,000 by R. C. Dalton, Jr., G. H. Scrack, L. C. Gratner, Albert Keckler and F. S. Culp.

THE OCHILTREE ELECTRIC COMPANY, Pittsburgh, Pa., has been incorporated with a capital stock of $115,000 to manufacture and deal in electrical appliances. The incorporators are David H. Thomas, 812 North Negley Avenue, Pittsburgh; H. S. McDouglass, 1100 North Park Street, McKeesport, and Herbert D. Lent, Jr., 5,003 Fifth Avenue, Pittsburgh.

THE RAMONA & OCHELATA LIGHT & POWER COMPANY, Tulsa, Okla., has been incorporated with a capital stock of $30,000 by P. J. Minck, E. M. Bond and Erwin H. Doerner, Tulsa.

THE MAINE ELECTRIC COMPANY, Inc., Brooklyn, N. Y., has been incorporated with a capital stock of $20,000 by George and C. Lauringer, Jamaica, and P. Kreus, 818 Knickerbocker Avenue, Brooklyn.

THE EMPIRE SWITCHBOARD COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $80,000 by N. P. Findley and C. E. Schoninger. R. J. Kent, 75 Fulton Street, is attorney.

THE TIPPINGS & SPRENGLE RADIO MANUFACTURING COMPANY, Pittsburgh, Pa., has been incorporated by L. H. Tippins, William A. Bonkin and W. L. Sprengle, Pittsburgh. The company is capitalized at $75,000 and proposes to manufacture electrical devices.

THE PILOT ELECTRIC MANUFACTURING COMPANY, Brooklyn, N. Y., has been incorporated with a capital of $5,000 by M. Berman, M. Berwitz and E. Halpern. H. Schapiro, 261 Broadway, is attorney.

THE ATLAS ELECTRIC SIGN CORPORATION, New York, N. Y., has been incorporated with a capital of $15,000 by D. Weiss, F. C. Pflueger and G. Searing. M. Sulzberger, 565 Fifth Avenue, is attorney.

THE KAUFFMANN-LLOYD MANUFACTURING CORPORATION has filed articles of incorporation under the laws of the State of Delaware. The incorporators are T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington. The company is capitalized at $1,000,000 and proposes to manufacture electrical and other appliances.

THE S. C. TARRANT COMPANY, Wilmington, Del., has been incorporated with a capital stock of $50,000 to manufacture electric lighting fixtures, etc. The Colonial Charter Company, Ford Building, represents the company.

THE CROPSEY (ILL.) LIGHT & WATER COMPANY has been incorporated with a capital stock of $5,000 by S., H. C. and Kenneth Slater. K. Y. Slater, Cropsey, is manager.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 27, 1921)

1,392,165. Flashlight; Robert L. Hunter, Norfolk, Va. App. filed Feb. 18, 1921. Adjustable focus.

(Issued Dec. 13, 1921.)

1,400,126. Contact Device; James A. Wotton, Montclair, N. J. App. filed Dec. 16, 1920. High-speed relay.

1,400,149. Electrotherapeutic Apparatus; Thomas W. Gleeson, Boston, Mass. App. filed Dec. 17, 1920. For electrically treating and massaging.

1,400,156. Electrically Heated Soldering Iron; James T. Griffin, Oak Park, Ill. App. filed July 17, 1919.

1,400,181. Semi-Automatic Telephone Exchange System; Lipa Polinkowsky, London, England. App. filed Oct. 23, 1918.

1,400,189. Means for Controlling Repeater Circuits; John F. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Four-wire repeater circuits.

1,400,199. Indicating Mechanism; Frank W. Wood, Montclair, N. J. App. filed Jan. 4, 1919. For automatically indicating direction and extent of swinging of structures.

1,400,229. Electric Circuit Control; Howard J. Murray, Brooklyn, N. Y. App. filed July 15, 1919. Circuit controlled by pendulum oscillated by variation in speed of vehicle.

1,400,235. Method of and Means for Producing Alternating Currents; John H. Payne, Jr., Schenectady, N. Y. App. filed Sept. 14, 1916. Electron-discharge device.

1,400,268. Battery-Charging System; William L. Cully, New York, N. Y. App. filed Jan. 9, 1920. Employing motor-generator set.

1,400,270. Recording Device for Signal System; Peter P. Dean, New York, N. Y. App. filed June 30, 1916. For operation of steamships.

1,400,283. Submarine Telephonic Transmitter; Henry R. Gilson, New Rochelle, N. Y. App. filed Sept. 25, 1918. Very great responsiveness.

1,400,305. Electric Hair Curler; Marie Miller, Ottawa, Canada. App. filed March 22, 1920.

1,400,333. Fluoroscopic X-Ray System; Harry F. Waite, New York N. Y. App. filed Nov. 20, 1920.

1,400,334. Guard for Telephone Transmitters and the Like; Gladys H. Weinrich, Chicago, Ill. App. filed March 10, 1921. For protection from infection.

1,400,336. Winding for Dynamo-Electric Machines; Robert B. Williamson, Milwaukee, Wis. App. filed Dec. 1, 1916. Alternating-current machines of comparatively large size.

1,400,346. Mercury-Vapor Lamp; Marie Joseph Cornu, Paris, France. App. filed Feb. 28, 1918. Damper of mercury oscillations, and arc-striking device.

1,400,357. Cable Securing Device Particularly Applicable to the Fixation of Electric Cables on Carbon Brushes; E. Gindre, Levallois-Perret, France. App. filed May 14, 1921.

1,400,410. Electric Resistance; Pierre Bossu, Paris, France. App. filed Aug. 25, 1917. For switching or regulating.

1,400,418. Electrode Holder; Herman A. Casey, Duluth, Minn. App. filed June 25, 1920. Manufacture of calcium carbide from coal and limestone.

1,400,437. Sadiron; Elmer Hysell, College Hill, Pa. App. filed March 24, 1921.

1,400,476. Trolley-Harp Attachment; J. C. Cooper, Sr., Altoona, Pa. App. filed Sept. 1, 1921. Loosely mounted upon trolley-wheel axle.

1,400,493. Telegraph System; Paul M. Rainey, Glen Ridge, N. J. App. filed Feb. 8, 1918. For manual or automatic transmission.

1,400,501. Regulating System for Dynamo-Electric Machines; Oliver F. Conklin, Detroit, Mich. App. filed April 28, 1917. Combined voltage regulator, reverse-current cut-out and modifying thermostat

1,400,502. System of Electrical Distribution; William A Turbayne, Niagara Falls, N. Y. App. filed Aug. 13, 1919. Car-lighting systems.

(Issued Dec. 20, 1921)

15,251 (reissue). Electric Plug Receptacle; William Ile, Lynbrook N. Y. App. filed March 9, 1920. Plurality of socket members.

15,252 (reissue). Sliding Trolley; Otto Moore Frankfort, Ind. App. filed Oct. 1. 1921. Combined wheel and sliding trolley.

1,400,517. Recording Apparatus for Radio-Telegraphic Signals; Andre E. Blondel, Paris, France. App. filed April 26, 1919.

1,400,526. Electric Water Heater; Herbert W. Christian, Detroit, Mich. App. filed Sept. 7, 1920. Water flows in form of film.

1,400,583. Telephone System; John F. Toomey, N. Y. App. filed April 18, 1918. Switchboards with long-distance transmission line.

1,400,590. Selective Telephone System; Alfred H. Dyson, Chicago, Ill. App. filed Nov. 29, 1907. Combined manual and automatic.

1,400,591. Electrical Wave Transmission; Cornelius D. Ehret, Philadelphia, Pa. App. filed March 12, 1919. Carrier-current telephony.

1,400,603. Electrical Relay; Clinton O. Harrington, Edgewood Borough, Pa. App. filed Jan. 31, 1920. Method for opening and closing relay shunt.

1,400,607. Guard for X-Ray Tubes; George C. Johnston, Pittsburgh, Pa. App. filed Aug. 21, 1919. Guards for terminals.

1,400,646. Electric Stopper for Fluid Containers; Ernest C. Webster, Chicago Ill. App. filed April 12, 1920. Heating element in plug of containers.

1,400,649. Weather Protector for Couplings; Harry F. Woernley, Pittsburgh, Pa. App. filed Dec. 6, 1918. Protects contacts of train couplings.

1,400,681. Trolley Wheel; Herman M. Kaul, Cedarburg, Wis. App. filed Jan. 12, 1921. Spiral groove return.

1,400,686. Terminal Connection for Electrical Heating Units; Frank Kuhn, Jay A. Hand and Jules G. Spiess, Detroit, Mich. App. filed Nov. 14, 1918. Construction to prevent overheating.

1,400,729. Electric Regulation; John L. Creveling, White Plains, N. Y. App. filed Jan. 25, 1916. Automatic regulation of generators.

1,400,732. Signaling System; Charles S. Demarest, Brooklyn, N. Y. App. filed May 12, 1919. Telephone trunk circuits.

1,400,775. Electric Lantern; Jerome W. Smith, Walla Walla, Wash. App. filed Feb. 17, 1920. Portable electric light.

1,400,779. Brush Arrangement for Disk-Shaped Commutators; Hermann Sundhaussen, Essen, Germany. App. filed Jan. 15, 1921.

1,400,784. Soldering Iron; Charles B. Archer, Chapman, Ala. App. filed Oct. 19, 1920. Combined solder iron, melting pot and file.

1,400,803. Electrical Apparatus; David Conlan, Jr., Brooklyn, N. Y. App. filed Dec. 24, 1920. Current extension apparatus for marine and water-tight uses.

1,400,811. Dimmer; Joseph Galamb and Earl P. Oswald, Detroit Mich. App. filed May 20, 1918. For automobile lights.

1,400,819. Portable Electric Lamp; Joseph W. Higgins, Bordentown, N. J. App. filed Jan. 26, 1920. Flashlight combined with small generator.

1,400,824. Electrical Fitting; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 18, 1920. For mounting electric fixtures.

1,400,832. Electric Clock; Louis E. Shaw, East Orange, N. J. App. filed Dec. 8, 1919. Electromagnetic mechanism for movement.

1,400,846. Heating Apparatus for Metal-Working Machines; Charles E. F. Ahlm and Thomas F. Ferry, Cleveland, Ohio App. filed May 7, 1920. Electrically heats material being worked on.

1,400,847. System of Radio Communication; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 31, 1918. Having high-frequency alternator.

1,400,856. System of Electrical Distribution; William L. Bliss, Niagara Falls, N. Y. App. filed April 3, 1916. For transferring load to battery on failure of other supply.

1,400,859. Multiple Reflector; Ermund N. Brown and Milton H. Shoenberg, San Francisco, Cal. App. filed Nov. 4, 1920. For radiant heater.

1,400,950. Panel; Guss H. Gneiss and Charles J. Peterson, Chicago, Ill. App. filed Feb. 27, 1919. Fuse panelboards for small-service distribution.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MIDDLEBURY, VT.—The Community Light & Power Company plans to build a switching station in the southern part of the town of Middlebury to step down electricity purchased from the Vermont Power Company from 44,000 volts to 2,300 volts for distribution by the Community Light Company. Extensions to East Middlebury and vicinity and Salisbury are under consideration. E. L. Kelley is clerk.

LEOMINSTER, MASS.—Steps have been taken by the Chamber of Commerce to secure improvements to the lighting system at Monument Square. The fire department plans to place the fire-alarm wires underground.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has filed notice of an increase of $2,720,000 in its capital stock, the proceeds of which are to be used for improvements and extensions to its system.

Middle Atlantic States

BUFFALO, N. Y.—A petition has been submitted to the City Council requesting improvements to the street-lighting system on Fillmore Avenue from North Parade Street to Main Street.

SOUTHOLD, L. I., N. Y.—The Long Island Lighting Company, 50 Church Street, New York City, is considering the construction of a new electric power plant at Southold, Long Island. E. L. Phillips is president.

UTICA, N. Y.—The construction of a one-story power house at the St. Joseph's Infant Home, Green Street, is under consideration in connection with the new mechanical laundry building, to cost about $45,000.

BUTLER, N. J.—An issue of $76,700 in bonds has been disposed of by the Borough Council for the construction of an addition to the municipal electric power plant.

CHESTER, PA.—The board of directors of St. James' Mercy Hospital contemplates the construction of a two-story power plant, 53 ft. x 60 ft., in connection with a new 4-story hospital. F. F. Durang, 1220 Locust Street, Philadelphia, is architect.

DANVILLE, PA.—A portion of the Danville power house of the Pennsylvania Power & Light Company, Allentown, was recently destroyed by fire. The loss, including equipment, is placed at about $100,000. The company plans to rebuild.

MAHANOY CITY, PA.—The installation of an electric light plant and other improvements at the Schuylkill County Insane Hospital is under consideration by the County Commissioners.

ORRTANNA, PA.—S. Z. Musselman of McKnightstown is reported to have purchased property near Orrtanna for the purpose of erecting an electric light and power plant.

PITTSBURGH, PA.—The Duquesne Light Company has awarded contract to Dwight P. Robinson, engineer, 125 East Forty-sixth Street, New York City, for extensions to its plant. The project includes the installation of a second unit of 60,000-kw. capacity at the Colfax power station together with three additional substations along the lines of the company in the Pittsburgh district. The Colfax station will have an ultimate capacity of six 60,000-kw. units.

SCRANTON, PA.—In a report submitted to A. M. Wilson, city manager, by Joseph L. Caldwell, city electrician, recommendation is made that all arc lamps be replaced with [illegible]-cp. or 400-cp. lamps, that five-lamp poles on North Tejon Street, Colorado Avenue and Pikes Peak Avenue be converted into two-lamp standards, that on the other streets where five-lamp poles are used one-lamp standards be substituted; that the police red-light system be extended and also that a police daylight signal system be installed.

SHAMOKIN, PA.—The Taubel, Scott & Katzmiller Company has had plans prepared for the construction of a one-story power plant at its local textile mills.

BALTIMORE, MD.—The Electrical Commission has ordered that all overhead wires except those needed for the operation of street cars and for other exceptional uses in the northeastern section of the city be placed in the city's electrical subways in that territory and poles taken down.

BALTIMORE, MD. — Plans are under way for the installation of new electric lighting systems in fifteen schools in Baltimore. Lester L. Kinsbury is chief electrical inspector.

CLIFTON FORGE, VA. — The Blue Ridge Power Company, it is reported, is considering the construction of two additional power plants on the Green River in Polk County, N. C., to have a capacity of 45,000 hp. and 10,000 hp.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, United States Army, Washington, D. C., until Jan. 23 for furnishing thirty testing sets. (Circular PR 8882-A-14 CP.)

North Central States

BROOKLYN, MICH. — Henry Ford has purchased power rights and a mill on the Flat River at Brooklyn from Blanchard Brothers and contemplates power developments. He has also purchased property in the village.

DETROIT, MICH.—Bids will be received by Edward N. Hines, chairman of the Board of Wayne County Road Commissioners, 1103 Real Estate Exchange Building, Detroit, until Jan. 31 for the installation of electrical equipment for the operation of a double-leaf bascule bridge crossing the River Rouge, as well as for lighting, signals, telephones, etc.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of the Board of Education, eighth floor, Denton Building, Seventh and Race Streets, until Jan. 23 for furnishing all material and labor necessary to complete the electric lighting work at the Linwood Public School Building.

HUDSON, OHIO.—The City Council of Cleveland has passed as an emergency measure an ordinance authorizing the expenditure of a sum not to exceed $16,000 for the erection of an electric transmission line, installation of transformers, construction of 11,000 ft. of water pipe, installation of electric pumps for fire apparatus and laundry, and other equipment necessary to secure electric service and water supply for the boys' farm division in Hudson.

FAIRBURY, ILL. The establishment of a municipal electric light plant in Fairbury is under consideration by the Council.

NAPERVILLE, ILL. — Plans are under consideration for an addition to the electric light plant in Naperville, to cost about $50,000. For further information address J. A. Reuss, Reuss State Bank Building.

KENOSHA, WIS.—The sum of $25,000 has been appropriated for the installation of an ornamental lighting system on various streets in Kenosha. M. J. Donahue is engineer.

MILWAUKEE, WIS. — Bids will be received by the Sewerage Commission, City Hall, until Jan. 27, for furnishing and erecting pumps, motors and equipment for an automatic electric return sludge pumping plant on Jones Island, Milwaukee, including three 20-in. centrifugal pumps of vertical-shaft type, three 50-hp. variable-speed, wound-rotor motors; switchboard, electrical control apparatus, wiring and appurtenances; cast-iron pipings and specials, gate and check valves and appurtenances. John H. Fowles is secretary.

MILWAUKEE, WIS.—The City Board of Estimates has voted to place $500,000 in the 1922 budget for a municipal electric light plant. The proposed plant will supply electricity for the new street-lighting system and for other municipal purposes.

MAGNOLIA, MINN.—The village authorities are considering the installation of an electric lighting system in Magnolia, to cost about $11,000.

EMINENCE, MO.—A company has been organized by local business men for the purpose of building an electric light plant for municipal and industrial purposes. Capital stock to the amount of $10,000 has been subscribed.

MOUNT MORIAH, MO. — The Missouri Electric, Gas & Water Company, First Wisconsin National Bank Building, Milwaukee, Wis., has been granted a franchise for the distribution of electricity for light and power in Mount Moriah, and extension from its lines at Cainesville, Mo., will be made immediately. The company, it is reported, also intends to extend its lines north into southern Iowa. W. N. Albertson, Milwaukee, is president.

Southern States

LANSING, N. C.—The City Council is considering the establishment of an electric lighting plant in Lansing. E. V. Ballou is in charge.

ATLANTA, GA. — R. C. Turner in his annual report recommends the installation of a water turbine and electric generator to utilize the water at the Hemphill waterworks station to generate electricity to light the entire waterworks plant.

LOUISVILLE, GA.—Plans are under consideration by the City Council for reconstruction of the municipal electric light plant recently destroyed by fire.

DE LAND, FLA.—Plans have been prepared by the De Land Light, Power & Ice Company for extensions and improvements to its power plant, to cost about $75,000.

ST. AUGUSTINE, FLA.—The Council is considering issuing $30,000 in bonds for the establishment of a municipal electric light and power plant in St. Augustine.

PARIS, TENN. — Improvements to the municipal electric light and sewerage systems are under consideration by the Council. W. J. Holman is engineer.

ARKADELPHIA, ARK. — The Caddo River Power & Irrigation Company, Little Rock, recently organized with a capital stock of $1,000,000, contemplates the construction of a hydro-electric power plant near Arkadelphia, on the Caddo River, to cost about $800,000. H. L. Remmel is president and H. C. Couch is secretary.

MOUNTAIN HOME, ARK. — Improvements to the local light plant, roller mill and ginnery are under consideration by N. L. Taylor, Kansas City, Mo. It is also proposed to erect an electric transmission line to Cotter, Ark.

BASTROP, LA.—Plans are under consideration for the installation of a new electric generating unit in the municpial electric light plant.

HAYNESVILLE, LA.—The Haynesville Light & Power Company contemplates the installation of new machinery.

LAWTON, OKLA.—Bonds to the amount of $600,000 have been voted for the construction of a municipal electric power plant and distribution system in Lawton.

LOCUST GROVE, OKLA.—The construction of an electric light system in Locust Grove, to cost about $20,000, is under consideration by the Council. V. V. Long & Company, 1,300 Colcord Building, Oklahoma City, are consulting engineers.

WOODWARD, OKLA.—Plans are being prepared by the City Council for the construction of a new municipal electric light and power plant, to cost about $100,000.

MERCEDES, TEX. — The City Council has ordered an election to be held in the latter part of January for the purpose of submitting to the voters a proposal to issue $100,000 in bonds for extensions and improvements to the street-lighting system and for paving.

SAN ANTONIO, TEX. –The San Antonio Public Service Company, subsidiary of the American Light & Traction Company of New York, contemplates an expenditure of approximately $1,500,000 for extensions and additions to its property in San Antonio during 1922. While detailed estimates have not been decided upon, it is stated that $500,000 will be used for a new steam-turbine unit for the power plant, and additional boiler capacity and electrical equipment; for electric distribution lines, poles, underground systems, transformers, meters, etc., the sum of $300,000 will be expended.

Pacific and Mountain States

CANBY, ORE.—The construction of a municipal electric light and power system is contemplated by the Council. The city has been authorized to appropriate 300 sec.-ft. from Mill Creek for the development of power.

FRESNO, CAL.—The San Joaquin Light & Power Corporation is reported to be considering the extension of its electrical service through Mussel Slough district.

FRESNO, CAL.—Plans are being prepared by the Sugar Pine Lumber Company, First National Bank Building, San Francisco, for the construction of a new lumber mill, including a power plant, on the San Joaquin River, near Fresno, to cost about $2,000,000. Elmer H. Cox is president.

HOLLYWOOD, CAL.—The Pacific Electric Railway Company, Los Angeles, has been authorized by the State Railroad Commission to make improvements to its Hollywood system at a cost of $2,600,000.

OAKLAND, CAL. — A company to be known as the Central Sierra Power Company is being organized in New York for the purpose of developing an irrigation project to supply eastern Sacramento County and to utilize power that can be developed between the North Fork of the American River and the Rubicon River to supply municipalities and manufacturing concerns of the coast district. The work includes the construction of a large mill, canals, main reservoirs at French Meadows to have a capacity of 60,000 acre-ft. and a continuous flow of about 490 sec.-ft. to power houses. Power house No. 1, to be located at Emigrant Gap, North Fork of the American River, will have a capacity of 89,500 hp.; power house No. 2, opposite Towle, North Fork of the American River, 44,800 hp.; power house No. 3, near Colfax, 31,300 hp.; power house No. 4, near Auburn, 26,800 hp. The cost of the projects is estimated at $20,000,000. H. E. Barieau, Auburn, is engineer. F. P. Tuttle, Jr., 428 Thirteenth Street, Oakland, is attorney.

SAN FERNANDO, CAL.—At an election to be held Feb. 26 a proposal to issue $500,000 in bonds to be used in connection with the Pacoima Canyon Flood Control project will be submitted to the voters.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has applied to the State Railroad Commission for authority to issue $5,000,000 in capital stock, to be sold at not less than $85 per share, the proceeds to be used for new construction work.

SAN FRANCISCO, CAL.—A petition has been submitted to the Board of Supervisors by the Point Lobos Improvement Club to place all wires underground on Clement Street from First to Funston Avenue and to remove all poles from the street.

SAN JOSE, CAL.—The construction of a new power house and cold-storage plant at the County Hospital is under consideration by the Board of Supervisors of Santa Clara County, San Jose.

MOUNTAIN HOME, IDAHO. — The Elmore Copper Company contemplates the construction of a dam and hydro-electric power plant on the south fork of the Boise River, about 25 miles north of the Arrowhead dam. The cost is estimated at more than $100,000.

SANTA FE, N. M.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 1 for installing lighting fixtures in the United States public building at Santa Fé, N. M.

SALT LAKE CITY, UTAH.—The Dixie Power Company has filed application on 15 sec.ft. of water from Coal Creek in Iron County, to develop 930 hp. The company is also considering increasing the capacity of the old plant and changing its system from three-phase to single-phase.

SALT LAKE CITY, UTAH.—The town of Junction has filed application at the office of the State Engineer for the use of 5 sec.ft. of water from City Creek in Piute County to be used in development of municipal power for the towns of Circleville and Junction. The plans provide for a total development of 530 hp. It is proposed to use the water twice, the first power development for distribution in Junction and Circleville and a second power development for use in the northern part of Piute County and the southern part of Sevier.

Canada

CAYUGA, ONT. — The City Council is considering plans for the installation of an electric light and distribution system in Cayuga. R. S. Colter is a member of the Council.

HENSALL, ONT.—The installation of an electric light and power distribution system in Usborne Township is under consideration. H. Strang is a member of the Council.

MEAFORD, ONT.—The question of submitting to the ratepayers a bylaw authorizing the extension of hydro-electric lines to Meaford is under consideration.

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"More Business—Better Business"

INSPIRATION and good working courage will flow to the entire electrical industry from the nation-wide "More business—better business" campaign that is now being organized by the National Electric Light Association. The central-station companies and the manufacturers are back of the movement. The jobbers will co-operate. The contractors and dealers will tie into it. The Society for Electrical Development has offered its full staff and resources. The entire industry will be united in the creative drive, and a great practical achievement will result.

For the opportunity which we confront surpasses all powers of description. Words and figures do not picture it. A million and a quarter new residence customers will be connected to the central-station circuits this year. Nearly seven million others are ready to buy additional equipment. Factory, store and business customers present a market in proportion. The nation stands waiting with its needs and with its mind about made up to satisfy them now at last. And business—more and better business—the return of those "good times" that we enjoy in periods of general prosperity—will come to us as soon as we are ready to do two essential things:

FIRST, we must recognize that it is every man's own job right where he is to make his business better for himself. Nobody rubs a magic lamp and conjures up prosperity. The circumstances that produce it do not happen of themselves. Good times are not the cause of better business but the natural effect. The better work of men and women is the cause. And good times come when men and women make them, not one day before. Therefore we have the making of the better business in ourselves, and when we set to work to *"do it now,"* then will it come.

Second, we must have bigger vision in our work. The man who has been wiring one home must see that nine more houses can be wired at the same time if he will do a bigger job. The man who has been selling ten flatirons must realize that he can as quickly sell one hundred if he will but increase his selling influence to scale, and he who in the past has been content to send five salesmen out must send out ten with five times the support and preparation to produce ten times the good result.

"MORE business—better business." What will it all be fashioned of? Ambition, enterprise, energy and effort—these are the tools to build it with. A bigger vision will do a bigger job. A stronger and more confident determination to get it done will speed the work. A more lasting courage will achieve the larger purposes. Clearer, more resourceful planning will carry through to greater measures of success.

This campaign will be made great by the individual men of the electrical industry—no other way. When we refuse to wait another day and with a bigger vision set ourselves to do this job, then, and then only, will more and better business come.

Irving Langmuir

A scientist of unusual ability, inventor of the gas-filled lamp and pioneer investigator in the new field of electron engineering.

ELECTRICAL engineering is on the threshold of a new era which bids fair to be of greater importance to the service of mankind than anything that has gone before. To this new development is now being given the name of electron engineering. Telephony, radio work, power transmission and illumination have all been greatly advanced as a result of these discoveries about the behavior of the smallest division of matter—the electron. Much of the progress that has been made in electron engineering can be attributed to the researches in the field of physical chemistry by Dr. Irving Langmuir, research physicist with the General Electric Company at Schenectady.

To the electrical industry at large Dr. Langmuir is probably best known as the inventor of the gas-filled incandescent tungsten lamp. It is a curious fact that the early experimenters who were searching for an incandescent lamp started with gas-filled bulbs, but because they did not know the laws governing energy dissipation from small wires they concluded that only exhausted bulbs could be used. Dr. Langmuir has also been engaged in making investigations on electric heating devices and on laws of heat transmission in electrical machinery.

Great as has been the practical value of his invention of the gas-filled lamp—so great that half the aggregate candle-power of tne lamps sold today is in such lamps—it is probable that still more important results will come from his pioneer work in electronics. Other leading physicists had worked in this field, but their results were seemingly inconsistent, and conduction in vacuo was a subject full of doubt and apparent contradictions. Langmuir by his discovery of "space charge" was able to clear up the doubts, reconcile the contradictions and round out the complete theory of pure electron discharge. The completion of this theory at once made possible the development of the pliotron, kenotron and other high-vacuum tubes, which are already revolutionizing the radio art and are rapidly approaching the point of utilization in the field of high-power engineering.

Dr. Langmuir's investigations of high vacua have made him the leading authority on chemical reactions at very low pressures, but his greatest contribution to theoretical science has been the development of his theory of the arrangement of electrons in atomic and molecular structure. This theory is comprised in what are known as the Langmuir postulates.

Dr. Langmuir was born in Brooklyn, N. Y., Jan. 31, 1881. He was graduated from Columbia University in 1903 with the degree of metallurgical engineer. Three years were then spent in post-graduate work in Germany at the University of Göttingen under Professor Nernst, inventor of the Nernst lamp. Upon his return to America in 1906 he became an instructor in chemistry at the Stevens Institute of Technology. Three years later he entered the research laboratory of the General Electric Company, where he is at present assistant director.

Possessed of an extraordinary analytical mind, he has in addition an intuitive ability to go to the heart of any problem even though it prove foreign to the field of his personal activities. His ability to discard non-essentials has been one of his greatest assets.

Dr. Langmuir is a member of a number of scientific organizations and has been the recipient of distinguished honors in the field of chemistry, physics and engineering. Among the awards made to him have been the Nichols medal, given by the American Chemical Society and awarded to him in 1915 and 1920; the Hughes medal, awarded by the Royal Society of London, 1918; the Rumford medal, by the American Academy of Arts and Sciences, 1920; the Farraday medal, by the Farraday Society, London, 1921, and a medal of honor awarded at the Panama Pacific International Exposition at San Francisco, 1915. Dr. Langmuir also received an honorary degree of doctor of laws from the University of Edinburgh in September of last year.

Editorial Comment

Electrical World, January 21, 1922

Volume 79 Number 3

The Never-Ending Coal Menace

THE wage agreements in both the anthracite and bituminous coal fields terminate on April first this year, and with their expiration comes the possibility of a coal strike of large proportions. Whether or not such a crisis will be brought about none but labor union leaders can tell. Encouraged by the unrest among the locomotive firemen, the miners' unions may seek to win the sympathy of the latter, hoping thereby to make their fight doubly effective in curtailing coal production and in hampering the commerce and industry of the country. Will these costly disputes between coal producer and miner ever cease? The question of coal production and distribution seems to be constantly up for discussion. Settlement and stability are as remote as ever, and as for the general public, apparently no thought is ever given it—certainly little consideration. If the miners are not starting a rumpus, the railroads are agitating something, and thus it goes. Meanwhile the users of coal must get on as best they can. In the public utility field, particularly, where service must be maintained at all hazards, the safeguarding of the coal supply becomes a trying problem under such circumstances. Nevertheless, utility managers must not cease their vigils, and even though threatening strikes do not materialize, they cannot afford to take chances. It would be an act of prudence, therefore, to insure against possible interruption of service by laying in ample reserves. Nor is it too soon to begin.

The Lockwood Committee and Incandescent Lamps

THE Lockwood legislative committee of New York, formed for the purpose of investigating the housing situation, chose to go far afield and delve into the manufacture of incandescent electric lamps. Not that the price of lamps has any effect whatsoever on the cost of building or the price of rent, but because one-sided testimony makes fine material for newspaper headlines. Startling accusations are made against the General Electric Company, all of which, of course, have still to be proved, but none of which need be feared. If to make the best incandescent lamp in the world is a crime, then we ought to encourage such criminals. Having invented a filament of admitted superiority, the General Electric Company rightly enjoys a patent monopoly on a certain kind of tungsten lamp. Naturally, plenty of other manufacturers would like to make it, just as plenty of automobile manufacturers would like to build Ford cars. If the General Electric Company chooses to license other manufacturers to make tungsten lamps, that is entirely its own affair and no one else's, and the courts will sustain it. Its system of lamp distribution, whatever its demerits, has the advantages of efficiency and economy and assures to the public at all times an excellent product at a reasonable price.

Considering the efficiency of the "Mazda" lamp and the money spent in its development, the cost is remarkably low—a result due to mass production. Its manufacture entails 112 operations of precision, and yet any one can buy the lamp in 25-watt or 40-watt sizes for 40 cents, whereas a straight oil-lamp chimney, involving nothing in its manufacture but the glass blower's art, sells for 27 cents. Moreover, glass lamp chimneys add little or nothing to the efficiency of the oil lamp, whereas the "Mazda" lamp is three times as efficient as the carbon lamp. Were carbon lamps still in vogue, the electric light bill of the country would have been $1,500,000,000 last year instead of $500,000,000. The best testimony to the worth of the "Mazda" lamp is shown by the rapidity with which it has displaced the carbon-filament lamp and its almost universal use at the present time. American law and tradition fortunately have never withheld proper credit and recompense from those to whom it is rightfully due and are not likely to do so now, the Lockwood committee and its counsel notwithstanding.

Lighting Code Deserves General Adoption

THE final adoption of the Illuminating Engineering Society's industrial code as the "American Standard" puts a new face upon the code situation throughout the country. One cannot entirely wonder that some states were slightly hesitant in taking up definite lighting codes while, in a sense, it was evident that the subject was more or less in a state of flux and that those best qualified to standardize practice had not yet finished their labors. At the present moment there is no such excuse left for inaction. During the past three or four years the matter has been pretty thoroughly thrashed over, and in the final adoption of the code by the Engineering Standards Committee a somewhat definite stand had been taken in details.

We could wish that the mandatory parts of the code had perhaps gone a little further, so as to furnish not only a sound basis for legislation but a model law worked out somewhat thoroughly. This, however, may well come later after further experience has been gained through the adoption of codes in various states. The general situation seems to be that there is comparatively little opposition on the part of employers who have either knowledge of the subject or desire to learn.

Those who oppose the provisions of existing codes are almost entirely connected with a few industries in which evil conditions in almost every respect have been handed down from bygone generations and whose managers are too blind either to see the requirements of the situation or, seeing them, to take action involving expense—expense which should have been incurred a generation ago instead of waiting for the strong arm of the law to enforce a change.

The main trouble in carrying through codes, we think, will be found in dealing with these comparatively few old industries and with a small but noxious group of mean and petty sweatshops that cause trouble whenever attempts to better working conditions are made. The principal practical difficulties in enforcing the codes through the actual work of the inspectors lie in the assignment of each operation or group of operations to its proper place in the table of intensities.

One of the commonest attempts to nullify and evade the provisions of the code is to demand insistently that the exact foot-candles for each and every operation should be set forth and specified by experiment, which might take anywhere from one to fifty years and during the course of which new operations and new methods of performing them would be perpetually brought up. Another specious scheme to avoid furnishing any perceptible quantity of light is based on the theory that in operating machines which are semi-automatic or fully automatic no lighting is required beyond the merest amelioration of absolute darkness. It is, of course, quite true that in certain operations a worker only uses his eyes occasionally, but in nine cases out of ten when he needs his eyes at all he needs them very badly. For instance, a typesetter gets so deft that he assembles the type with scarcely a glance at his case, his fingers instinctively picking up the right letter. A half of a foot-candle might answer his purpose if he did not have to look at his work. But when he does have to read the face of the type the conditions are such that he needs the very best light attainable, and needs it at once. The argument is merely an effort to evade responsibility and will, we think, carry no weight whatever with intelligent inspectors.

The inspector's duty is not easy, however, because he has to pass upon the class in which a given operation should fall. But he can be trained to do the work and do it fairly and well, relying incidentally on measurement, chiefly on the application of common "horse" sense to the perception of the workman's needs as interpreted by one who stands by his elbow and attempts to put himself in his place. We hope that this coming year is going to inaugurate a new era in the formulation and application of regulations for industrial lighting.

The Invested Interest Will Not Be Forgotten

NOT many years ago a wave of enthusiasm for municipal ownership of public utilities was sweeping through the country. That wave has died away now, and there are two things that are responsible. One is mismanagement of the railroads under public operation. The other is customer ownership of securities.

The difficulties into which we came while the government ran the roads convinced the people everywhere that the "M. O." idea is not workable. The experiences of the increasing number of people who have become partners with the public service companies through stock ownership have demonstrated that the most sensible and satisfying way to regulate and operate is through personal participation in the enterprise. And so this new era of prosperity and hope has come to the utilities. The fear of municipal ownership has been laid away. For the lesson of the mismanagement of the railroads will be forgotten, but the invested interest of the customer in the utility will not be forgotten. Blessed be the name of "customer ownership."

Burning Tests to Determine Fuel Quality

THE best test of the value of coal for producing steam is that made under the boiler when it is operating under service conditions. The amount of steam produced and its cost is the final answer. Oftentimes an analysis will indicate that a given coal is possessed of desirable qualities when experience with it will show that it is much less desirable than coal that appears of far poorer quality. This may be due to the character of the grate or stoker equipment not being suited to the coal, or it may be due to characteristics of the coal itself, such as the tendency to form clinkers to an extent that increases boiler-operating troubles and makes handling of ash a serious and expensive problem. Capacity of boilers may be cut down by the same cause.

The analysis is a factor in the judging of coal that is needed, but its largest usefulness probably lies in the day-by-day checking of the quality of a fuel that has been previously determined by actual tests to have the proper burning qualities to suit the plant in which it is to be used.

Causes of Labor Turnover Need Study

THERE has been considerable discussion in the last few years of the matter of labor turnover in manufacturing plants, public utilities and all places where skilled or unskilled labor is used. Many definitions of labor turnover have been proposed and many means of calculating it have been devised. Those plants where the labor turnover is small compared with the average pride themselves on their adequate treatment of their men; other plants where the turnover is high regret the condition and generally blame it on the shiftlessness of the employed.

Labor turnover during the war and in the period immediately following was enormous and even now in dull times we find that it is high in many places. The evil should be corrected. The actual economic waste is very large. Men trained in one particular plant must learn new methods in another plant, even if they do approximately the same work. Furthermore, they do not reach their former efficiency at once. Often leaving one job means taking another one with very different requirements where time is required to gain proper skill. Bookkeeping and record keeping, complicated as they are because of piece work and bonus systems, are immensely increased by labor turnover. Not only is the general efficiency of plants decreased, but the men who make many changes lose time, lose pay and lose opportunity for betterment and advancement. Both capital and labor are losers.

It is evident that the logical way of attacking the problem is to make use of the data available. These data may in some places be adequate to suggest remedies. In most places accurate determination and concise records of the causes for leaving employment must be made over a period of time. When in each plant or in each industry the reasons for men quitting are known definitely it will not be difficult to determine whether improvement of general working conditions, decreasing the monotony of the work, adopting bonus and profit-sharing systems or participation of the workers in the management is the most needed remedy, or in what degree each one will conduce to better conditions. What we need are accurate records and intelligent analysis.

Should Utilities Repair Their Distribution Transformers?

AS THERE is considerable difference of opinion regarding the advisability of transformer repairs being made by central-station companies, G. E. Decker's article in this issue on "Factory Methods Applied to Transformer Repair Work" is timely and should be of assistance to the industry. It is evident naturally that a decision as to the repairing of distribution transformers should be based entirely on a thorough study of the economics of the proposition, taking in all the features involved. The problem is a large one and many companies have not undertaken it. The outline by Mr. Decker of the method to use is complete. It shows that he has apparently given careful thought to all the considerations involved. He has also shown very completely the results of such a practice in the case of a large company, and though his findings apply to an unusually large number of transformers on one system, his general method can be applied to any system. The thoroughness of the work should be of great assistance in facilitating a similar study in other places, not only for making certain that present repairs are justifiable, but for making a decision regarding the installation of a repair shop where none is in existence.

More Accurate Knowledge of Industrial Electric Heating Vitally Important

NO SMALL significance appears in the recent announcement of intensive courses in industrial electric heating for central-station power engineers which at this moment are scheduled to have begun under the auspices of the Power Sales Bureau of the N. E. L. A. through the co-operation of leading manufacturers of this class of apparatus. The need of a far better understanding of the development of this branch of the art by these well-trained utility men has been overlooked in the recent past by not a few executives. Progress during the last five years has been so rapid in this field that in a good many cases central-station sales engineers have little more than a bowing acquaintance with the equipment and resources today available for solving problems of intensive heat application electrically. The attractiveness of such loads from the diversity-factor and consumption standpoints is often unrealized, excluding, of course, some applications which are still troublesome. Long-hour demand is another characteristic which warrants the enthusiastic interest of managers of central-station companies in cultivating intelligently this newer and expanding use of electric service.

The courses to be given at the factories of the Westinghouse and General Electric companies are not expected to develop specialists in this field overnight, but in seventeen to nineteen days men of the caliber of the successful central-station power engineer of 1922 can absorb more ideas as to the achievements and resources of electric heating under the intensive instruction of experts of national reputation than can be attained so quickly in any other effective way known to us. The range of the courses, their persistently practical nature and the type of men standing back of the lectures, shop and laboratory work involved are sure to inspire those who complete them to more valuable service.

That the manufacturers are giving these courses with no cost to the students beyond their traveling and hotel expenses and their regular "money from home" speaks extremely well for the spirit of co-operation thus evidenced. As things stand now, too little real knowledge of the fundamentals of industrial electric heating applications exists in central-station circles, and here is an opportunity to invest the time of picked and enthusiastic men for the ultimate reward of intelligent and profitable load building in a field whose future bids fair to rival that of the motor.

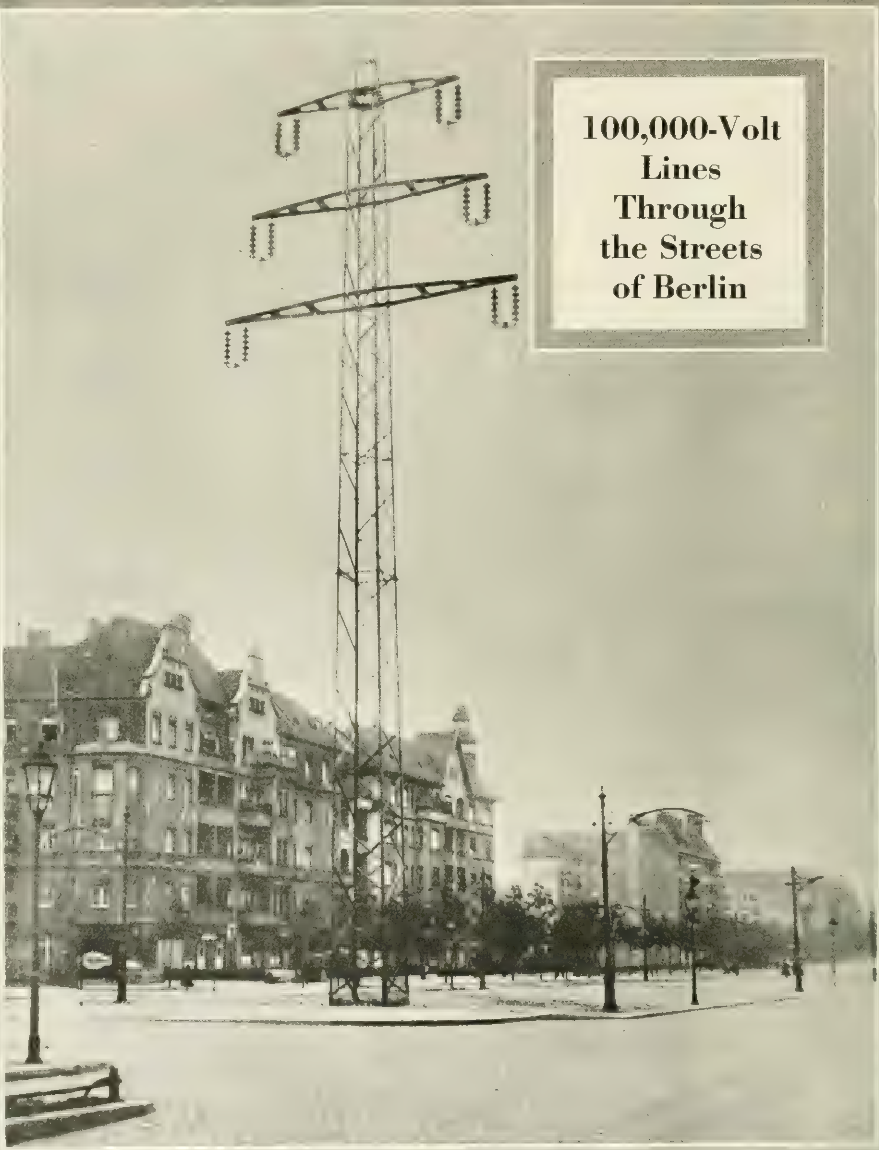
Great Achievements Expected in Electron Engineering

PROGRESS in applications of the electron tube goes on apace, due to the widening knowledge of its properties, to experiment with new forms of tube and to recognition of its adaptability to various practical uses. The importance and value of the tube in recent engineering research were noted in the issue of the ELECTRICAL WORLD for the first of the year. The most striking recent applications have been in its use as amplifier and detector, a culminating example being the simultaneous delivery of President Harding's Armistice Day address to large audiences on both the Atlantic and Pacific Coasts.

Naturally close study of the tube itself has continued, and its characteristics in all its varied forms are becoming more and more definite. The past year has seen several new forms of rectifying tube, new properties of four-electrode tubes, including that of a negative-resistance characteristic, and the introduction of the magnetic field as a control agent. The last-named class of tube is especially interesting, not only because as detector it permits electrical separation of the circuits on the receiving and delivery sides, but specially because as generator and rectifier there is mentioned in connection with it the possibility of greatly extending the range of power handled. Evidently this tube is being closely studied from this standpoint. It has already risen above the watt and embraced the kilowatt as its unit of rating, being used under these circumstances as a high-frequency generator. From the standpoint of engineering it would appear that further progress is to be looked for along the two general lines mentioned, namely, further applications of the tube, especially in its functions as detector and amplifier, and the developments of the tube itself to place it in the power-transforming class, particularly as generator and rectifier. There is every indication that in the last-named capacity particularly important achievements will soon be realized.

These tubes make a powerful appeal to the imagination since all their remarkable properties arise in the very simple expedient of the flexible control, by either electric or magnetic fields, of the motion of free electrons in space. This brings us at once to an intimate acquaintance with a fundamental constituent of all matter, *i.e.*, the electron, and thus very close to the ultimate problem of physical science, the nature of the constitution of matter. One important line of investigation in this field is the study of ionization by collision at higher and higher velocities. It is found that the deeper an electron may be made to penetrate into the mass of an atom, the more varied the effects, as, for example, in the luminous and electromagnetic radiations from a gas, and from these effects it is possible to draw very definite conclusions as to the nature of the structure of the atom of the gas. In order to obtain these high velocities, high voltages are necessary, and the hot-cathode tube provides one of the best methods for controlling electronic omission as regards both volume and velocity under high-voltage gradient.

100,000-Volt Lines Through the Streets of Berlin



THE citizens of Berlin do not object to high-voltage lines in the center of their city if the accompanying illustration of a 100,000-volt line through a main thoroughfare is any proof. Neither does Seattle nor Niagara Falls, in both of which a high-voltage line runs across the city, although at somewhat reduced voltages. This practice is not common, but it does not seem that there should be any objection to it anywhere if proper precautions are taken to provide rugged construction. Voltages of this magnitude are no more deadly than 2,300 volts and 4,400 volts, which are accepted city distribution voltages. In some cases the permission to run high-voltage lines through cities would save the electric service companies considerable expense, which must be offset by increased rates where they are obliged to place their step-down stations in the outskirts.

Factory Methods Applied to Transformer Repair Work

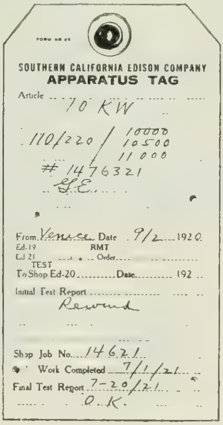
The Large Number of Transformers Passing Through Repair Shops of the Southern California Edison Company Allows the Use of Factory Methods in Rewinding and Repairing

By G. E. DECKER
Superintendent of Shops, Southern California Edison Company

FOR years it has been the practice of the Southern California Edison Company to rewind or repair all of its own transformers of whatever rating and voltage whenever this could be done at a profit over the cost of new transformers. A definite system of testing all transformers and the keeping of accurate records of performance and costs have been the factors which have permitted this work to be placed upon a businesslike basis. Careful study of the best methods of handling such apparatus in the shops has held the cost of repairs to the minimum.

The company maintains a record of each individual transformer from the time of its purchase until it is junked. As soon as a transformer is received from the manufacturer it is sent to the testing department, where all necessary data—such, for instance, as concern the ratio, core loss, heating, resistance and polarity—are determined and the high-voltage and other tests made. This record is used as an acceptance test and is checked against the manufacturer's guarantee. The record then is available for any future change or rewinding that may take place.

Every time a transformer is disconnected from the lines for any reason it is again passed through the testing department for inspection and test to determine its condition, and it is then passed on to the shop department with a small tag attached (Fig. 1) on which notations are made, such as "Rewind" or "Clean and paint." If the transformer has been in service a great many years or is of an old design such as those made before the general use of the present high grade of transformer iron, the core-loss test is again made. Upon coming from the shop it receives a final check and is passed into the general store.



SOUTHERN CALIFORNIA EDISON COMPANY
APPARATUS TAG
Article 10 KW
110/220 / 10000
10500
11000
1476321
G.E.
From Venice Date 9/2 1920
Ed-19 RMT
Ed 21 Order
TEST
To Shop Ed-20 Date 192
Initial Test Report
Rewind
Shop Job No. 14621
Work Completed 7/1/21
Final Test Report 7-20/21
O.K.

FIG. 1—TAGS ARE ATTACHED TO EACH PIECE OF APPARATUS PASSING THROUGH DEPARTMENT

It is the standard practice of the Southern California Edison Company to require all work that comes out of the shop to pass the same high-standard A. I. E. E. tests that are required of new apparatus. As the A. I. E. E. voltage test is double voltage plus a thousand volts for the ground test, it is obvious that difficulties with some old makes of transformers, especially those with 6,600-volt primaries, have been experienced. Many of these transformers probably never had any test that compares with the one prescribed by the A.I.E E. today.

Several 6,600-volt transformers have been found inclosed in cases that were designed for only 2,200 volts, and the clearance between case and terminal board was too small to allow the standard test voltage to be applied. In some instances of this kind the difficulty has been overcome by putting on a special cover with a raised center to give the necessary clearance. In addition, some of these transformer cases were so short that the oil did not cover the terminal board. Then it was found advisable in rewinding to change the primary voltage to 2,200. In rewinding to a lower voltage, however, the new cost of the lower-voltage transformer must be used to predetermine the limiting cost of repairs and allow for the necessary margin between the new cost and the cost of rewinding.

JUNKING LIMITS FOR TRANSFORMERS

The necessary margin to allow between the new cost f.o.b. the company's warehouse and the total cost of rewinding is based entirely on fixed quantities. Moreover, the advisability of rewinding or junking a transformer is likewise predetermined by a formula that has been worked out in the testing department.

For Transformers Not Burned Out.—The watts loss per annum at \$0.008 per kilowatt-hour should not exceed the interest at 8 per cent on the cost of a new transformer (less the junk value) plus the average loss on a new transformer at \$0.008 per kilowatt-hour. (See Formula A.)

The exciting current is figured the same way except that the energy is figured at \$0.0016 per kva. (See Formula B.)

(A)

$$\frac{8{,}760 \times 0.008 \times X}{1{,}000} = 8\% \times C + \frac{8{,}760 \times 0.008 \times W}{1{,}000}$$

(B)

$$\frac{8{,}760 \times 0.0016 \times Y \times (\text{va. rating})}{1{,}000} =$$

$$8\% \times C + \frac{8{,}760 \times 0.0016 \times Z \times (\text{va. rating})}{1{,}000}$$

in which:

8,760 = hours per year.
0.008 = dollars cost per kilowatt-hour.
8% = interest charge on investment.
W = watts core loss on average new transformer.
C = average cost of new transformer less its junk value.
X = the maximum core loss in watts that will be allowed.
(va. rating) = the volt-ampere rating of transformer.

$0.0016 =$ dollars cost per kva. for exciting current.

$Y =$ the maximum exciting current in per cent that will be allowed.

$Z =$ exciting current in per cent of an average new transformer.

Example.—Given a 10-kw., 6,600-volt transformer, to find X and Y.

(A)

$$\frac{8,760 \times 0.008 \times X}{1,000} \quad 0.08 \times 154 + \frac{8,760 \times 0.008 \times 87}{1,000}$$

Therefore $X = 263$.

(B)
$$\frac{8,760 \times 0.0016 \times Y \times 10,000}{1,000} = 0.08 \times 154 + \frac{8,760 \times 0.0016 \times 0.025 \times 10,000}{1,000}$$

Therefore $Y = 0.113$, or 11.3 per cent.

For Transformers Burned Out.—The above formulas A and B are used except that instead of using the "net cost of a new transformer" the difference between the "net cost of a new transformer" and the "cost of rewinding" is substituted.

In using this table it is necessary to know what the losses were before the transformer was burned out and also that they do not exceed those given for the average new transformer. These are given in the accompanying table.

In order to eliminate the necessity of figuring each individual transformer, tables are made up for the different classes of transformers which will show at a glance whether a transformer should be junked or rewound. Such data for 2,200-volt primary transformers is shown in the table. By referring to this table it will be seen that a 5-kw. transformer which is not burned out has a limit of 134 watts for core loss and 12.9 per cent exciting current; therefore, in testing this transformer, if either one of these factors goes above this limit, the transformer is automatically junked. In case the transformer is burned out, the core watt limit is 68 and the per cent exciting-current limit is 6.3.

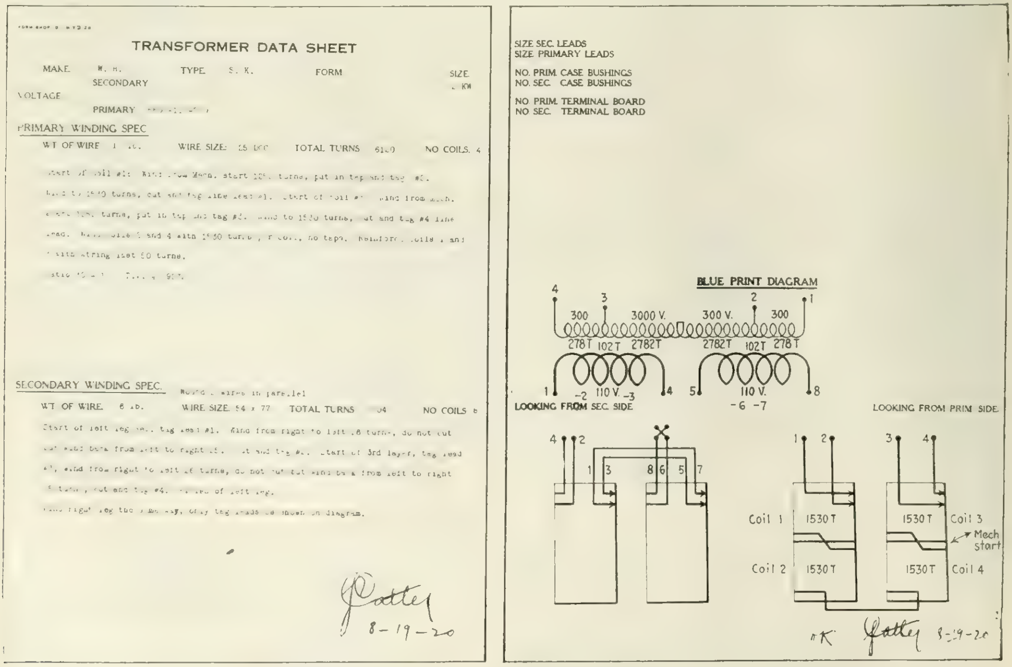
Because of the very rapid growth of the Southern California Edison Company, due not only to the absorp-

JUNKING LIMITS FOR ALL MAKES OF OLD TRANSFORMERS

50-cycle, 2,200-volt primary winding

(Showing at a glance the test limits within which a transformer must come to make it economical to rewind it)

							Not Burned Out Limits		Burned Out Limits	
Kva. Rating	Loss of Watts	Per Cent Exciting Current New Transformer	Transformer Cost, New	Junk Value	Net Cost	Rewind Cost	Core Loss Watts	Per Cent Exciting Current	Core Loss Watts	Per Cent Exciting Current
1	25	9.0	35.50	2.50	33		63	28.0	Junk	
1.5	27	8 0	43.50	3.00	40.50	..	74	23.4	27	8.0
2	31	7.5	50	4.00	46	44	84	20.6	33	8.1
2.5	34	7.0	56	5.00	51	44	93	18.7	42	8.6
3 0	38	6 5	62	6	56	45	102	17.2	51	8.6
4	44	5 5	72	8	64	48	117	14 7	62	7.8
5	50	4.5	83.50	10	73.50	58	134	12.9	68	6.3
7.5	66	4 5	109	14	95	68	175	11.7	97	6.6
10	81	4.0	133	18	115	78	213	10.6	123	6.1
15	106	4 0	177	24	153	88	282	9.9	180	6.5
20	135	4.0	216	30	186	97	347	9.3	237	6.5
25	165	4.0	256.50	36	226.50	135	425	9.2	270	6.1
30	200	4.0	296	41	255	180	492	8.85	286	5.4
37.5	237	4.0	343.50	45	298.50	220	578	8.6	325	5.2
50	320	4.0	423	62	361	250	742	8 1	447	5.3
75	500	4.0	529	93	436	290	1,000	7.3	668	5.1
100	610	5.0	635	125	510	330	1,190	7.9	816	6.0
150	840	5.0	810	187	623	380	1,555	6 8	1,118	5.9
200	1,100	5.5	937	250	687	420	1,885	7.5	1,405	6 3



TRANSFORMER DATA SHEET

MAKE W. H. TYPE S. K. FORM SIZE KW

SECONDARY VOLTAGE

PRIMARY

PRIMARY WINDING SPEC

WT OF WIRE WIRE SIZE TOTAL TURNS NO COILS 4

SECONDARY WINDING SPEC.

WT OF WIRE 6 lb. WIRE SIZE TOTAL TURNS NO COILS

Potter 8-19-20

SIZE SEC. LEADS

SIZE PRIMARY LEADS

NO. PRIM. CASE BUSHINGS

NO. SEC. CASE BUSHINGS

NO PRIM. TERMINAL BOARD

NO SEC. TERMINAL BOARD

BLUE PRINT DIAGRAM

OK Potter 8-19-20

FIG. 2—ALL NECESSARY WINDING DATA FOR TRANSFORMERS ARE PLACED ON SUCH FORMS
THE BACK OF THE FORM IS USED FOR THE WINDING DIAGRAM

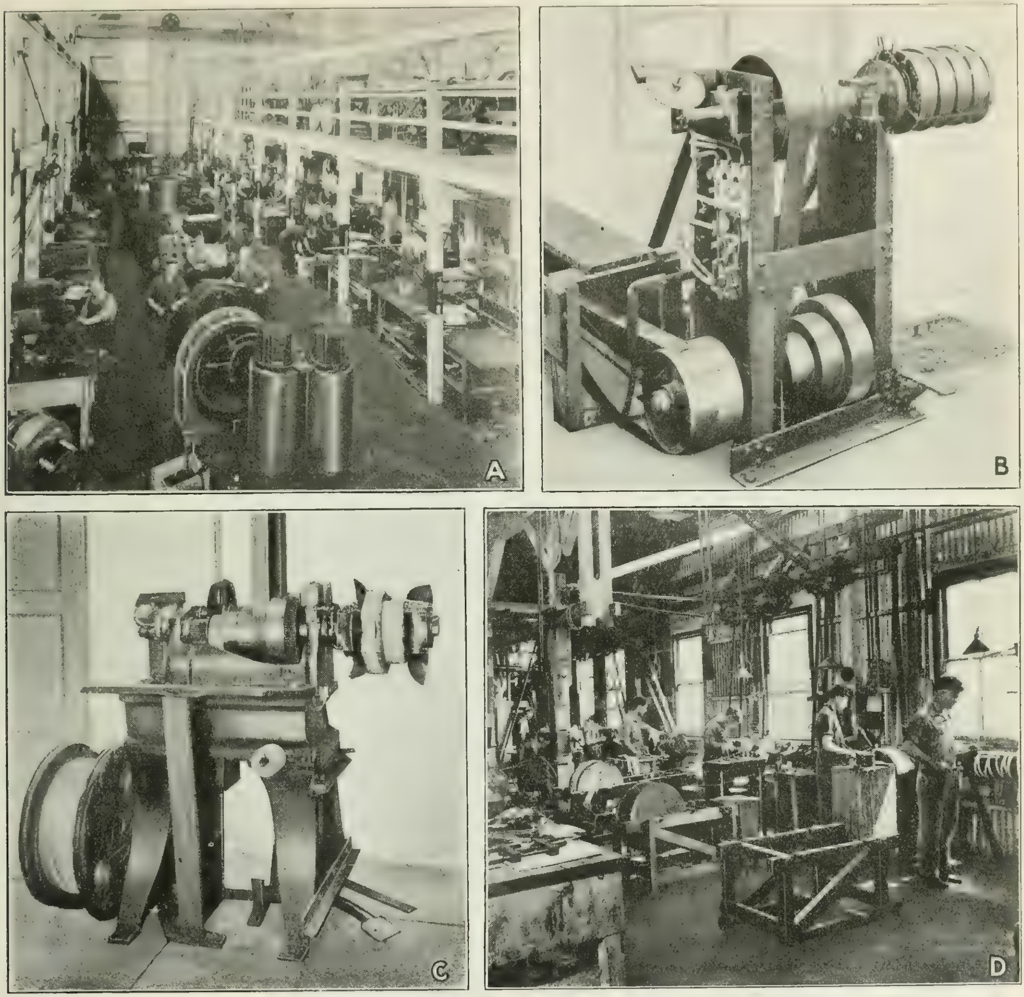


FIG. 3—INSIDE THE TRANSFORMER REPAIR SHOP

A—Compact arrangement of repair shop facilitates use of factory methods. B—High-speed coil-winding machine is adaptable to small jobs. C—A rebuilt lathe makes an admirable winding machine. D—Coil-winding machines are grouped closely.

tion of other companies but also to the large amount of new business, the transformer requirements have been on a very large scale and the special uses which call for odd voltages have been many. In 1910 one winding machine in the shop took care of all the rewinding, whereas at the present time there are sixteen such machines in operation for performing the work.

APPLICATION OF FACTORY METHODS

Owing to the large number of transformers that pass through the shop (in 1920 there were 673 rewound and 1,955 repaired) factory methods have been used in many ways to cut the repairing cost down to the lowest figure possible. The transformers are segregated into groups according to size, voltages and class, which makes it possible for a workman to become especially familiar with one particular character of work, thereby gaining speed and efficiency. It is the practice to assign a dozen or more transformers to a certain journeyman winder for his personal charge. He has three or four helpers assisting him and has the use of two or three winding machines. The journeyman works at the bench where the dismantling and reassembling is done and attends to the procuring of the material, such as insulation, wire, tape, etc., and oversees the winding of the coils. In fact, it is his personal responsibility to see the job completed and "O. K.'d" by the testing department, and at a cost that is reasonable. The necessary winding data are supplied the journeymen by the general foreman on forms, as shown in Fig. 2. This form eliminates guesswork and can be used over and over again for all similar transformers.

It is obvious that on a system the size of the Southern California Edison Company, which has more than

35,000 transformers in service, almost every conceivable kind of transformer is encountered and the experience of the men in the transformer department becomes very general. Even with a shop the size of this, it has not been found practicable to adopt piece work, but another plan of showing costs and putting each man on a competitive chart has been of value. The chart shown in Fig. 8 is kept posted in the winding room and is an individual record of each job. The vertical scale is divided into dollars and the horizontal scale into kilowatts. Curve A shows the cost of various sizes of transformers of a certain voltage; curve B is an assumed reasonable cost of a complete rewind for an individual transformer, and curve C is the actual average cost of rewinding. Curve C is lower than curve B because of quantity production and keen competition. As soon as a journeyman's job is completed and billed a small tag is pinned on the board, with the workman's name, the size and number of the transformers rewound and the unit cost. The position of this pin on the curve shows with what success the job was completed.

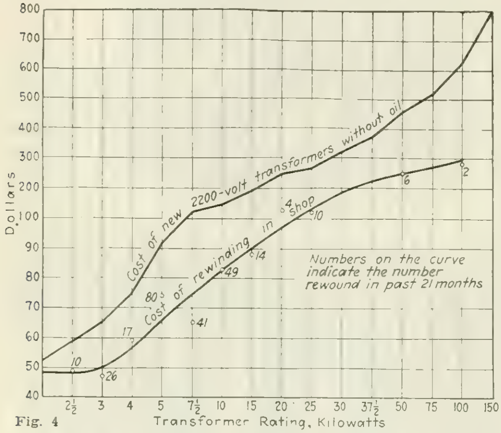


Fig. 4

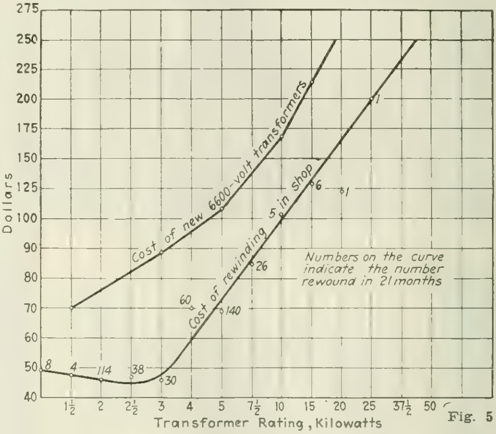


Fig. 5

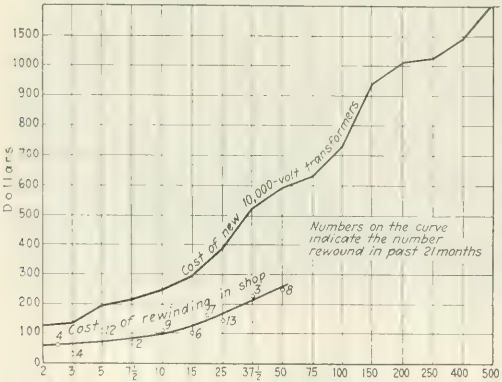


Fig. 6

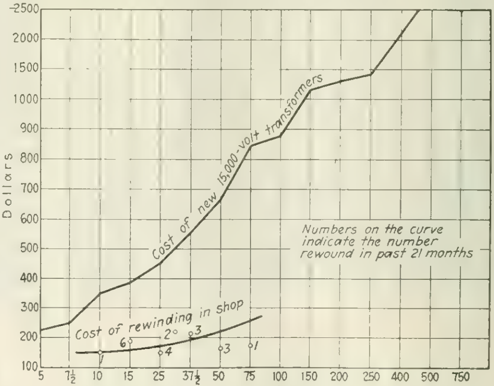


Fig. 7

FIGS. 4, 5, 6, 7—COST OF REWINDING TRANSFORMERS COMPARED WITH BUYING NEW ONES

A record that has been kept of 6,600-volt transformers is shown in Fig. 5. The data shown were for a period of twenty-one months. It is interesting to note that quantity production is reflected in lower costs to such a decided degree. The costs of rewinding 2,200-volt, 10,000-volt and 15,000-volt transformers are shown in Figs. 4, 6 and 7.

It is the constant aim to make all transformers as good as new, or better if possible, and therefore the best grades of insulating material are used. All rubber-covered leads are removed in the shop and cambric-covered leads installed. All short or damaged leads are also renewed. Old-style paper or cardboard barriers are usually replaced with mica board of some kind.

Fig. 3B shows a machine developed to do small winding that could be operated at high speed. This machine is operated by a 1½-hp. motor, and a tight and loose pulley is used for starting as it has been our experience that this method is more desirable than a friction clutch.

A winding machine is shown in Fig. 3C made out of an old lathe that had been in a fire and was reduced to junk value. It is the most flexible of all the machines used as the back gear gives it a great range of speed and lots of power for heavy work. It may be noted that the bed was cut in two, the legs were brought close together and the head was turned around on the bed. The left-hand pedal is a brake working on the small cone and the right-hand pedal controls the starting and stopping by operating the friction clutch on the jack-shaft. Several of this type are in use, and they are not only cheap to make but better for general work than any other type in use in this shop.

The counter shown on the left-hand end of the shaft in Fig. 3B was developed for this particular kind of work and has now superseded all other makes of counters. It will count forward and backward at any speed with absolute accuracy. The small window on the right is for units, the elongated window in the center is for tens and the left-hand window for hundreds. It can be instantly set back to zero or locked so that the count cannot be tampered with. Moreover, a half revolution can be corrected, which is very important in starting a coil. The workman pays no attention to the counter until the wire is in position, when he turns the head over one-half revolution, and he is then ready to start the count. The counter is then set to zero, but in case it does not come exactly to that point it can be brought to zero by the adjusting screw on the end of the shaft. The Southern California Edison Company has found that it not only pays to rewind nearly all transformers, but the fact that a skilled force of men is constantly employed makes it possible to handle any emergency with the least possible loss of time, men and material being always available.

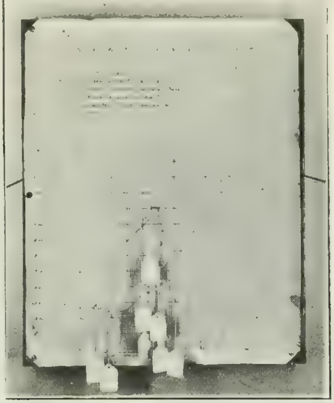


FIG. 8—A BULLETIN BOARD INDUCES COMPETITION BETWEEN WINDING CREWS

Generating Electricity Within the Arctic Circle

AN ARTICLE in the London *Engineer* of recent date contains a comprehensive account of one of the northernmost electrical developments in the world—that at the Porjus waterfall in the extreme north of Sweden, within the Arctic circle. This hydro-electric plant serves the industrial interests engaged in mining the immense deposits of iron ore made accessible by railroad construction in comparatively recent years, 5,000,000 tons of iron ore being now exported annually from the district. In deference to the tourists one waterfall above the Porjus development has been permanently reserved as a scenic feature. The Porjus water power is a combination of rapids and falls, 1¼ miles long, which continue to the Gulf of Bothnia as the Great Lule River. Here three 10,000-kw. generators deliver energy at 80,000 volts over a 200-mile transmission line. The author says that the electric railroad now almost completed which runs through the vast forests of Lapland and of which Porjus will be the northern terminus crosses rivers capable of yielding 8,500,000 hp. No railroad probably has ever been built under greater difficulties.

Simpler Disconnecting-Switch Practice Desired

One Solution Is a New Form of Heavy-Duty Disconnecting Switch that Does Not Require Cumbersome Mechanism

BY J. ALLEN JOHNSON
Electrical Engineer Niagara Falls (N. Y.) Power Company

AS THE art of power generation and distribution has advanced the design of disconnecting switches has failed substantially to progress with that of other types. This has doubtless been due, at least in part, to the perhaps unconscious desire of engineers to preserve simplicity in the fundamentally simple function of disconnecting dead apparatus. But as systems have grown the use of disconnecting switches of the usual form in larger capacities has demanded the sacrifice of this simplicity by requiring the addition of operating mechanisms which have become more and more complicated. This situation has reached such engineering importance that today there is a strong feeling among some engineers that a return to simplicity in disconnecting-switch practice is desirable. But this necessitates new forms of disconnecting switches which can be operated easily by hand in large ratings. It was with this requirement in mind that the design of the switch shown in the accompanying illustrations was undertaken.

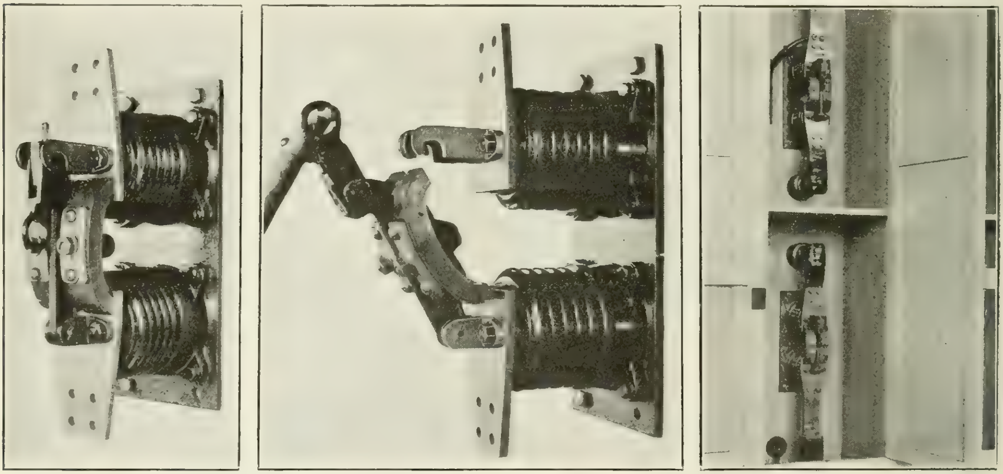
COMPLICATIONS INCREASED WITH SIZE OF SWITCH

Any one familiar with the history of electrical distribution will recall how as the capacity of systems increased it was found that disconnecting switches were often forced open in times of short circuits by direct electromagnetic action. This led to the use of latches. As systems still increased in size disconnecting switches grew so large that they became very difficult to operate by hand in the usual manner and the mechanically operated disconnecting switch appeared. At first very simple in character, the mechanism gradually increased in complication until at last the state of development arrived where the mechanism for operating disconnecting switches became almost as complicated as that for operating the oil switch itself. Then, finding virtue in necessity, the presence of this complicated mechanism suggested the possibility of electric and mechanical interlocks between the disconnecting-switch and oil-switch mechanisms, thus adding still further complication, and now finally has come the proposition that the oil-switch mechanism be actually made to operate the "disconnects" also.

Besides this complication, the faults of the switch itself became more apparent as larger sizes were made. As the larger sizes are hard to open or close, there is considerable strain in the insulating supports. After a switch has been closed for some time it may "freeze." To open the switch great force must be exerted, which may loosen the mounting. Besides being difficult to open these switches are difficult to close. Often they cannot be closed with a steady push, but must be shut with a bang, which may also result in injury.

An analysis of the construction of a knife switch brings out another inherent disadvantage. It has been established that the resistance of a contact depends upon contact pressure; therefore heavy pressure is necessary at the contacts of a knife switch designed to carry heavy currents. But heavy pressure also makes the switch more difficult to operate. Cutting at the hinge may result if the switch is not kept lubricated. If a switch is once cut, it will not carry heavy loads without burning.

An attempt was made in the design shown to overcome these weaknesses. This switch has a bridge member consisting of laminated copper brushes flexibly mounted upon a bronze bar or frame which is pivoted on a steel pin. Contact pressure of positive and definite magnitude is obtained by means of a simple eccentric device, and the same movement which applies pressure to the contacts also effectively locks the switch in the closed position. As shown in the illustration, the switch is operated by an ordinary hook stick which is inserted in an eye on a swinging arm mounted on the hinged bar. This arm holds a pin which is slightly eccentric to the hinge of the arm. After the switch is pushed into position by the stick the arm is pushed up, causing the eccentric pin to engage with two hooks mounted on the stationary contact. The arm is then rotated downward, the movement of the pin exerting a heavy pressure on the contacts. As the pin cannot come out of the hooks unless the arm is swung outward from the closed position by means of the hook stick, the switch remains locked even with a heavy current surge.



THIS DISCONNECTING SWITCH CAN BE OPENED AND CLOSED WITH LITTLE EFFORT

At the right is shown the switch as it appears installed in a plant of the Niagara Falls Power Company

TEMPERATURE RISE OF DIFFERENT PARTS OF 2,000-AMP. BRUSH-TYPE DISCONNECTING SWITCH

Part of Switch	Temperature Rise, Deg. C. At Rated Current	Temperature Rise, Deg. C. At 125 per Cent Rated Current
Left-bottom contact	20.1	26.2
Left-top contact	18.2	23.2
Right-top contact	19.9	29.2
Right-bottom contact	20.7	31.2
Center of brush	20.6	28.2
Top connection	20.5	28.7
Bottom connection	19.4	28.2
Air temperature, deg. C	24.1	25.3

Switches of this type in any reasonable rating may be operated by one man with an ordinary hook stick. No great force or violent motion is necessary for either closing or opening the switch, so that the insulators cannot become loose or be weakened from this cause.

The almost straight path of the current through the switch is very favorable under short-circuit conditions, as there is little tendency for the brushes to lift, and this tendency is overcome by the strong and definite contact pressure created and maintained by the eccentric locking device. Should the contacts in any way become burned or require redressing, it is a very simple matter to remove the brushes for this purpose, or, if desired, new brushes can be installed in their place without sacrificing the remainder of the mechanism of the switch.

Another advantage of the new type of switch is the interchangeability of the parts. A switch originally installed, say for a capacity of 1,000 amp., can be easily changed to a 2,000-amp. switch by mere substitution of new current-carrying parts. Very little dressing, grinding or fitting is required. An adjustment is provided to allow for slight inequalities in brushes, and a slight flexibility in mounting permits each contact surface to adjust itself to a perfect bearing.

It might be thought that the passage of a portion of the current through the bridge and locking mechanism would cause trouble, but such has not been found to be the case in practice. The conductance of the bridge and locking mechanism is so small compared to that of the brushes that very little of the current passes through it, and no unequal heating results.

A 2,000-amp. switch of the type shown, when operated continuously at full load and 25 per cent overload at 25 cycles, gave the temperature rises shown in the accompanying table. From the results it will be noted that the temperature rises at rated current are only about 20 deg. C. and almost uniformly distributed. Even at 25 per cent overload they are well within safe limits, as their temperature is only about 31 deg. C. above room temperature.

This switch is being made under the writer's patent by the Electric Power Equipment Corporation of Philadelphia.

What a New Customer Thinks the First Day

A Picture of the Reaction from a Bad First Impression—Friendship or Hostility Depend on Early Contacts with the Company "Human" Administration Essential to Confidence and Good Will

By **H. A. LEMMON**

Personnel Manager Stone & Webster, Inc., Boston, Mass.

PAINSTAKING scientists at the Smithsonian Institution can take a fossil bone and from it reconstruct the fossil framework of some prehistoric monster upon which the eyes of living man have never dwelt. From the incidents of his first day's contact with the public service company, Bill Jones, average citizen and voter, reconstructs this entire organization in his mind and fixes his present and future relationship to it. That Bill is the chap who decides the destiny of the central-station company was vigorously emphasized by H. A. Lemmon at the recent convention of the Stone & Webster Managers' Association in Boston. Throwing the spotlight upon the outworn methods of disregarding the individual, which still hamper too many utility organizations, Mr. Lemmon made this strong plea for a warm-blooded, man-to-man conduct of affairs which will dispel misunderstandings, create friends and insure a development of service mutually profitable to community and to corporation.

I WANT to paint a little picture of one of the very fundamental sources of trouble in the relationship between the central-station company and the people. It is the little matter of the first impression out of which grows the opinion, attitude and influence which every householder maintains to either the benefit or the disadvantage of the public utility company. Here is the picture. Bill Jones and his family and their small possessions arrived in their present home one Saturday morning, and with the unpacking and lugging of goods into the house it was early afternoon before any of the family chanced to think of electric lights and gas. Two or three of the cords had lamps swinging at their ends, but neither the snapping of the key nor the turning of the cocks produced any results. Vaguely Bill knew that for some reason these services had been disconnected, and so notwithstanding his anxiety to get the beds up and the range working he saw no way out of it but to clean up and walk over to a neighbor's to telephone to the gas and electric company.

Mrs. Jones had reminded him that the next day was Sunday and the following day was a holiday, giving him a list of groceries which she must have before evening. He called up the grocery store first. A pleasant voice responded and took his order. Bill said it must be delivered that evening. The voice explained that his order was in too late to go out on one of the regular deliveries, but that it would certainly be sent out specially and would surely arrive in the evening. It did.

NO SERVICE WITHOUT AN OFFICE CALL

Then he called up the gas and electric company, apologized for forgetting to order his service reconnected before and rather awkwardly explained the situation. The voice at the other end broke in impatiently: "You'll have to come to the office and sign up." Bill ventured to suggest that he could come in Monday or Tuesday. "No," said the voice; "you'll have to come into the office and sign up if you want lights or gas," and the tone indicated that the conversation was ended.

Bill "cussed" a bit, but he hurriedly went home and Mrs. Jones finally found his other clothes in the big box. Bill donned them and trudged off for the office of the public service corporation. It was only a twenty-minute walk, and at quarter of three he entered the portals of a big establishment which he thought must be a bank.

There was a mahogany counter surmounted by curlicues and rods in polished brass, punctuated here and there with inhospitable portholes. He glanced over these, but none of the eyes he met staring out from them conveyed an invitation, and so he fell into the line which he observed lock-stepping its way to the one which appeared the most popular. After ten minutes, which seemed to Bill an hour as he thought of the things he must accomplish that night, his turn at the window came. "I want to get lights and gas connected at 978 Fairfield Street," began Bill, when he was interrupted by the caged inmate with a terse "Contract window!" and a glance of dismissal which tried to look past and around Bill to the next person. Bill didn't quite catch the significance of the remark nor the in-curve glance and so he started to repeat. "Contract! I said," came the interruption again, this time quite conclusively. Bill grasped the idea that he was wrong for some reason or the other and stepped aside to think it over.

One of the lock-step gentlemen took pity on him and said: "He means you are to go to the window marked 'Contracts.' You only pay bills at this window." Bill stumbled a bit both mentally and physically to the designated porthole, and notwithstanding the impersonal glare which met him told the story of his requirements.

NO POINT OF PERSONAL CONTACT HERE

The proposed transaction seemed to be quite an important one to Bill, but was received in silence and was only interrupted by the clerk thrusting a card at him with the command, "Sign here." Bill started to read the very fine print he was ordered to sign, but this proceeding was so evidently out of order that finally he hastily appended his signature. Could he have service that afternoon? "Information" was the only word shot back at him. He had learned much by this time, however, and he looked about and found a place so designated. He told his story for the third time here in part, and the clerk wanted to know if he had signed an application card. Bill didn't know. He had signed something at another window. With a bored and resentful air the clerk walked over and presently came back with the card, which in turn he handed to a boy who disappeared with it into the mysteries concealed by a partition.

Bill didn't know that back there they were going over the book of bad bills to see if his name appeared there. In time the card was returned. The information clerk scrawled his initials upon it and began to fill out another blank.

"Ten dollars."

"What?" said Bill.

"Ten dollars—a deposit."

Bill didn't have the ten dollars with him; he would have to walk home to get it. Could he bring it in or send it Monday? He could not. The deposit must be made before he could receive service. Bill trudged home, got the ten dollars and trudged back. He wasn't tired. There were surging up within him emotions which anesthetized any feeling of weariness which he might otherwise have felt.

No Sympathy Here

There was no delay in getting to the right window this time. Bill was learning the ropes of that mysterious place of business. He paid the money, got a receipt and the clerk finished filling out the second blank. Rather timidly this time, Bill again started his tale of the inconvenience which would fall upon his little family if he couldn't have service that night. Bill had never walked into a bank and asked the cashier to give him a million dollars, but he knew exactly what the sensation would be from the look he received at that desk.

"The wagons went out on their last trip two hours ago. We cannot connect any more tonight," was the answer. Bill ventured the opinion that the morrow was Sunday and the next day was another holiday, but apparently this statement had no element of news in it, for it met with nothing but a yawn and a glance at the clock. The incident was closed.

I relate this story because I have seen it enacted not once but many times. All or part of it can happen with many more companies than any of us want to confess. From the incidents of that first day's contact Bill Jones constructed the entire organization of the lighting company in his mind and so fixed his present and future relationship to it. This point of contact might have been through the collector, the meter reader or any other so-called minor representative of the company, and the result would have been the same. Yet Bill is the chap who decides the destiny of our franchise amendments, and our obligations, and our applications for increased rates, and our dividends.

Groceries Are Understood

Mr. Jones' grocery bill is very nearly $40 per month these days as against $25 six years ago. If his grocer prospers until he occupies his own building and has a stock worth $50,000 Bill doesn't care and in fact is rather proud of it. He likes to associate himself with successful people and institutions. He mildly resents the increased price of groceries, but in the back of his head is the fact that, while the cost of living has risen, his wages or salary has also advanced.

But if the lighting company to which Bill Jones pays an average of $2.20 per month proposes to increase that amount by 20 cents, Mr. Jones is indignant, then enraged, and is not content until he has invoked all the powers and resources of his citizenship to combat the "outrage." Why? Lack of understanding. Lack of understanding that corporations are subject to the same immutable economic laws that govern the grocery business. He rather imagines that the directors get together in the back room about once in so often and by incantation and other mysterious hocus-pocus create money out of the air, as it were. It might make a better citizen, customer and neighbor of Bill if the mechanism of the company should be taken apart and the pieces spread out in the open for him to handle and understand. Assuredly it would be better for the lighting company.

Customer Ownership Would Help Here

Bill doesn't know, though he is capable of understanding, that while his grocer turns his capital four to six times a year, the lighting company does it once in six years. He doesn't know that an incorporation is merely a convenient form of association of people just like himself; that many of the stockholders are just his kind of folk who have taken their little savings out of the bank for investment; that not one in ten is of the plutocratic stratum of which he is so suspicious; and he doesn't imagine that the company's affairs could be openly presented and understandable. He would be astonished to know that there are 2,700 stockholders in his company instead of the ten or twelve he has pictured, and that the "little fellow" receives exactly the same dividend per share as the larger holder.

He does not realize that the state itself establishes and scrutinizes the form of bookkeeping used by the utility; that there can be no stock-jobbing deals because the state supervises security issues, fixing the price thereof and the rate of return upon the capital invested; that it fixes his lighting rate to produce no greater sum than is needed for a reasonable return only; that the state examines all the operating expenses, prescribes the sort of service which he may receive to the full value of his money and, in short, oversees every step in his relations to the company, guarding his individual interests more perfectly than in any other business.

No Revenue Except from Earnings

It didn't help Bill any to learn that the increase in his lighting bill was due to a coal clause. So far as he knew, he hadn't used any coal clauses; but he could have known and would have approved of the underlying principle had it been properly presented to him at the right time.

He had never had it made entirely clear to him that money itself is entitled to an annuity. At present he feels that interest earned upon the investment is *profit* instead of being an *expense* of doing business; but very little effort would convince him. Likewise he resents the fact that the patrons of the company are required, through enforced rates, to pay taxes and other overhead expenses. He thinks the stockholders ought to bear these burdens, and yet he could be made to understand that the company can only pay out money which it has first taken in, and that its only source of revenue is the sale of its product. He has visions of a very fat treasury and of great sacks of gold in the company's vaults, and yet he is fully capable of understanding that under state regulation all expenditures for additions and betterments must come from without the company itself. He will be far less antagonistic to the company after he has learned all this. He is fully capable of understanding that in the end the customers of the company and the community at large suffer far more than do the stockholders if the company is kept in a semi-starved condition.

Bill does not realize that the fundamental reason why the company enjoys a monopoly—has no competition—is because the business isn't profitable enough to offer temptation. If the company is a potential monopoly, the protection is really to the people of the community rather than to the stockholders.

Bill has heard a local politician talk about the valuable franchise the city gave the company, and he curses the councilmen who in that remote day gave away his rights to the corporation. He doesn't understand that a franchise is a thing which the city exacts—not something which it gives—merely a license to do business, just as his grocer friend required, only the grocer didn't have to submit to so many vexatious restrictions before he began operations. He waxed indignant as he listened to a discussion of how the use of the streets was given to the company, it not being called to his attention that the use of the streets was not given to the company but to himself in order that he and its other customers might be supplied with light. The use of the streets is also given to Bill's grocer friend for the delivery of his goods, as well as to every other citizen and merchant in the place.

If the grocer were taxed for each delivery wagon, and if he were charged a high license, and if his rent were increased, he would have to charge more for his goods, and Bill Jones and his like would pay these increases. He understands that if the city makes it possible to supply service to him at less cost than would otherwise be the case, he reaps the benefit—not the company. Jones would be a strong advocate of the service-at-cost theory if he really knew what it was and believed it would be honestly handled.

TOO MUCH TECHNICAL LANGUAGE

Bill and his neighbors read in the papers that it costs the company about 2 cents a kilowatt-hour to generate electricity, and they didn't understand why, such being the case, they had to pay 12 cents for their lighting. So a little self-elected committee of them called on the manager one day to find out. He was just going out, but he set down his golf bag—Bill and his neighbors don't play golf—and he completely submerged, bombarded, incrusted and asphyxiated them, between nervous glances at his watch, with such terms as "distribution costs," "reserve plant capacity," "transformation and line losses," "obsolescence," "depreciation," "overhead" and "development costs." They didn't find out what they wanted to know, and they felt sure that if there had been any satisfactory explanation, certainly he would have told them—and have told them in English—so they knew he couldn't justify such charges. The candidate for member of the City Council had no difficulty in explaining the situation to them—"it was just plain robbery."

But when Mrs. Jones went into the grocery store to pay her bill three or four of the clerks smiled and had a word of greeting as she passed on her way to the cashier, and the latter wanted to know how her boy was getting along in high school and whether she had put up her blackberries yet. They were glad to see her and to have her custom. When she paid her electric light bill perhaps the people there were glad to get the money, also, but they didn't know her name and they certainly gave the impression they were conferring a favor upon her by accepting it. As she passed the Federal building on the way home, it occurred to her that the atmosphere at the electric light office, when she paid her bill, was precisely the same as at the post office when she purchased a postal order—impersonal and studiously courteous. Also, when she went into the electric office and talked lights, the people there talked voltage and watts, and how could she enjoy calling upon people whose language she could not understand?

NO CENTRAL-STATION PROFITEERS

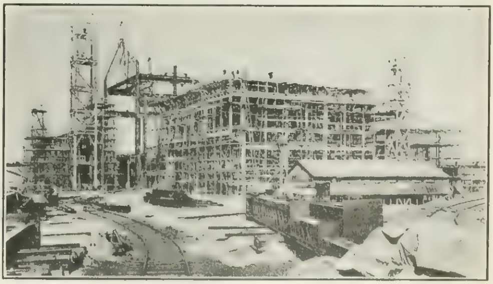
Bill has heard a lot about profiteering during the war and since. But no one has shown him that of all the people with whom he has done business he may be most certain that the lighting company has done no profiteering. The figures haven't been presented to him, and so he doesn't know that while the cost of living has increased over 140 per cent, his lighting bill has increased only 17 per cent.

Bill Jones is the public—our typical citizen, the man in whose mind lies the destiny of the public utilities, and the man to whom courts and commissions are directly responsible. He creates them. Don't we want him to know these things and others? How can he know them when not even one in ten of our own employees knows them—and that is the most damaging statement that can be made of any institution doing business with the public. We want Bill Jones to know all our cards face up on the table, because until he does he will never yield to us that to which we are entitled. The public must know all the principles governing our business and must be informed frankly and earnestly. Bill Jones is a bottle. What he thinks has first been poured into him. How much of his contents have we contributed?

Some men will say that these implied refinements in handling customers and keeping them informed are a passing fad, akin to psycho-analysis or something of that sort. In reality, they are simply recognition of human nature as it is. Failure to study human nature has wrecked railroads and it will wreck other utilities as readily. There is no lasting protection against confiscation of capital invested in public service save public confidence and good will.

Water-Cooled Generators in 200,000-Kw. Plant in Paris

FIVE 40,000-kw. turbo-generators, three of which will be water-cooled, are to be installed in the Centrale de Gennevilliers, Paris. The turbines will operate on a pressure of 320 lb. and a superheat of 350 deg. Fahr.



A SUPERPOWER PLANT FOR PARIS

The generators will be connected to 6,000/60,000-volt transformers without intervening low-tension buses so that the generators and their respective transformers will operate as units. The accompanying illustration shows the station as it appeared the middle of last summer.

Field of Electric Heat Treating Extending Rapidly

Used in Diversified Industries—Baking of Water Japan an Important Development—Ease and Accuracy of Control Important Featur

DESPITE the depressed industrial conditions, there has been a very satisfactory extension during the past year of the application of electrically heated ovens, ranging from the japanning of such small articles as shoe eyelets and camera parts down through the baking of foundry cores to the treatment of large castings for use in the manufacture of automobiles. In addition there has been increased use in the older application of japanning the sheet-metal parts of automobiles.

The use of the electric oven for baking water japan is perhaps one of the most important applications of the past year. The problem has been to secure ventilation that will prevent disastrous explosions with the least sacrifice of heat from the furnace. One automobile-plant installation made in the last year for japanning purposes and to heat-treat cylinder blocks, cast-iron pistons and parts of engine-crank cases is particularly interesting because of the tendency it indicates in the atuomotive field to make extensive use of the electrically heated oven in all operations requiring the use of heat-treating or baking.

The use of the electric oven in the manufacture of shoe eyelets presents an example that is interesting not only because of the small size of the article treated but because of the ability to get along without the large amount of ventilation required in larger furnaces. Allied with this use in the relative size of the parts is the use of the electric oven in the camera-manufacturing industry for the japanning of small parts. Another application is the heat-treating of ball-bearing parts to relieve internal strains that may have been incurred in the tempering or hardening process.

DIVERSIFIED APPLICATIONS AND DEVELOPMENTS IN ANNEALING FIELD

The electric oven is also being applied to the baking of the armature and coils for such small machines as those used in automobile starting and lighting equipment. The dental industry is making use of the oven in japanning of furniture and equipment parts. In one case mahogany graining is produced on metal that is almost impossible to distinguish from the actual wood finish. The pencil-manufacturing industry has applied the electric oven to the baking of pencil leads, with improved results over the older furnaces. Food-products companies have applied it in the dehydration of fruits and vegetables. Rapid progress in bread and pastry baking is being made as installations in use prove themselves in unit operating costs, better product due to heat control and a greater volume of finished product from the same amount of raw material. The Navy Department is making use of the electric oven for core-drying purposes in its foundry work and also at several of the navy yards for baking the metal furniture that is used on shipboard.

Developments continue rapidly in the brass, aluminum and glass-annealing field. Cases have been noted where in brass annealing the process has been reduced in time from approximately six hours for the fuel-fired furnace to less than one-half hour. In the treatment of sheet aluminum used in the manufacture of kitchenware the treatment of forty-eight hours or more required in the fuel-fired furnace where the materials have been stacked solidly has been reduced in the electric furnace to less than one-half hour. In doing this the charges have been reduced and the materials spread out so that the heating up process is less one of soaking than it is of getting the heat quickly to all parts of the materials under treatment. In the glass industry one case noted in the manufacture of fine glassware has shown a remarkable increase in the better grades of the product due to the heat control and the absence of the detrimental fumes met with in the fuel-fired furnace. In this case a small percentage of the samples selected at random by the manufacturer in a test showed the largest percentage as grade C, whereas a similar number of samples taken from the electric furnace showed almost 100 per cent grade A. Very much the same results have been obtained in the hand-painted, high-grade china industry. With the fuel-fired furnace some authorities have placed as the expected defective product a figure of 20 per cent. This is not unusable product, but simply that below 100 per cent condition. With the electric furnace this figure is in the neighborhood of 1 per cent. In addition the colors retain more life, owing to the absence of the detrimental gases that even in the muffle type of fuel-fired furnace cannot be entirely excluded.

FEWER REJECTIONS EXPERIENCED THAN WITH FUEL-FIRED

Cutlery manufacturers have also found a lesser number of rejections from the product of the electric heat-treating furnace. One optical company with a large number of furnaces has found that qualities of glass can be obtained with the electric furnace that are impossible with any other type. The furnace is also being used in the manufacture of vehicle springs.

Not including experimental furnaces and those for purely laboratory purposes, the range of development in manufacturing work shows electrical capacities ranging from 25 kw. to 30 kw. for the furnace used to handle small parts up to 720 kw. for annealing ingots on heavy forgings.

While it is impossible to fix definitely the field in which any given type of oven should be used, the tendencies based on the production involved may be indicated as follows: For small production the shelf type is used extensively, and if the parts are small and diverse the drawer type is useful. The fixed-shelf oven is special and rather limited in its field owing to high operating costs.

For larger work and somewhat larger production the rack, truck or car type ovens generally meet requirements. Next in order is the gravity type with the inlet higher than the outlet. This is used where the pieces are rather bulky and not many are handled per day. It is extremely flexible as to time of bake. The angle iron or I-section trolley type may be classed with the gravity type. The intermittent conveyor type, covering such typical work as japanning the sheet-metal parts of automobiles, conduit parts and the sheet-iron cases by which so much equipment of all kinds is protected and where the production is large and uniformity of results is important, is very much used. It is probably the most nearly standardized type of oven because of its more extensive use. The continuous-conveyor type is the one that is applicable to cases where the largest possible production is desired.

Operating Expenses of Six Plants

Study of Massachusetts Stations Emphasizes the Advantages of Electrical Equipment from Upkeep Standpoint Data Indicate Changes Which Are Taking Place as Result of Transition to New Industrial Basis

ELECTRICAL installations keep on making records in economy year after year in plants of many kinds, and nowhere can this be better seen than in the central-station itself. The comparatively small cost of maintaining generating switchboard and other electrical apparatus when weighed against the annual outlay required to keep steam-plant equipment in first-class condition is significant to the analyst of power-plant operation and to the sales force no less.

The latest available maintenance data from six of the better central stations of Massachusetts shows that the "steam end" of such a plant today requires easily three to six times as much money per year for upkeep as does the "electrical end." To broaden the freedom of discussion, the plants are presented here by letters instead of by name, but the data printed are all based upon returns to the Massachusetts Department of Public Utilities for the year ended June 30, 1921. The six stations selected for a brief analysis of their maintenance expenses ranged in capacity during the above period from 18,437 kva. to 77,500 kva. This capacity represents the mean rating of each plant during the year.

The plants are all of the "straight" steam type, without hydro-electric supplementary stations owned by these companies, although in two cases, stations C and F, interconnection with hydro-electric systems is in regular service. These stations are thoroughly modern in design, for the most part, with water-tube boilers, mechanical stokers and turbo-generator units of reasonably good economy. They serve cities and surrounding territories in some cases of from 100,000 to 200,000 population, and are being ably managed.

TABLE I—OPERATING AND MAINTENANCE EXPENSES OF SIX MODERN MASSACHUSETTS COMPANIES

Company	Kw.-Hr. Generated	Station Operating Expenses	Plant Maintenance Expenses: Building	Plant Maintenance Expenses: Steam Equipment	Plant Maintenance Expenses: Electric Equipment	Plant Maintenance Expenses: Total	Average Plant Rating, Kva.
A	34,232,840	$542,748	$4,529	$23,355	$9,432	$37,316	23,150
B	29,194,096	672,803	8,472	25,166	6,675	40,313	25,787
C	29,056,200	289,935	2,525	22,946	2,349	27,820	18,437
D	30,144,388	580,852	4,029	36,830	5,482	46,341	20,265
E	81,691,800	1,050,390	23,819	52,427	8,233	84,479	77,500
F	63,140,000	983,159	23,135	100,712	14,138	137,975	59,700

In general, these plants are undergoing a gradual development from pre-war stations of moderate load-handling abilities to post-war plants "set" for the great task of furnishing energy economically to broadening or intensifying markets. Their total sales of energy in the year referred to above ranged from 23,613,941 kw.-hr. to 69,507,076 kw.-hr. Their station operating expenses, exclusive of purchased energy, ranged from $288,935 to $1,050,390, the former being due to a very large purchase of energy by station C and the latter to the operation of the plant (E) as an independent installation with no interconnection of any importance.

Turning to the maintenance data yielded by these six companies for the year, it will be noted that the total station upkeep represents a very small proportion of the total operating costs of each plant. Data as to outputs, total plant expenses and total maintenance costs are given in Table I. The actual plant maintenance costs ranged from $27,820 per year in station C, a large purchaser of energy, to $137,975 in the case of station F. These sums are not insignificant and are worthy of attacking from the efficiency standpoint on the principle that a dollar saved is a dollar earned; but in comparison with the total production costs of these installations (in which high-priced coal cut so much figure) maintenance expenses are modest indeed. This is emphasized in Table II in terms of cents per kilowatt-hour generated for the three leading items of plain maintenance outlay. In only one case does the total plant upkeep exceed 2 mills per kilowatt-hour, and in the other cases it runs always below 1.6 mills. Usually, too, these plants have to spend only between 6 and 10 cents for maintenance for every dollar expended in operation, and from every dollar of revenue from the sale of electricity these stations have to devote only from 2.1 to 5.9 cents to upkeep of plants.

TABLE II—MAINTENANCE EXPENSES IN CENTS PER KILOWATT-HOUR, IN PERCENTAGE OF OPERATING EXPENSE AND PER DOLLAR OF REVENUE

Company	Plant Maintenance Costs in Cents Per Kw.-hr. Generated: Building	Steam Equipment	Electric Equipment	Total	Ratio Plant Maintenance to Station Operating Expenses, per Cent	Plant Maintenance per Dollar of Electric Revenue, Cents
A	0.0134	0.068	0.0275	0.1089	6.9	3.1
B	0.029	0.0863	0.023	0.1383	6.0	3.1
C	0.0087	0.079	0.0081	0.0958	9.6	2.1
D	0.0134	0.122	0.0182	0.1536	8.0	3.9
E	0.0292	0.064	0.0101	0.1033	8.0	4.3
F	0.0365	0.158	0.0224	0.2169	14.0	5.9

Steam equipment exacts its toll in maintenance outlay, as Table III shows in detail. More than half the money expended on plant repairs in every one of these stations goes into keeping the "steam end" up to "concert pitch," and in some cases more than 75 cents per

TABLE III—RELATION OF STEAM AND ELECTRICAL MAINTENANCE AND REPAIR EXPENSE TO TOTAL

Company	Ratio to Total Plant Maintenance Expenses (per Cent): Building	Steam Equipment	Electric Equipment	Repairs for Kva. Station Capacity: Building	Steam Equipment	Electric Equipment	Total
A	12.1	62.5	25.4	$0.196	$1.01	$0.408	$1.614
B	21.0	62.3	16.7	0.329	0.976	0.26	1.565
C	9.0	82.3	8.7	0.137	1.24	0.127	1.504
D	8.7	79	12.3	0.198	1.82	0.27	2.288
E	28.2	62	9.8	0.307	0.675	0.106	1.088
F	16.7	72.5	10.8	0.386	1.67	0.237	2.293

TABLE IV—MAINTENANCE AND REPAIR EXPENSE OF DISTRIBUTION EQUIPMENT IN DOLLARS AND ALSO PER UNIT OF ENERGY SOLD AND DOLLAR OF REVENUE

			—Maintenance Repairs and Renewals—				Distribution Expense	
Company	Kw.-hr. Sold, Including Station Heating	Distribution Expenses	Lines and Conduits	Meters and Transformers	Street Lamps	Revenue from Electric Sales	Per Kw.-hr Sold	Per Dollar of Electric Revenue
A	27,458,701	$125,880	$35,782	$4,722	$8,036	$1,207,301	0.364c	10.3c.
B	24,730,766	177,962	18,362	10,729	8,084	1,295,160	0.72c	13.7c.
C	39,044,709	120,169	22,424	6,176	12,852	1,306,671	0.307c.	9.2c.
D	23,613,941	122,772	46,884	2,752	7,034	1,180,407	0.52c.	10.4c
E	69,507,076	103,269	36,958	4,288	15,932	1,953,056	0.148c.	9.4c.
F	60,015,648	231,753	110,915	13,909	30,319	2,333,811	0.385c.	9.9c.

dollar of plant repairs is used by that side of the house. In some cases it costs more to repair the station building during the year than has to be spent on electrical upkeep within its walls. Such figures are not a reflection on the design of steam machinery and apparatus in general, but they do reflect a certain intrinsic superiority arising out of electrical methods of working. The annual repairs to plant per kilovolt-ampere of rating ranged from about $1.08 to $2.29, certainly a less wide variation than might have been expected from a group of stations, all of which are separately managed with the exception of stations A and D.

Maintenance costs in connection with distribution are shown in Table IV for these stations. Here again it is apparent that the high fuel costs which such companies have been forced to meet have profoundly affected their entire gamut of operations from the coal pile to the consumer's meter. Total distribution expenses ranged broadly in these plants between $100,000 and $230,000, and the per kilowatt-hour sold ranged from about 1.5 mills to 7 mills. Maintenance items, however, still represent only a moderate proportion of distribution expenses, with one or two exceptions, but a sufficient proportion to justify a sharp watch on this class of costs. Roughly, from 9 cents to 13 cents per dollar of electrical revenue goes into distribution expense in these companies, and half or a third as much can be put into maintenance without serious effect on the relative showing of upkeep and earnings.

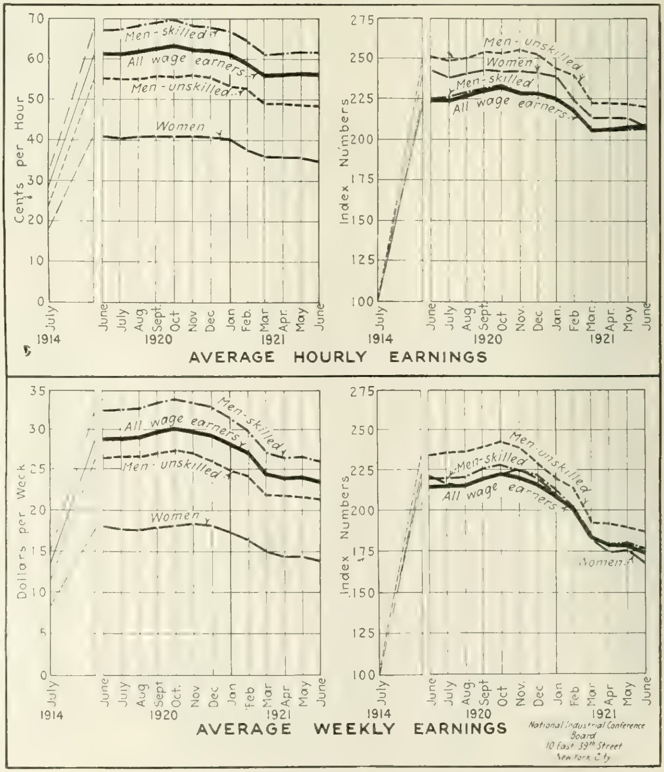
From the moderate size of upkeep expenses compared with operating and distribution costs it appears that some increase in these might in many cases be permissible if the returns are well indicated. In other words, more money can and should in many cases be expended on inspection—for what might be called "preventive maintenance," forestalling troubles before they arise. Nothing like the neglect of inspection often encountered in industrial power applications, or in some industrial power plants, can be found in central stations of the type listed here. Central-station managers and engineers can afford to take a much more liberal view of inspection costs if by their increase a more scientific system of trouble prevention is effected. To the thoughtful investigator of central-station economics this is a most attractive field of attack.

Wages in Electrical Industry

A COMPREHENSIVE investigation of wage changes in twenty-three basic industries of the country for the period from July, 1914, to July, 1921, has been completed by the National Industrial Conference Board, and the results are described and illustrated by charts and tables in its Research Report No. 45. The study covers data from 4,398 establishments, employing approximately 1,250,000 workers, and is believed to be the only continuous record available of comparable data as to wage changes occurring during the entire period since July, 1914.

For the electrical apparatus industry the report covers 107 plants in nineteen states, employing in October, 1920, 88,000 wage earners, or more than 35 per cent of the workers engaged in the industry.

Composite hourly earnings of all wage earners in this industry showed an increase of 132 per cent from July, 1914, to October, 1920. The decline from October, 1920, to July, 1921, was 11 per cent, and at that time the increase over July, 1914, was 106 per cent. Composite weekly earnings of all wage earners increased 123 per



TREND OF WAGES IN THE ELECTRICAL INDUSTRY, 1914-1921 cent from July, 1914, to October, 1920, and from the latter period through June, 1921, declined 22 per cent, showing a net increase in the middle of 1921 of 74 per cent over July, 1914.

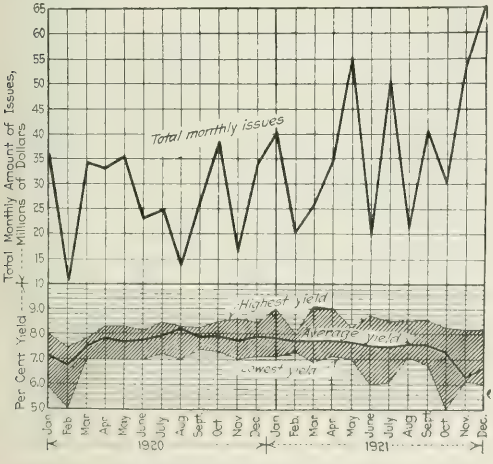
In the electrical generation and distribution industry data were received from 236 plants in thirty-seven states and employing in December, 1920, 16,268 wage earners.

Composite hourly earnings of all wage earners in this branch of the industry increased 105 per cent from July, 1914, to November, 1920, and from the latter period through June, 1921, declined 4.4 per cent, leaving a net increase of 96 per cent over July, 1914. Composite weekly earnings of all wage earners in the electrical generation and distribution industry increased 89 per cent from July, 1914, to August, 1920, and from the latter period through June, 1921, declined 4.2 per cent, leaving a net increase of 81 per cent over July, 1914. The report notes that no proper comparison can be made between wage and employment conditions in electric light and power plants and in those of electrical manufacturing establishments, as the wage situation in public service plants is largely controlled by legal provisions and local ordinances and is but little affected by the general economic condition.

Security Yields Show Material Decrease During 1921

New Electric Light and Power Issues in the Last Year Total $459,066,643—Large Growth of Series Issues Is a Feature

THE year 1921 proved to be a remarkable one in investment market history because there occurred during that period a decided change for the better in the prices for all classes of bonds. Although the advance was a gradual movement and not a sudden development, there was from the beginning of the year a marked tendency toward better credit conditions to which bond prices readily responded. As the year progressed the reaction became more pronounced, and in the final quarter bonds were marketed on unusually advantageous terms.



MONTHLY ISSUES OF ELECTRIC LIGHT AND POWER SECURITIES, AND THE GRADUAL DECREASE IN YIELD

ELECTRIC LIGHT AND POWER SECURITY ISSUES IN 1921

	Amount of Issue
Mortgage Bonds (average yield 7.35 per cent)	
6 issues at 5 per cent	$5,060,000
27 issues at 6 per cent	104,154,000
2 issues at 6½ per cent	30,572,000
27 issues at 7 per cent	98,314,000
17 issues at 7½ per cent....	50,937,000
12 issues at 8 per cent	17,156,000
91 issues	$306,193,000
Debentures (average yield 7.99 per cent)	
2 issues at 7 per cent	$8,600,000
2 issues at 7½ per cent	12,000,000
1 issue at 9 per cent	436,000
5 issues.	$21,036,000
Notes (average yield 7.44 per cent)	
1 issue at 5 per cent	$1,750,000
1 issue at 6 per cent.............	600,000
1 issue at 6½ per cent	2,000,000
8 issues at 7 per cent	41,700,000
2 issues at 7½ per cent	1,869,000
10 issues at 8 per cent............	15,700,000
23 issues	$63,619,000
Preferred Stock (cumulative)—(average yield 7.94 per cent)	
9 issues at 8 per cent	$25,313,000
3 issues at 6 per cent..................................	7,080,275
1 issue at 7 per cent..................................	1,000,000
13 issues	$33,393,275
Preferred Stock (non-cumulative)—(average yield 7.76 per cent)	
2 issues at 8 per cent	9,000,000
1 issue at 7 per cent.	88,200
1 issue at 6 per cent	1,200,000
1 issue	547,863
5 issues	$10,836,063
Common Stock	
10 issues	21,837,605
Total of all issues of year	$456,914,943

Electric light and power financing was extremely active during the past year. The total amount of stocks and bonds of this class offered investors was $456,914,943 as compared with $315,990,740 for the year 1920. The year started with January's showing a total of $40,584,000, an increase of more than $2,000,000 over October, 1920, the banner month of that year. In February there was a slump, but a quick recovery followed, and from that month until June there was a steady upward trend in the amount of financing. In June the amazingly low figure of $19,939,263 was reached, representing a decrease of more than $35,000,000 under the high total reached in May. June, 1920, however, also showed a correspondingly large drop from the total of the preceding month. After August the record was one of almost unbroken advance, culminating in December in the unprecedented total of $66,300,400.

The accompanying tabulation shows the prominent position occupied by the sale of electric light company stocks during the year. New stock issues were especially numerous during the latter part of the year when the decreasing bond yields rendered dividend paying stocks more attractive. The new stock issues totaled $66,066,943, or 14.5 per cent of the total electric light and power security issues in 1921.

The accompanying curve reveals the fluctuations in the per cent yield from month to month and indicates the decided drop which has taken place in security yields. During the first five months of the year the average yield ranged from 7.85 to 7.71, but in June the rate of return dropped to 7.54 and in July to 7.51. During August and September there was no appreciable change in the yields, but in October offerings yielded on an average only 7.33 to investors. The lowest average yield during the year was reached in November (6.33), and December brought but a slight increase.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

How Insects Attack Cables in Canal Zone

To the Editors of the Electrical World:

Insects or termites have been causing considerable trouble with lead cables in the Canal Zone by cutting through the lead and into the insulation, where they afterward make their homes. A close inspection has shown that when anything comes in contact with the claws with which these small invaders work a white, milky substance issues from their mouths. It is thought by some that this substance dissolves the lead. The accompanying illustration shows a built-up tunnel formed on top of a cable joint.

TUNNEL BUILT ON CABLE SHEATH BY INSECTS WHICH CUT THROUGH THE LEAD

A. R. Lane.

Pedro Miguel, C. Z., Panama.

School for Electric Metermen

To the Editors of the Electrical World:

On page 1244 of the Dec. 17 Electrical World I observe announcements that Iowa and Wisconsin universities will give meter courses in January. Our first school for electric metermen, which was started last April, proved to be much more popular than we had anticipated and was attended by about sixty representatives from light and power utilities in the state as well as by representatives of the meter manufacturers. As a result of this school it was requested by those present that this work be continued in a course of not less than one week's duration to be held next March. This we are planning to do.

We have found a very ready response on the part of the utilities and manufacturers, the latter furnishing large quantities of latest design instruments for test and demonstration, and the former furnishing testing standards and resistance loads which were calibrated against our standards in the relatively large classes on meter testing.

It is expected that the question of current and potential transformers will probably be more extensively studied at the forthcoming school.

C. Francis Harding,
Head of the School of Electrical Engineering.
Purdue University, Lafayette, Ind.

Ease of Using Illumination Charts

To the Editors of the Electrical World:

I have read with considerable interest R. H. Cook's contribution to the Electrical World in the issue of Oct. 29, 1921, page 876, in which he presented a "Simple Chart for Illumination Calculations." Before commenting on this chart it should be noted that the "vertical distance from lamp to working plane" should be Y on the diagram instead of X, the latter marking being obviously a mechanical error.

Mr. Cook states (in referring to my article in the June 19, 1920, issue of the Electrical World, page 1,423): "I believe that the curves in the form presented . . . are very unwieldy and hard to handle. The eye can more readily follow a system of straight lines than a system of curves and straight lines. I have attempted to produce a chart correcting the conditions just mentioned," etc.

The writer takes exception to Mr. Cook's statement that the chart as presented by me is "very unwieldy and hard to handle." The intersection of abscissas and ordinates on my chart locates at the same point the value of the multiplying constant K and the angle θ which is used in obtaining the candlepower I from the light distribution curve. These values of K and I can readily be jotted down in tabular form, as shown in Table I below. That completes the use of the chart. Mr. Cook is undoubtedly correct, however, in stating that the eye can more readily follow a system of straight lines; but the extra tax on the eye seems to be insignificant in comparison with the extra use of the slide rule, or arithmetic, and the necessity for and use of a cosine table, in order to produce the same result with Mr. Cook's chart.

The purpose of the writer's chart is clearly summed up in the last paragraph of his article, which is: "It is hoped that this chart will supply . . . a means of arriving easily, quickly and with reasonable accuracy at foot-candle values from the distribution curves of lighting units." The foot-candle values here referred to were those which are perpendicular to the horizontal plane.

The purpose of Mr. Cook's chart, outside of presenting a system of straight lines which can be easily read, is not obvious. In fact, his chart merely determines the third side of a right-angle triangle when any two sides are given, and also obtains the square of the hypothenuse. The angle θ has been lost sight of in the simplicity of straight lines, so that any practical use to which the chart may be put requires the further use of a table of natural sines or cosines. In explana-

TABLE I—SOLUTION BY I. W. GROSS' CHART ("Electrical World," June 19, 1920, page 1423). $H = 10$ ft.

D	K	θ	I	F
Ft.	Constant	Deg.	Cp.	Ft.-candles
0	0.098	0	540	5.29
5	0.072	27	620	4.37
10	0.037	45	570	2.11
14	0.0021	54	520	1.090
15	0.0019	57	500	0.950
20	0.0009	63	470	0.423

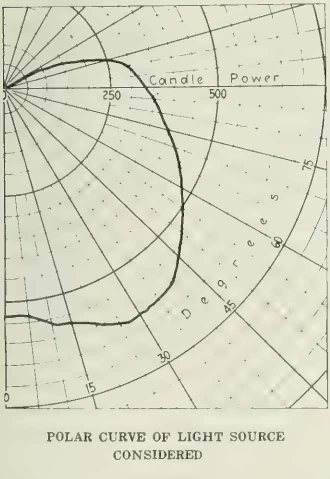
TABLE II—SOLUTION BY R. H. COOK'S CHART ("Electrical World," Oct. 29, 1921, page 876).

X	Z	Z^2	Y/Z	θ	I	E_1
Ft.	Ft.	Ft.^{2}	Ratio	Deg.	Cp.	Ft.-candles
0	10	100	1.0	0.	540.	5.40
5	Indeterminate on chart.					
10	14.1	200	0.71	44.8	580.	2.05
14	17.2	295	0.582	54.4	515.	1.013
15	Indeterminate on chart.					
20	Indeterminate on chart.					

tion take Mr. Cook's example under his chart, where he has determined $I = 4{,}420$ cp. If it is desired to plot this value on a polar curve of the lighting unit in question, it is necessary to know θ, and to know θ a natural function of θ must be determined and θ looked up in a table. Neither my chart (ELECTRICAL WORLD, June 19, 1920) nor the standard tables, such as are found in the "Railway Electrical Engineer's Handbook," require the use of other equipment than the polar curve of the light source.

Mr. Cook's chart, as presented, has only a limited range for X, that is, from 7 ft. to 14 ft. His contention that "it can be used for greater values by multiplying each variable (X, Y or Z) by a common number . . . which will result in an increase in range of the chart of two, three and four times" is misleading. For example, taking Y as 10 ft., the X range is from 7 ft. to 14 ft., and you cannot multiply X by any number other than 1 and have the chart values hold true, provided, as in the practical case, Y is to be held constant in a given problem.

As a typical illustration of the working of Mr. Cook's chart and my own I present below the solution of the following problem: Determine the foot-candle illumination perpendicular to a horizontal plane, the source of light being 10 ft. above the plane and having the polar curve of Fig. 3. Aside from tabulating the horizontal distance D and X in the tables herewith, Mr. Cook's chart requires six tabulated columns against four for my chart. His chart requires two slide-rule operations against one for mine. His requires the use of a cosine table; mine does not. Further, in Mr. Cook's chart E_1 cannot be determined for three of the points selected for X above, while with my chart an infinite number of E values can be determined from $D = 0$ to $D = 20$, and in fact E can be determined for any value of D up to 250 ft., which in this case is far outside any desired value.



POLAR CURVE OF LIGHT SOURCE CONSIDERED

The above simple example shows Mr. Cook's chart to be considerably more cumbersome than the writer's chart, besides requiring the use of information not given, namely, the table of cosines. I. W. GROSS.

New York, N. Y.

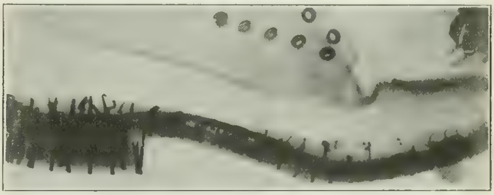
Nails in Soles of Electrical Workers' Shoes Are Suicidal

To the Editors of the ELECTRICAL WORLD:

The hidden dangers of shoes having nails in the soles and heels are clearly revealed through the aid of the X-ray. From such photographs it is seen that it is suicidal for electrical workers to wear shoes of this type. All shoes worn by men who are exposed to electrical hazards should have wooden pegs instead of metal nails.

No one who thought for a moment would enter an electric plant carrying a steel fishing rod over his shoulder, and yet that is exactly what a man did, and for his thoughtlessness he nearly paid his life. It was only through the prompt application of the prone-pressure method of resuscitation that his life was finally saved.

However, the long steel fishing rod is no better conductor of electric current than a wire that is concealed in a derby hat or a wire nail that is hidden in a shoe. Altogether too little attention is given by electrical workers to the highly important matter of dress. Even a finger ring or a watch chain has been known to prove deadly. In like manner there is hidden danger in metal buttons on clothing and in eyeglasses with metal or inflammable frames. Often danger may lurk in the metal button that is slipped into the lapel of a man's coat.



X-RAY OF SHOE WORN BY ELECTRICAL WORKER SEVERELY INJURED

Most men are on the lookout for danger when they enter an electric plant, but many of them may not realize that they are carrying right with them into the plant the metal or inflammable parts that may serve to drive a deadly current through their bodies.

Chicago, Ill. GEORGE F. PAUL.

Long Spans for Rural Lines

To the Editors of the ELECTRICAL WORLD:

The article on "Long Spans Proposed for Rural Lines," published in the Dec. 10 issue of the ELECTRICAL WORLD, is very interesting to me, particularly in view of the fact that we have been constructing and operating rural lines having long spans for the past six or seven years with excellent results. Aside from tree troubles, which are not affected by length of span, the most prolific source of trouble is the failure of insulators due to mechanical injury or poor design. Increasing the length of span eliminates a large percentage of insulators and so minimizes insulator troubles.

Referring to the specifications given in the article, why is it considered advisable to use weatherproof insulation, particularly in view of the decreased factor of safety, the doubtful benefits and the trend toward higher voltages for rural lines?

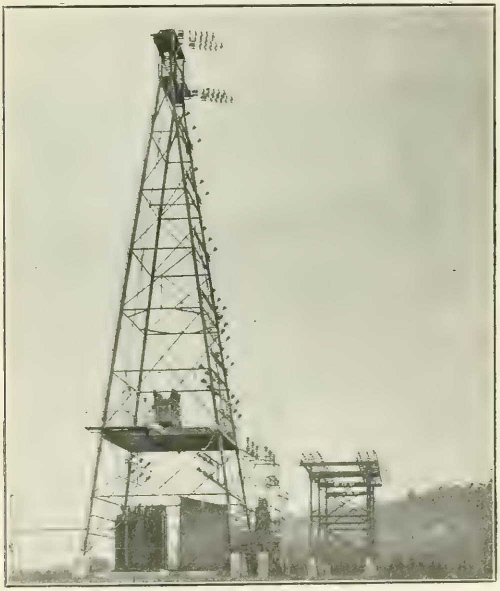
Utah Power & Light Co., PAUL P. ASHWORTH,
Salt Lake City, Utah Distribution Engineer.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Transmission Tower Serves Also as Substation Frame

A 125-FT. crossing tower turned into an outdoor substation is the unusual feature of the High Bridge substation of the Northern States Power Company at St. Paul. The tower shown in the illustration is one support of a 1,700-ft. span over the Mississippi River, and the substation of two transformer banks of 3,000 kva. rating each steps the voltage from 63 kv. to 13.2 kv. for the rural and suburban service in the St Paul territory and also connects with the 13.2-kv. tie-line circuits between St. Paul and Minneapolis. The crossing conductor is made up of a stranded-steel cable core around which is built up copper equivalent to No. 2/0. The strain under maximum load conditions is 17,000 lb. per conductor. The two transformer banks are protected on the high-tension side by 70-kv. outdoor, automatic, solenoid-operated oil circuit breakers which are controlled from the steam station 8,000 ft. away. The 13.2-kv. switching equipment is placed in steel switch houses, one being provided for each bank of transformers. These houses are placed within the uprights of the tower. The 13.2-kv. bus construction is suspended underneath the platform on which the 70-kv. oil circuit breakers are installed. The 13.2-kv. transmission lines terminate on the steel structure shown at the right of the illustration, from which they go through open air switches to the 13.2-kv. bus. Lightning arresters are placed between the 13.2-kv. rack and the foot of the tower. The entire construction is very compact and utilizes the steel tower to the utmost. FIELD EDITOR ELECTRICAL WORLD.



RIVER CROSSING TOWER UTILIZED AS A SUBSTATION BY THE NORTHERN STATES POWER COMPANY

Chicago, Ill.

Melting Sleet by Short-Circuiting Transmission Lines

VERY successful elimination of sleet from certain transmission circuits of the New England Power Company was practiced during the recent severe storm by applying reduced voltage to short-circuited conductors. A detailed account of the manner in which the job was handled was recently sent the New England Bureau of Public Service Information by A. E. Pope, assistant general manager of the company, and through the courtesy of the bureau the following condensed summary of the events described is presented:

The lines in question were two No. 1 copper three-phase circuits about 8.3 miles long, extending from a station in the lower Deerfield Valley over the Hoosac range to the North Adams substation. The greater part of the right-of-way is at elevations of 2,000 ft. to 2,500 ft., and on two former occasions sleet coverings measuring 3 in. to 4.5 in. diameter have been experienced. The circuits are parallel, and previous tests showed about 350 amp. necessary to melt sleet. The two lines were alternately short-circuited at the North Adams substation, about 6,000 volts being necessary to furnish the requisite current for melting. To obtain this voltage the company used two transformers of its regular equipment, consisting of 4,000-kva., three-phase, 69,000-volt Y/2,300-volt delta units. The special voltage required was secured by connecting the high-tension side of the transformers in multiple, opening one of the low-tension deltas, and connecting the individual coils of this delta in series with the regular 2,300-volt delta of the other bank, giving an extended delta connection of virtually 6,000 volts between wires. The entire outfit was operated from an independent machine.

From two to two and a half hours was required to thaw the circuit after application of 340 amp. to 350 amp., and about one and a half hours was consumed in making the necessary arrangements to withdraw one line from service, short-circuit it, and make the thawing apparatus connections, the other circuit carrying the load meanwhile. Sleet formed so rapidly that alternate periods of thawing were required for about fifteen hours. During all this period customers' service on this section of the system was continuously fed by one or the other of the two circuits. Considerable time was lost in changing over, as this was the first trial of the thawing outfit on the transmission lines, and the operators attempted to follow the usual rules for tagging, etc. In the future a similar condition will be treated as an emergency, and this should cut down the time for changing over to between fifteen and thirty minutes. The company is now studying its entire transmission system to determine how far this method can be applied in line protection throughout its territory.

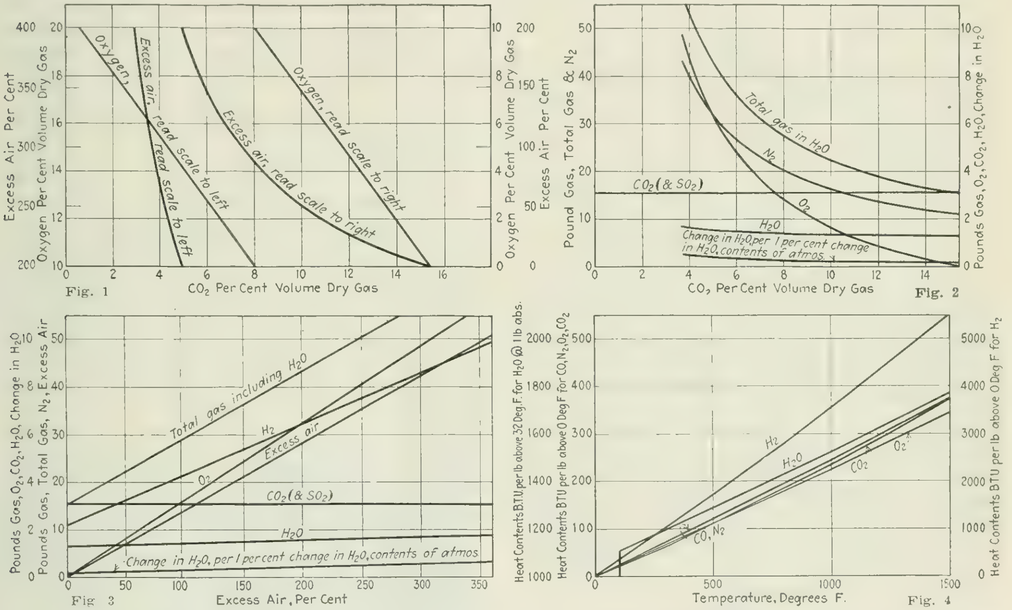
Determining Heat Content of Gases from Oil-Fired Boilers

In the operation of oil-fired boilers a large proportion of the heat lost is that combined in the gases discharged to the stack. All operators know in a general way of the effect of excess air and temperature on this loss, and the determination of its amount is not difficult —the necessary formulas being given in many handbooks—but calculations are rather long and tedious for a complete solution. For convenience, these data have been reduced to a series of curves by means of which the properties of these flue gases can be determined quite easily. The first three sets of curves are based on the analyses of fuel oil and atmosphere given in the accompanying table. The oil analysis assumed is an average figure which is close enough for routine work with any of the fuel oils now in common use. In the atmosphere analysis a departure from the usual practice has been made by including a small amount of water vapor. As water vapor is always present in the atmosphere and as its specific heat is approximately twice that of other gases of combustion, its effect on the heat content is relatively large. Therefore the actual water-vapor content of atmosphere or gases of combustion should be considered in combustion problems. One per cent has been selected as an average water-vapor content of the atmosphere, representing a relative humidity of 65 per cent at 70 deg. Fahr.

ANALYSIS OF OIL AND ATMOSPHERE IN PERCENTAGES BY WEIGHT

Fuel Oil		Atmosphere	
Carbon	84.0	Nitrogen	76.08
Hydrogen	12.7	Oxygen	22.92
Oxygen	1.2	Water vapor	1.00
Sulphur	0.4	Total	100.00
Nitrogen	1.7		
Total	100.0		

In Fig. 1 the oxygen curve is useful principally for checking the consistency of the Orsat analyses. The excess-air curve is used to determine the amount of excess air corresponding to various CO_2 determinations. No allowance has been made for the presence of CO, as the gases from a properly controlled oil-fired boiler will never contain any CO. Fig. 3 is similar, but on an excess-air basis.



FIGS. 1, 2, 3 AND 4—RELATIONS BETWEEN VARIOUS GASES AND TEMPERATURE IN STACKS

Fig. 1—Relation of CO_2 to oxygen and excess air. Fig. 2—Weights of products of combustion of 1 lb. of oil for various percentages of CO_2. Fig. 3—Weights of products of combustion of 1 lb. of oil for various percentages of excess air. Fig. 4—Heat content of products of combustion for temperatures below 1,500 deg. Fahr.

Fig. 2 gives the weight of each constituent of the flue gas in pounds of gas per pound of oil for various percentages of CO_2. The change in the amount of water vapor for each 1 per cent change in the amount of water vapor in the atmosphere is also shown. This water-vapor correction may be either added or subtracted as the case requires. If oil is atomized with steam, the amount of this steam should be added to amount of water vapor found from curves.

One example will be sufficient to illustrate the use of these curves: To find the heat content of the gas resulting from the combustion of 1 lb. of oil under following conditions: CO_2, 13 per cent; temperature, 500 deg. Fahr.; vapor content of atmosphere, 1.5 per cent; steam used for atomizing per pound of oil, 0.2 lb. From Fig. 1 the excess air equals 17 per cent; from Fig. 2

Constituent		Weight, Lb.	Heat Content per Pound Gas, B.t.u.	Total Heat Content, B.t.u.
CO_2		3.09	110	340
N_2		12.6	120	1,512
O_2		0.55	110	60
H_2O from curve	1.30			
(0.5 × 0.18)	0.09			
Atomizing steam	0.20	1.59	1,285	2,043
Total		17.83		3,955

for 13 per cent CO_2 and from Fig. 4 for 500 deg. Fahr. the following are taken:

The difference in total heat content of gases at any two points will be the amount of heat given up by gases between those two points. The weight of air admitted to a furnace for any given gas analysis will be the total gas from Figs. 2 or 3 less 1 lb. for oil. The weight of dry air will be the weight of air, as above, less the weight of the water vapor, for which an amount shown by the "change of H_2O" curves may be used. The heat content of dry air may be found closely enough for ordinary work by taking the heat content of nitrogen from Fig. 4 and the heat content of water vapor from the H_2O curve if the temperature is above 101 deg. Fahr.; otherwise steam tables may be used. The use of these curves will give results commensurate with the accuracy of the CO_2 and temperature determinations obtained in operation practice.

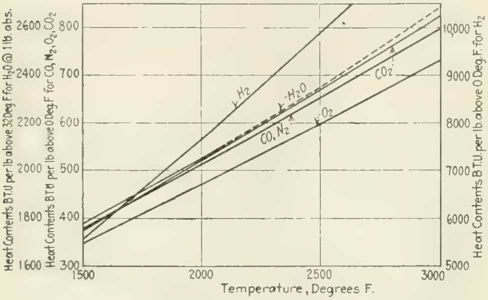


FIG. 5—HEAT CONTENT OF PRODUCTS OF COMBUSTION FOR TEMPERATURES ABOVE 1,500 DEG. FAHR.

N. G. Hardy,
Chief Mechanical and Electrical Engineer.
The Arizona Copper Company,
Clifton, Ariz.

Adapting Electric Heat for Baking Japan on Automobile Fenders

Using electric heat in baking the japan on automobile fenders and running-board curtains, the Moon Motor Car Company has been able to produce 11.1 lb. of finished product per kilowatt-hour. The oven used for baking is a standard design and is arranged for overhead, semi-continuous conveyor operation. This conveyor runs through the top of the oven, and the parts to be baked are suspended from it by metal hooks. The semi-continuous operation allows one load to be removed from the conveyor, while another is in the oven baking and still another is hanging on the other end of the conveyor so that the excess japan can drip off before the material enters the oven.

The inside dimensions of this oven are: Length, 16 ft.; width, 9½ ft.; and height, 8 ft. All the walls, both top and bottom, are covered with 4 in. of insulating material. The nickel-chromium heating elements, which have a rating of 144 kw., are oversize for this installation and are mounted on the lower side walls and in the center of the floor. The electrical operation of this oven is automatic, being arranged with a safety door switch. A 5-hp. motor runs the conveyor and a ½-hp. motor operates the ventilating system, consisting of ducts running from the top of the oven down the sides, with the intakes at the top and along the bottom floor.

A maximum of seven bakes in a nine-hour day is obtained, since one hour and thirty-six minutes is required to bring the oven up to the temperature of 400 deg. after the first load is placed within the oven in the morning. From this time on, one hour to one hour and eight minutes is necessary for each succeeding bake. The average weight of each load is about 1,400 lb., consisting of forty-eight front fenders, thirty-four rear fenders or sixty running-board curtains; but since some of these fenders are very bulky the actual weight is often reduced. Since each part must receive two coats of japan before assembly this electric oven furnishes a steady production, a better control and an evenness of baking.

James W. Carpenter,
Industrial Heating Engineer.
Union Electric Light & Power Company,
St. Louis, Mo.

Two Governors on Hydraulic Unit Give Advantageous Regulation

A high degree of flexibility and a flat efficiency curve under varying load conditions were attained in the hydraulic unit recently installed in the Newhalem Creek hydro-electric plant, where two Pelton wheels, each having its own governor, drive one generator. This plant supplies power for construction purposes on the Skagit project, which is being carried out by the city of Seattle about 100 miles north of that city on the Skagit River.

In selecting the hydraulic unit best suited to the conditions at this plant both impulse and reaction types were considered. The manufacturer would guarantee 84 per cent efficiency on a reaction turbine and only 79 per cent on an impulse wheel. However, the impulse type was chosen because it was believed to give greater assurance of continuous service, which was important as there was to be only one unit in the installation and no other plants on the system.

Features of the impulse type which were considered of particular advantage in this plant were (1) the possibility of dividing the prime mover into two parts, (2) the elimination of wear on gates, and (3) eliminating the thrust problem.

The plant has a single 3,000-hp. generator driven by two waterwheels, one on each end of the extended main generator shaft. The runners are of the impulse type and operate under a head of 510 ft. at 450 r.p.m. The desired degree of control was secured by the use of two independent governors, one for each side of the unit. One of these is adjusted for a narrow speed range, while the other is set to take care of the heavy load swings. Each governor has its own oil pressure pump, pressure tank and sump, the governor head and pump being independently belt-driven from the waterwheel shaft.

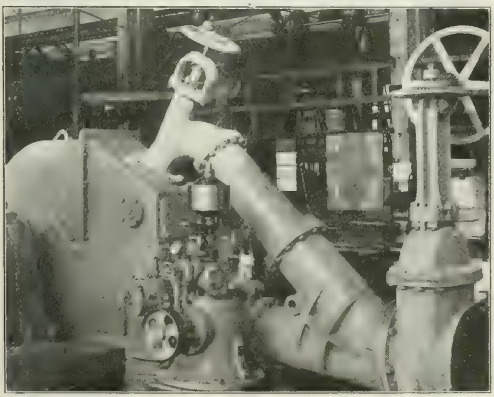
The subdivision of the prime mover into two parts makes it possible to shut down either half separately, thus operating the electrical unit at half load with hydraulic efficiency as good as for full load. This is expected to be a great advantage in times of light load requirements or limited water supply. It is also possible to make adjustments or replacements of parts on either side of the unit while the other half is in service, thus providing more than the usual insurance against complete shut-down and interruption of service. With two governors on the unit, either one can be taken out of service and adjusted or repaired without decreasing the output of the plant, all load fluctuations up to 50 per cent of capacity being taken care of meantime by the remaining governor.

By a sensitive adjustment on one of the governors and a wider speed range on the other, compensations for all small load fluctuations are made by the first governor, while large changes in demand are handled by the second. Thus a closer and more sensitive speed regulation is obtained than would be feasible if the entire unit were being controlled by a single governor, because any tendency toward hunting which might occur in a single governor with an over-sensitive adjustment is prevented by the action of the second and more sluggish governor.

This arrangement makes it possible to operate a single-unit plant on a basis similar to that of a well-balanced power system in which the sensitive governing is taken care of on one unit while other units are adjusted to handle only the heavy load variations.

Speed regulation in the Newhalem plant could have been effected (1) by direct governor control of needles in the nozzles or (2) by use of a diverting jet of either deflector or sleeve type. The needle type of control would have made it possible to economize on the use of water, but as no provision for storage was made in this development there was no advantage in saving water. A sleeve-type deflector was therefore selected, designed to avoid any loss of efficiency in the jet and to give full protection from pressure rises in the penstock.

As this unit is rarely if ever to be operated at less than 50 per cent of its rating, it was considered permissible to omit the hand-operated needle on the lower nozzle of each runner, thus avoiding the losses in efficiency which such needles would have involved. The upper nozzles, however, are provided with hand-operated needles so either runner can be cut down to half load without disturbing the governor setting.



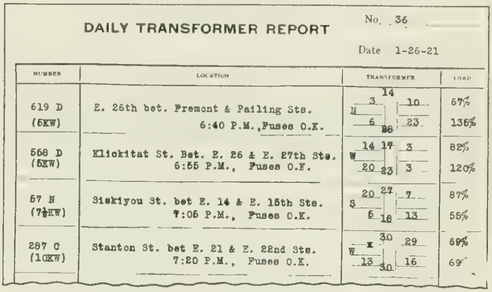
ARRANGEMENT OF ONE PELTON WHEEL AND GOVERNOR OF TWIN SET DRIVING ONE 3,000-HP. GENERATOR

The hydraulic equipment at the Newhalem plant was supplied by the Pelton Water Wheel Company.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Distribution-Transformer Tests with Ammeter Are Satisfactory

AS A VERY satisfactory method of testing loads on distribution transformers the Portland (Ore.) Railway, Light & Power Company has for some time been employing an ammeter and split-type current transformer and making only momentary readings. These readings are made periodically on the outside (220-volt) legs of the three-wire, 110/220-volt secondaries. This method replaces the former one of using maximum-demand meters which were used over a period of several days in one location. It has been found that the information obtained by the present method is of more value than that formerly obtained and may be gathered at considerably less expense.



DAILY TRANSFORMER REPORT

No. 36

Date 1-26-21

NUMBER	LOCATION	TRANSFORMER	LOAD
619 D (5KW)	E. 26th bet. Fremont & Failing Sts. 6:40 P.M., Fuses O.K.	14 N 3 | 10 6 | 23 28	67% 136%
568 D (5KW)	Klickitat St. Bet. E. 26 & E. 27th Sts. 6:55 P.M., Fuses O.F.	14 17 3 W 20 23 3	82% 120%
57 N (7½KW)	Siskiyou St. bet E. 14 & E. 15th Sts. 7:05 P.M., Fuses O.K.	20 27 7 S 6 18 13	87% 55%
287 C (10KW)	Stanton St. bet E. 21 & E. 22nd Sts. 7:20 P.M., Fuses O.K.	x 30 29 W 13 30 16	69% 69

FORM TO SIMPLIFY DISTRIBUTION TRANSFORMER TESTS

The distribution engineer each day makes up a list of transformers to be tested that evening. Each crew, consisting of a testman and a lineman, makes tests from 6 p.m. to 9 p.m. during the peak of the lighting load. In this period one crew tests an average of fifteen transformers. Readings are taken on the outside line wires in each direction and also on the outside leads from the transformer to the line wires, making a maximum of six readings at each transformer.

Record of the readings is kept on the forms shown in the accompanying cut. The results of the test on transformer 619 D, for example, are shown in the first line. In the column headed "Transformer" is printed a diagram of the transformer and line wires. Tests on the north side of the transformer showed a load of 3 amp., and 6 amp. and tests on the south side a load of 10 amp. and 23 amp. Readings in the leads from the transformer to the line wires showed 14 amp. and 28 amp. respectively, which are expressed in the last column as percentages of rated load on the two halves of the transformer. Comparison of the readings on the north and south sides of the transformer indicates that the transformer does not stand in the center of its load. Furthermore, the load on the two sides of the secondary in each direction, as well as the load on the transformer itself, is badly unbalanced. The reading of 28 amp. shows also that the 5-kw. transformer cannot take on a great deal more load.

A. B. CAYO,
Assistant Superintendent of Distribution.
Portland (Ore.) Railway, Light & Power Company.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Some Brand-New Arguments for Better Street Lighting

Test Figures Show How Greatly
Modern Street Lighting Can Cut
Down Crime and Traffic Accidents

THERE has been a pronounced swing over to residence lighting, sign lighting and street lighting within the past year. Salesmen who specialized on industrial lighting in 1919 and 1920 and who sold protective floodlighting in 1918 have had to develop other fields within the past year. Statistics show that the man who will concentrate his efforts on street lighting for the next year should realize in a big way.

Municipalities that have long been delaying the construction of various projects on behalf of the public health, convenience and safety are now loosening their purse strings, the two principal reasons being lower construction costs and the employment situation.

Some one says: "This ought to be a mighty good time to sell street lighting, but I am not the right man to sell it. I have never worked that field, and it would be foolish for me to try. It's a game that requires political influence, and political influence is the one thing I don't possess." Now, political influence is a good deal like the measles—a great many people have it in them long before they realize it. In this instance it is nothing more nor less than salesmanship, properly directed.

Some sales ammunition is available this year which did not exist before, namely, definite figures showing that high-candlepower street lighting greatly cuts down crime and traffic accidents.

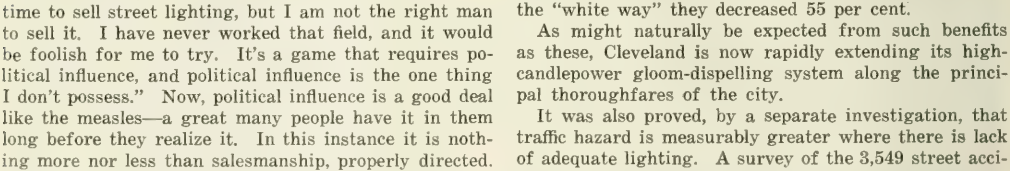
In Cleveland a crime investigation was made covering over a thousand cases of burglary, automobile stealing, robbery, pocketpicking and other crimes that flourish on poorly lighted streets. Lighting engineers checked up on the percentage of crimes committed at night and found that about nine out of every ten crimes occur after nightfall—only one during the hours of daylight. They also checked up on the influence of location. Taking 5 miles of downtown business streets—less than 1 per cent of the total street mileage of the city—it was found that these streets were the scene of fully 17 per cent of the night crimes. That, however, was before the complete overhauling and remodeling of the downtown street lighting. Superseding the former system, 600 ornamental posts were erected, all wires were put underground, and the posts were equipped with huge lanterns of rippled glass, each containing a lamp of at least 1,000 cp.—in some locations lamps of even 1,500 cp. were installed. Furthermore, the posts were spaced only 85 ft. apart—much closer than formerly and were arranged in pairs—a post on either side of the street forming a "lane of light" or "white way." What were the results?

Night street crimes in the downtown district showed an actual decrease during a period when crimes outside of that district increased by more than 50 per cent! In fact, there were 41 per cent fewer crimes on the "white way" than would naturally have been expected had there been no change in the lighting. Burglaries outside the "white way" increased 46 per cent, while on the "white way" they decreased 55 per cent.

As might naturally be expected from such benefits as these, Cleveland is now rapidly extending its high-candlepower gloom-dispelling system along the principal thoroughfares of the city.

It was also proved, by a separate investigation, that traffic hazard is measurably greater where there is lack of adequate lighting. A survey of the 3,549 street accidents that took place in one year in Cleveland showed that lack of illumination contributed to 38 per cent of the accidents occurring after nightfall. At least fourteen of these accidents to which lack of light contributed resulted fatally. The police records will show how many serious traffic accidents there were in any town last year.

While lighting engineers agree that even with 1,000-cp. lamps or bigger, supplemented by the most efficient equipment, they cannot furnish artificial street lighting that approaches the intensity of sunlight, without prohibitive cost, still they point out that it is entirely practical to provide from three to ten times as intense lighting as the average city now enjoys.

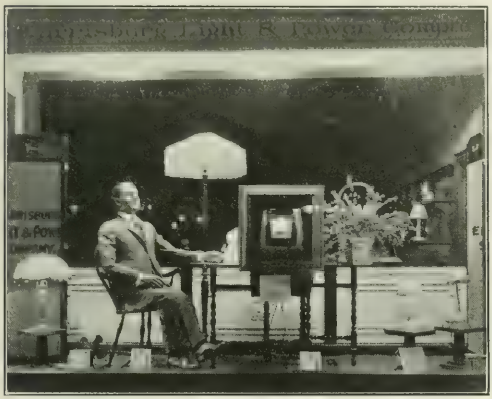


THE DIFFERENCE IN HEIGHT OF THE TWO THUGS INDICATES THE 41 PER CENT DECREASE IN NOCTURNAL STREET CRIMES EFFECTED BY HIGH-INTENSITY "WHITE WAY" LIGHTING IN CLEVELAND

Contest Teaches Public How to Read Electric Meter

AS A MEANS of educating its customers to read their electric meters correctly the Harrisburg (Pa.) Light & Power Company recently conducted a meter-reading contest extending over twelve days. Prizes were offered to those who read the meter correctly the greatest number of times during that period.

As shown in the picture, a meter was placed in a specially constructed shadow box 18 in. square in front and extending back 22 in. to a 9-in base just large enough to hold a 5-amp. meter. The box was surrounded in front by a gilt frame and lined with black velvet, a tubular lamp with a reflector lighting up the meter dial very distinctly. A time switch connected with the meter closed the circuit on two 100-watt lamps at midnight and opened it at 5 a.m., allowing readings to be taken over a period of nineteen hours. The meter used was equipped with a weak magnet which allowed the disk to run at 200 r.p.m., and a clock from a 150-amp. meter registered a total of 4,421 kw.-hr. during the twelve days, or 368.4 kw.-hr. per night.



WINDOW DISPLAY FOR METER READING CONTEST

The contest proved quite popular. Two of the prizes were won by women. In addition to arousing the interest of the public it influenced a great many persons to come into the company's office and learn how to read an electric meter.

Inducing Customer-Owners to Reinvest Their Dividends

WHEN the quarterly dividend checks of the Central Connecticut Power & Light Company of East Hampton, Conn., are mailed to stockholders a courteous letter accompanies each check calling their attention to the possibility of further investment in the company's securities. The letter reads:

STOCKHOLDER:

We are inclosing check for the dividend earned by your investment in the preferred stock of the company during the period ending Sept. 30.

We trust the check will serve you as a reminder of the desirability of this security as a means of employment of your savings at as high an earning capacity as is consistent with wise investment.

This return from your investment is made possible by the stability of the earnings of the company. And may we ask you—while saving for further investment—to bear in mind that a higher income may be secured through investment in carefully selected public utility securities than can be obtained through other securities of equal reliability?

We look upon your investment with us as an earnest of your co-operation and good will, factors necessary to our mutual wellbeing and progress, and we trust that your plans for continued saving will include further investment in the company's preferred stock. Returns in the form of a generous quarterly dividend will be your reward. Yours very truly,

CENTRAL CONNECTICUT POWER & LIGHT COMPANY.
L. P. PERRY, Treasurer.

This letter in pointing out the desirability of the company's securities at an opportune time has been instrumental in causing a number of stockholders to turn their dividend checks back for investment in more stock.

What Other Companies Are Doing

Spokane, Wash.—In order to stimulate merchandise sales during 1922 the Washington Water Power Company is planning to increase its advertising and sales efforts. Although door-to-door selling has not been necessary for the last two years, the company believes that this practice can profitably be resumed and that it will result in increasing the gross merchandise sales.

Winston-Salem, N. C.—The Southern Public Utilities Company reports having disposed of most of its post-wartime stock of appliances and is now directing its efforts toward the standardization of merchandise. This company is making a complete record of all appliances on its lines and has started a systematic house-to-house canvass for new customers as well as the sale of household appliances.

Dayton, Ohio—Members of the Lions' Club of Dayton were the guests on Jan. 5 of the Dayton Power & Light Company at the Miller's Ford power station of the company. Following a dinner prepared on an electric range, the club members made a tour of inspection of the plant.

Milwaukee, Wis.—In 1921 approximately 8,400 already-built houses were wired for electric service in addition to the several thousand new homes built in that city. The year was a record year in home building in this territory, but 1922 is expected to exceed it. The electrical interests in Milwaukee have combined to promote a better lighting campaign during December, January and February, and the Milwaukee Electric Railway & Light Company is devoting all its available forces to this activity. F. A. Coffin is sales manager.

Baton Rouge, La.—The Baton Rouge Electric Company reports that the outlook for merchandise sales in its territory during the coming year is good. While the prospects for the sale of washing machines have decreased because of cheaper domestic labor, it is expected that there will be a good demand for vacuum cleaners and the smaller household heating devices.

Malden, Mass.—A turn for the better in electric power business is reported by the Malden Electric Company, one of the Charles H. Tenney & Company properties north of Boston. Last week the company sold six motors aggregating 47.5 hp., not a large total in itself, but representing practically as many units as were sold in several months past. H. J. Walton, sales manager, feels that this purchasing of motors by local manufacturers is an index of an improving business outlook for the near future.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Heat Losses in Stranded Armature Conductors.—WALDO V. LYON.—Heat losses in stranded conductors embedded in rectangular slots are calculated by the method of complex hyperbolic functions. The article deals with strands separated by insulation of appreciable thickness.—*Journal A. I. E. E.*, January, 1922.

Adjustable Speed with Motor-Driven Mills.—K. A. PAULY.—Two satisfactory systems of speed adjustments on rolling mills, the Kraemer and the Scherbius, are referred to with comments on the relative characteristics and particular work to which each is most adapted. Curves showing efficiency and power factor for typical loads are given. Duty-cycle curves of roughing and finishing mill loads are illustrated.—*Iron Age*, Dec. 22, 1921.

Pneumatic Steam-Turbine Governor.—D. L. BARBOUR.—Methods are described in which the air pressure produced by the fan on that end of turbine shaft acts upon aluminum disks that are connected to the valve stem lever. Slight changes of speed change the air pressure on disks, thereby operating the valve.—*Sibley Journal of Engineering*, January, 1922.

Lamps and Lighting

The Lighting of Coal Mines and Mining Properties.—S. G. HIBBEN.—A description of the various types of miners' headlights and the method of lighting underground passageways.—*Electric Journal*, 1922.

Generation, Transmission and Distribution

New Electric Power Station at Runcorn.—Description of a new power plant in which the exhaust steam from turbine-driven generators is utilized for evaporating brine in a vacuum plant. The coal and ash handling plant embodies the most recent improvements, from the English viewpoint, and it is expected that the steam consumption will be less than 10.15 lb. per kilowatt-hour. The station is laid out so that it may be extended for an ultimate rating of 100,000 kw. It differs from American practice chiefly in the switching equipment.—*Engineer* (*London*), Dec. 2, 1921.

City of Chester Bulk Supply Scheme.—An outline of the scheme, including a brief description of the station equipment and nature of the transmission lines.—*Electrical Times* (*London*), Dec. 15, 1921.

Demonstration of an Automatic Coal-Mine Substation.—A brief description of a semi-automatic substation recently installed at the Drifton colliery of the Lehigh Valley Coal Company, including an explanation of the sequence of operations and the various protective devices employed.—*Electrical Review*, Dec. 17, 1921.

Modernizing the Cincinnati Traction Power System.—Calls attention to large savings to be effected by scrapping long-obsolete generating equipment, building new substations and purchasing a portion of the energy required. Three automatic substations are included in the plan. Methods of undertaking the rehabilitation are discussed, and considerable attention is directed to the automatically controlled stations which form an important part.—*Electric Railway Journal*, Dec. 24, 1921.

Water Powers of British Columbia.—Refers to the report of Arthur White, consulting engineer to the Commission of Conservation of Canada, on the water power of British Columbia, calling attention to the principal parts of the report.—*Electrical Times* (*London*), Dec. 8, 1921.

Waste Heat Utilized to Produce Electric Power.—C. H. REEDER.—The Petoskey (Mich.) Portland Cement Company uses waste-heat boilers that are fed by the hot gases from the cement kilns. The cement plant is designed so that the waste from the boilers just about meets the power demands of the electrical equipment.—*Electric Review*, Dec. 31, 1921.

Traction

New Street Cars for Geneva.—L. PAHIN.—Ten new eight-wheel, two-truck, central-entrance cars and ten new four-wheel, end-entrance cars have been added to the rolling stock of the street railways of Geneva. The motors are rated at 50 hp. and 27 hp. respectively, have four main and four commutating poles and are all equipped with ball bearings. The controllers have ten running positions and six stops for electric braking. All resistances are mounted on the roof of the cars.—*L'Industrie Electrique*, Dec. 10, 1921.

Electric Locomotive Drives.—Brief comments on two lines of development, namely, the quill and the coupling-rod types. Reference is made to experience of some American engineers, particular attention being called to some comparative tests of steam and electric locomotives. In conclusion the writer says: "It is quite possible that in freight working, or indeed in such passenger service as is probable in this country for some time, the quill or the direct drive may suffice, but there would seem, on the other hand, to be little doubt that the freedom in electrical design presented by the introduction of the coupling rod drive, taken with the indisputable advantage of the higher center of gravity, will insure this machine a very good share of popularity, especially where easy running and good speed are sought for on curved roads."—*Engineering* (London), Dec. 9, 1921.

Chilean Railroad Electrification Program.—Outline of plans for electrifying the first part of the Chilean State Railway, including 144 miles of track, with a brief description of the equipment which will be furnished to make this electrification possible.—*Railway Electrical Engineer*, December, 1921.

Direct-Current 3,000-Volt Locomotives for the Paulista Railroad.—JOHN A. CLARKE, JR.—A description of the electrification of the 28-mile (61-cm.) Jundiahy-Campinas section of the Companhia Paulista de Estradas de Ferro in the State of São Paulo, Brazil. Each freight locomotive comprises six single-armature motors of 1,680 hp. and operates at a speed of 23.4 miles (37.6 km.) an hour, while the passenger locomotive has four double-armature motors rated at 2,240 hp. and a speed of 43.2 miles (69.5 km.) an hour.—*Electric Journal*, January, 1922.

Electrification of Steel-Plant Railroad.—R. B. GERHARDT.—Compares steam and electric industrial plant railroads. Data are given showing the relative cost of each, considering fuel, repairs and operating labor. Dangers of material or hot metal falling on third-rail installations are considered.—*Iron Age*, Dec. 29, 1921.

Electric Tractors and Freight Transfer Service.—Economies effected by the New York, New Haven & Hartford Railroad in handling less-than-carload shipments with electric tractors are described. The methods of handling are discussed and data given on the speed of handling and operating costs.—*Railway Electrical Engineer*, December, 1921.

Telegraphy, Telephony and Signals

Radio Equipment of the Ships Paris and Lafayette.—On both ships 5-kw. tube senders were installed with a wave range of between 2,000 m. and 9,000 m. A 5-kw. motor-generator set is used to produce the plate high tension for four rectifying and four oscillatory tubes and the low-voltage current for the heating of the filaments of these tubes. Both vessels are equipped with a radio range finder or "radio goniometer." A distance of 3,400 km. has been covered safely by messages sent from the apparatus of the Paris.—*Radioélectricité*, November, 1921.

The Ground Resistance of Antennas.—A. MEISSNER.—How to build the most suitable antenna for a given station is one of the most important radio problems. Up to the year 1911 nothing but guesswork was done in building the aërial. For this reason Telefunken authorized a long series of tests with different antennas to determine their capacity, frequency, damping effect, effect of insulating all metal parts, etc. All tests were made between Nauen and Jena. The article contains the results of these and tests of similar character conducted by others.—*Jahrbuch der Drahtlosen Telegrafie*, November, 1921.

Transmission of Wireless Signals Between Toulon and Tahiti.—M. GUIERRE.—Investigations carried out to measure the strength of radio signals sent from Lyons and Nantes. Reception at ranges of 7,000 km. to 10,000 km. were made, in which comparisons were drawn between day and night receptions. Signals were found to be weaker in the Pacific than in the Indian Ocean, and the audible range of signals was not symmetrical.—*Radio Review*, December, 1921.

Installations, Systems and Appliances

Electric Power and the Rubber Industry.—BYRON T. MOTTINGER.—A study of rubber, its manipulations and its physical properties, with a history of the most important steps in the development of power application to the rubber mills. Various methods of driving the process machines, such as direct, gear and belt, are considered.—*Electric Journal*, January, 1922.

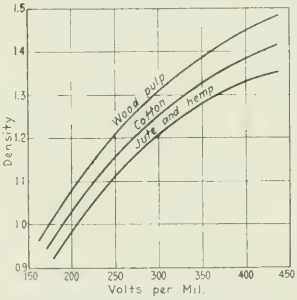
Automatic Electric Welding.—L. J. STEELE and H. MARTIN.—Abstract of paper presented before the Institution of Electrical Engineers, in which the authors take up the evolution of the "Cyc-Arc" process, experimental difficulties, essential adjustments to obtain satisfactory welds, the influence of arc lengths, timing and control apparatus, performance of the particular apparatus under consideration and results of welding experiments, reference being made to some practical applications.—*Electrician (London)*, Dec. 9, 1921.

Stability of Conducting Furnace Hearth Structures.—FRANK HODSON.—Emphasizes the necessity of giving particular consideration to the design and structure of the furnace hearth, the comments being based on one particular type in which relining was not required after four years of continuous operation.—*Electrical Review*, Dec. 17, 1921.

Metallic Arc Welding of Manganese Steel.—Points out that peculiar metallurgical characteristics must be taken into consideration to obtain the best results. The article also discusses the type of electrode material to use, most efficacious polarity, arc manipulations, welding procedure and finishing. The possibilities of increasing the speed of arc welding are considered.—*Railway Electrical Engineer*, December, 1921.

Miscellaneous

Industrial Research on Pressboard.—A. P. M. FLEMING and ALLAN MONKHOUSE.—Experimental batches of pressboard were made from carefully chosen raw materials, and the results of tests on these led to the conclusions that (1) wood-pulp boards were too stiff for most purposes and liable to age rapidly, although their dielectric strength was good; (2) cotton boards were soft, porous, yielded a high dielectric strength and were also very pliable; (3) jute and hemp boards, although they showed a high dielectric strength, had the disadvantage that they became very brittle after prolonged immersion in hot oil; (4) linen boards were tough, pliable and showed a high dielectric strength. Further tests led to the conclusions that (1) the dielectric strength of pressboard is directly proportional to its density for any class of raw material; (2) the porosity and ability to absorb liquids also bear a direct relationship, however, dependent on the finish imported to the board and the method employed to obtain the denser board. It was also observed that the jute boards were the most absorbent of those tested.—*Electrician (London)*, Nov. 25, 1920.



RELATION BETWEEN DENSITY AND BREAKDOWN VOLTAGE FOR PRESSBOARD MADE FROM VARIOUS FIBERS

World-Wide Power Development.—A. H. GIBSON.—Emphasizes the attention which is being given to the subject in France, Italy, Japan, Canada and the United States and gives a table of available and developed power in all countries. Particular attention is devoted to the power available in Great Britain and the British Empire. The author concludes with an outline of the uses to which hydro-electric energy will be applied in the countries considered. The article is to be continued.—*Canadian Electrical News*, Dec. 15, 1921.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **Prof. Vladimir Karapetoff**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ELECTRONICS, INVESTIGATIONS IN.

Two general types of inelastic impact between an electron and an atom may occur—the first of these results in an orbital shift of the electrons bound in the atom, and the second in the complete removal of an electron or ionization of the atom. The respective potential differences through which an electron must fall to acquire sufficient velocity for these two types of collision to occur are known as the resonance and ionization potentials for the particular element in question. The determination of these constants has been continued. Work of this character is of practical interest in the design of vacuum tubes, rectifiers, etc. Tables are available giving these constants for phosphorus, iodine, sulphur, nitrogen, oxygen and hydrogen and for zinc, cadmium, mercury, magnesium and calcium, with predicted data for strontium and barium.—*Bureau of Standards, Washington, D. C.*

CONCRETE FOR ELECTRICAL CONSTRUCTION.

The Hydro-Electric Power Commission of Ontario has made extensive researches on the manufacture of concrete, including methods of testing cement, sand and stone, both for quality and for their concrete-making properties; proportions of these ingredients to obtain concretes of the desired strengths; the effect of gradation, silt and impurities on the strength of concrete; the laws governing the plasticity of concrete mixtures; field methods of measuring, mixing and placing, and inspection of concrete.—*R. B. Young, Hydro-Electric Power Commission of Ontario, Toronto.*

MALLEABLE IRON INDUSTRY, ELECTRIC HEATING IN.

Development work and research are now being carried on in order to determine the scope of the field to which electric heating can be applied in the malleable iron industry, and data from actual installations will be analyzed.—*General Electric Company, Schenectady, New York.*

INSULATING MATERIALS, THERMAL CONDUCTIVITY OF.

Tubes were made of various insulating materials used in turbo-alternator slots and were heated by copper tubes placed inside. Temperatures inside the tubes and on both surfaces were measured with thermocouples, and from the known dimensions of the tubes the thermal conductivities of the materials were computed. The effect of prolonged excessive heating upon the dielectric strength was also ascertained. The results were published in the Bulletin of the *Société Francaise Electrique.*—*R. Jouast, Laboratoire Central d'Electricité, Paris, France.*

LAMPS, NEON.

Small neon lamps have been developed in which light is derived from an electrical discharge through rarefied neon gas, the light appearing as a soft orange glow. The lights are at present feeble, apparently less than 1 cp., but, as they can be made to consume only 5 watts on 220 volts, it is believed that they will prove useful as pilot lights, etc.—*Edison-Swan Electric Company, Ltd., London, England.*

CURRENT TRANSFORMERS, STUDIES OF.

The following studies have been recently made on current transformers: (a) Effect of magnetic leakage in different types; (b) errors in ratio and phase angle due to wave form; (c) errors due to the position of the primary conductor in a thorough-type portable transformer; (d) minimizing the errors by means of shunts of resistance or condensance, or both. The results will be described in detail in our bulletin.—*H. W. Price and C. K. Duff, University of Toronto, Toronto, Canada.*

MICA, DIELECTRIC CONSTANT OF.

The dielectric constant of twelve different grades of mica was determined at 1,000 cycles per second using a shielded capacity and conductance bridge to measure the capacity of the condenser formed by two mercury electrodes and the sheet of mica. It was found that mica in which air films could not be seen had an average dielectric constant of 8.1 with no difference between the various grades. Thick sheets with plainly visible air films had low dielectric constants (2.9 to 4.8), while sheets having stains had dielectric constants slightly above the average. The most probable cause of the low values of the dielectric constant is the existence of air films between the laminas.—*J. R. Weeks, Jr., Western Electric Company, New York.*

RADIO REFERENCE LISTS.

The Bureau of Standards has for some time carried on the compilation of a special list of references to papers of radio interest. Papers are noted as soon as they are published, and a list is issued twice each month. These references are classified according to an extension of the Dewey decimal classification, which was prepared at the bureau for this purpose. These lists are intended primarily for use by members of the staff of the bureau, but there is a very limited outside distribution. —*S. W. Stratton, Bureau of Standards, Washington, D. C.*

REFLECTOMETER FOR PHOTOMETRIC PURPOSES.

A simple and inexpensive reflectometer has been developed for measuring the reflection factor of surfaces. It may be of service for certain practical purposes where inaccuracies of 10 to 15 per cent are allowable.—*Bureau of Standards, Washington, D. C.*

AMPLIFIER, SUPERHETERODYNE, RESISTANCE COUPLED.

An experimental assembly of the superheterodyne system for short-wave reception, as suggested by E. H. Armstrong, was made, employing resistance coupling between the radio-frequency amplifier tubes. Common batteries for the filaments and for the plates were used and a grid condenser and leak were employed in each radio-frequency stage, thus introducing partial detection as well as amplification. A frequency of 120,000 cycles was found to give optimum radio-frequency amplification. The merits of the system as applicable to actual reception were also investigated.—*Radio Laboratory, School of Electrical Engineering, Cornell University, Ithaca, N. Y.*

STEEL, EUTECTOID CARBON, EFFECT OF RATE OF COOLING UPON MAGNETIC PROPERTIES.

Six specimens of eutectoid carbon steel were heated to 800 deg. C. and allowed to cool at various rates. Various magnetic and other observations were then made on each sample with the following results: (1) With a decrease in the cooling rate there is a marked increase in the value of the maximum induction for a given value of the magnetizing force, and an increase in the maximum permeability with a decrease in the coercive force. (2) As the structure is changed from an essentially sorbitic one to "divorced" pearlite, there is a gradual shifting toward the origin of the break in the reluctivity line and an increase in the difference between the "real" and "apparent" values of the maximum intensity of magnetization. (3) There is a good agreement between the values of the coercive force and the scleroscope hardness as affected by the various cooling rates.—*C. Nusbaum and W. L. Cheney, Bureau of Standards, Washington, D. C.*

HOIST, MINE, DRUM-SHAPE.

The reduction of the acceleration peak in deep hoisting is an advantageous point which comes automatically with the coning of the drum. The problem is of considerable importance in connection with saving of power, reduction in the rating of the driving motor and increasing the mine output. For a discussion of a simpler problem when the shaft is shallow and the weight of the rope is unimportant, see article by F. L. Sloane, *A. I. E. E. Proceedings*, 1918, page 1203.

Suggestions for Research

WELDING, ELECTRIC, MECHANICAL TESTS ON WELDS.

According to H. M. Hobart, fatigue tests of welded joints are most vital. The importance of obtaining reliable information as to how this test should be made probably transcends that attached to any other research in the field of fusion welding. He urges systematic tests with various well-known fatigue-testing machines in order that standard specifications for the testing procedure may be prepared.

LIGHTNING AND OVERHEAD GROUNDED WIRE.

There is a general research that would be valuable to transmission engineers relative to the effects of cloud lightning and the value of the overhead grounded wire. In a paper to be published in the January number of the *A. I. E. E. Journal* I have questioned the economic value of the overhead grounded wire in several of its applications. There is one analysis that is new, namely, the effect of resistance of the tower legs on the overhead wires, preventing arc-overs at the insulators. The overhead grounded wire loses one of its most important functions if it fails to prevent accidental arc-overs of insulators. It has not been possible to gather data of value on induced lightning strokes, owing to lack of recording instruments. Recently there has been made available a device for recording the values of the induced voltages. It consists of a sphere gap with a recording device in series and is known as a "transient voltage recorder." It does not record the exact voltage but simply that of a gap sparked over. With this and other devices it might now be possible to determine experimentally something about the value of the overhead grounded wire and also about the nature of ground induction.—*E. E. F. Creighton, Schenectady, N. Y.*

TURBO-GENERATORS, HUMIDITY OF SURROUNDING AIR.

The relative humidity of the air surrounding a high-tension generator, as well as of that used for cooling, is of great importance. A high humidity (up to 95 per cent) is desirable in order to drain off static charges promptly. If, however, precipitation of water is allowed to occur, insulation may deteriorate in weak places. It is desired to investigate this question thoroughly and to develop simple and sensitive means whereby the degree of humidity in the machine may be kept automatically within the best limits and an alarm promptly given when these limits have been exceeded.

RESISTORS, HIGH-RESISTANCE.

Resistors have been experimented with in Germany which are made of thin layers of carbon or metallic oxides deposited in the interior of glass tubes either as uniform coating or in spirals (*Zeits. Techn. Physik.*, Vol. I, page 256). With such a construction the conducting layer is well protected mechanically and at the same time is well cooled. Further experiments in this direction are desirable.

PRIMARY CELLS, ACCELERATED TESTS ON.

The difficulty in testing primary cells arises from the fact that identical cells yield widely different amounts of service under varying conditions. For this reason a life test must be practically a duplicate of the use to which similar cells are to be put. No way has been found as yet to make accelerated tests that will include all the factors entering into the performance of the cells. (Circular of Bureau of Standards, No. 79, page 32.) For practical purposes, especially for testing competitive cells, it would be very desirable to devise some short tests which would give at least an approximate idea of the expected life for a desired continuous or intermittent service.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Tariff Bill May Be Reported Out of Committee This Month

UNQUESTIONABLY an earnest effort is being made by the finance committee of the Senate to report out the tariff bill at the earliest moment. Some of the Republican leaders, however, continue to be of the opinion that this is no time to attempt a permanent revision of the tariff and prefer to see the bill delayed still further.

The probabilities seem to be that the committee will be allowed to have its way and will report out a bill before the end of January. While it is known that there will be material changes in the House bill, including a material reduction in the level of most rates, no definite information as to its plans has gone out from the committee. The committee is supporting the American valuation idea, but it is very apparent that it is beset with uncertainties as to the practical application of that plan.

Consideration of the tariff on the floor of the Senate is certain to be more extended than usual. It is true that the Republicans have a majority of twenty-four in the Senate, but views on the tariff are much less partisan than they were when the Payne-Aldrich measure was enacted.

Boston-Cleveland Comparisons Difficult, Says Wallis

NO SATISFACTORY comparisons can be drawn between such a central-station system as that of the Edison Electric Illuminating Company of Boston and the Cleveland municipal lighting plant for rate-making purposes, declared L. R. Wallis, superintendent of the former's sales department before the Massachusetts Department of Public Utilities last week. Representatives of the city went to Cleveland to make a study of operation under the municipal system in order to obtain data for the rate appeal brought by the city of Boston.

Questioned by petitioners' counsel, the witness pointed out that the Cleveland municipal plant charges a rate of 3 cents per kilowatt-hour for lighting energy, but that it serves a densely occupied and very limited area, with a total plant investment of about $6,000,000 against an investment of $59,506,000 by the Boston company, which provides lighting service in a territorial area of approximately 650 square miles.

It was brought out that if taxes are allowed for 1921, in accordance with precedent, the Cleveland municipal plant has lost money during the year. Extended comparative data were presented by Mr. Wallis showing that the Boston Edison system's area, more than double that served by the Cleveland Electric Illuminating Company, combined with a vastly greater underground system and with no gas service in the Ohio city and a 60 per cent larger Boston investment in plant, involves greater over-all costs of service in the former case and hence predicates higher rates.

Financial Condition of Massachusetts Utilities Improving

ON THE whole, declared the Massachusetts Department of Public Utilities in its annual report to the incoming Legislature last week, the financial condition of the gas and electric companies of the state has improved within the past year. Several companies which have been carrying large floating debts have been able to finance these in whole or in part by the issue of permanent securities upon reasonably favorable terms. Others which had during the war years attempted to issue stock only to have a considerable proportion left on their hands have found it possible with the aid of recently passed and more flexible legislation to dispose of the remaining shares. Still others which have been postponing needed additions and improvements have found it possible to finance these and to proceed with the work. The commission points out that in view of the effect of the November sleet storm upon net earnings, it may be necessary to carry the cost of these extensions into succeeding years. The commission notes that fewer petitions for rate increases are being received and says that if no material increases occur in the prices of coal and oil, some reductions in rates may be expected as general business improves. Hitherto the loss of power business in particular has combined with relatively high fuel costs to render rate reductions difficult.

Difference of Opinion as to Who Should Merchandise Appliances

CONSIDERABLE difference of opinion developed at the annual convention of the Massachusetts State Branch of the National Association of Electrical Contractors and Dealers, held Jan. 5 at Springfield, as to the desirability of central-station companies merchandising appliances. Representatives of the United Electric Light Company, Springfield, and of local contractor-dealer houses testified that in Springfield remarkably satisfactory results have followed the withdrawal of the company named from merchandising. C. Ernest Greenwood, superintendent appliance department, Boston Edison Company, in a written contribution, declared that the time has not arrived as yet when a wholesale withdrawal of central-station companies from this field would be for the good of the industry. There appeared to be a general recognition of the stimulus to appliance sales which central-station participation affords.

General agreement that the entire industry should work energetically to secure installation of more outlets in the home followed a long discussion of sales matters.

Alaska and Iowa Projects Seek Permit from Power Commission

THE city of Wrangell, Alaska, has applied to the Federal Power Commission for a preliminary permit covering a power project on Mill Creek at a point 8 miles from Wrangell. The estimated primary capacity of the development is 1,000 hp., and it is the intention to install a plant of similar capacity. The power is to be used for public utility purposes.

The only other application received by the Power Commission during December was from the city of Oskaloosa, Iowa. Oskaloosa asks for a preliminary permit covering a dam and power house in the Des Moines River at a point just below Harvey. The estimated primary capacity of the development is 600 hp., and it is the intention to install a plant of 1,200 hp. capacity. The power is to be used for public utility purposes.

Baltimore Engineers Oppose Legislation to License Profession

A PROPOSED state law requiring the registration and licensing of practicing engineers in Maryland caused an animated discussion at a recent meeting of the Engineers' Club of Baltimore which was largely attended by members of the national mechanical, electrical, civil, chemical and other technical societies. The final vote at this meeting was conclusively against the proposed legislation, and the motion passed expressing this opposition was subsequently approved unanimously at a meeting of the local section of the American Society of Mechanical Engineers.

The bill was, however, strongly supported by some Baltimore engineers, who asserted that they had met with obstacles in getting business in states which already have such laws, there being now fourteen such states. These advocates held that the bill would elevate the standing of the engineer, tend to increase his compensation and better protect the public. Their opponents disputed these arguments and insisted that no state-appointed board could properly grade and appraise the practitioners in a field so wide as engineering. Instead of falling into line with states where such statutes are on the books, the Baltimore antagonists of the measure were inclined to favor going into other states to lend assistance, if possible, to the repeal of such laws where they exist and to their prevention where they have not yet been enacted.

Public Utility Securities Falling Due in 1922 Total $432,934,890

PUBLIC utility maturities in 1922 will be almost $128,000,000 in excess of those that fell due in 1921, according to the figures of the *Wall Street Journal*, the respective amounts being $432,934,890 and $305,110,350. The short-term notes which have been issued in large amount during the last few years because of the high rates for money will, it is expected, give place to long-term issues with the growing ease of the money market. The largest issues falling due in 1922 are $50,000,000 in three-year 6 per cent notes of the American Telephone & Telegraph Company, maturing Oct. 1, and $39,199,000 in one-year extended 8 per cent notes of the Interborough Rapid Transit Company, New York. Electric light and power company issues falling due, including those of combined gas and electric companies and combined railway and electric companies, are listed by Dow, Jones & Company approximately as follows:

January	$5,300,000	July	$6,300,000
February	30,400,000	August	20,500,000
March	28,500,000	September	19,100,000
April	2,400,000	October	8,400,000
May	15,600,000	November	9,250,000
June	8,900,000	December	11,500,000

These figures give a total of more than $166,000,000, of which the largest items are $12,500,000 of Philadelphia Electric 6 per cent notes and $16,000,000 of Boston Edison 5 and 6 per cent notes, falling due in February; $12,442,600 of Public Service of New Jersey 7 per cent convertible notes and $5,868,000 of Kansas City Gas & Electric first fives, falling due in March; $9,794,000 of Philadelphia Company convertible debenture fives and $5,000,000 of Mississippi Valley Gas & Electric collateral trust fives, falling due in May; $5,693,790 of Central States Electric 5 per cent notes, falling due in June; $5,000,000 of Consolidated Gas, Electric Light & Power 7 per cent notes, $5,000,000 of Consolidated Power of Baltimore 6 per cent notes and $4,950,000 of Metropolitan Edison first refunding fives, falling due in August; $8,272,000 of Utah Securities Corporation 6 per cent ten-year notes, falling due in September; $5,444,500 of Merchants' Heat & Light refunding fives, falling due in October; $7,500,000 of Brazilian Traction, Light & Power 6 per cent notes falling due in November, and $6,000,000 of Cincinnati Gas & Electric 8 per cent one-year notes, falling due in December.

Fighting Ice Formation by Discharge of Tepid Water Into River

SPEAKING before the recent convention of the American Association for the Advancement of Science, held at Toronto, John Murphy, engineer of the Canadian Department of Railways and Canals, declared that it is possible to combat ice formation in rivers serving electric plants by spilling tepid water into them. Mr. Murphy said that the water for 13 miles of the Rock River in Illinois had for five winters been kept above the freezing point by the discharge into the river of two barrels of tepid water every second.

Mr. Murphy has been engaged for many years in studying the problem of prevention of ice formation, especially with relation to hydro-electric plant operation.

Reading Will Substitute Electricity for Gas on All Streets

THE City Council of Reading, Pa., passed a resolution last week to discontinue all gas lamps for street lighting after 1921 and to install electric lighting throughout the city. The Council's action followed a notice from the Consumers' Gas Company that the rates charged for gas for city street lighting would be increased Jan. 1, under penalty of having the service discontinued. The letter suggested that the price be kept at its present figure with only 500 lamps instead of 581, thus allowing the company a larger revenue for the service. This suggestion was disregarded by the Council.

Southern Electrical Men and N. E. L. A. Bureaus Confer at New Orleans

AT NEW ORLEANS on Jan. 17 to 20, under the auspices of the local Electrical League, a meeting of all electrical interests of the South and Southwest to discuss sales work was held jointly with the bureau and committee meetings of the Commercial Section of the National Electric Light Association scheduled for the same time in that city. Arrangements for this series of joint meetings were made by a committee representing the New Orleans Railway & Light Company and the electrical jobbers and contractor-dealers of the city. W. E. Clement of the New Orleans Railway & Light Company, chairman of the Commercial Section of the Southwestern Division of the N. E. L. A., was chairman of the program committee, and Col. Robley S. Stearnes acted as general chairman on the committee of arrangements.

Both morning and afternoon sessions of the first day were devoted to the work of the N. E. L. A. wiring committee. R. S. Hale, chairman, in a progress report outlined the standardization of wiring devices, heater cord connections, plugs and receptacles, and recommended changes in wiring needed to make the use of electrical heating devices convenient and the adoption of suitable plugs with a rating of 45 amp. for electric ranges.

CONTRACTOR-DEALER PLAN VIGOROUS CAMPAIGN

On Wednesday a joint meeting was held of the Mississippi State Association of Electrical Contractors and Dealers and the Louisiana Association of Electrical Contractors and Dealers. Members of the former body were invited by the Louisiana association to discuss plans for vigorous sales activity during the coming year. The following officers were elected by the Mississippi association: President, J. M. Fried, Vicksburg; vice-president, Joe D. Lanham, Greenwood; secretary, W. C. Warrick, Laurel. Plans were discussed for a meeting in July at Biloxi, and a committee was appointed consisting of three Mississippi representatives and three Louisiana representatives of the contractor-dealers and one electrical jobber to fix the date of another joint meeting.

At the Wednesday morning session meetings of the N. E. L. A. Lighting Sales Bureau and Power Sales Bureau were held. Ways and means for securing new business were taken up, and the committees were authorized to make recommendations to the executive committee of the N. E. L. A.

At the meeting of the Merchandise Sales Bureau Wednesday afternoon the question of electric range business was discussed and plans for the presentation of the annual report were briefly outlined. It is proposed in this report to present sales information from various sections of the country.

The meeting on Thursday morning, conducted by Leo Hirsch, president of the Electrical League of New Orleans, was a general one attended by all branches of the industry present at the meeting. Harold W. Newman, president of the New Orleans Stock Exchange, made an address of welcome, to which Executive Manager Aylesworth of the N. E. L. A. responded. Samuel A. Chase of the Westinghouse Merchandising Bureau spoke on "The Results of Team Work." A feature of this session was the presentation of a special illuminated film on dealer merchandising, displayed for the first time by Percival Stern, president of the Interstate Electric Company, New Orleans.

The Thursday afternoon session was devoted to meetings of the "Salesmen's Handbook" committee, the committee on electrically equipped furniture, and the committee on commercial service and relations with customers. A meeting of Southern jobbers was also held. Addresses at the main session were made by George H. Hughes, president Edison Electric Appliance Company, Chicago; Lawrence W. Davis of New York, representing the National Association of Electrical Contractors and Dealers; A. Hardgrave of Dallas, president Southwestern Geographic Division, N. E. L. A.; S. E. Doane, chief engineer National Lamp Works, Cleveland, and R. H. Tillman of Baltimore, chairman Commercial Section, N. E. L. A.

An elaborate entertainment program was provided, including an automobile tour, a special sightseeing trip and a banquet at the Southern Yacht Club, Col. Robley S. Stearnes being toastmaster. On Friday executive meetings were held.

Lockwood Committee Digs Deeper Into Incandescent-Lamp Business

THE manner in which the General Electric Company conducts its incandescent-lamp business was taken up again by the Lockwood legislative committee, following the testimony of H. W. Harper, reported last week. Those who appeared before the committee included August E. Wiest, head of the Crystalite Manufacturing Company, and Louis C. Kahle, its manager; Thomas Spina, manager of the Continental Lamp Company; Patrick J. Mee of the Daylight Lamp Company, Inc.; Alfred J. Liebmann, manager of the Elkhorn works of the General Electric Company and formerly manager and vice-president of the Independent Lamp & Wire Company; Lambert Schmidt, president of the General Illuminating Company; George K. Hamblin, of the Acton Lamp Company; Cornelius C. Billings, patent attorney and counsel of the Independent Lamp & Wire Company; Max E. Ebenstein, owner of the Electrical & Engineering Corporation; William A. Kennedy, sales manager of the Sibley-Pitman Electric Corporation; Charles P. Scott, secretary-treasurer of the Royal Eastern Electric Supply Company; Myer Zucker, of A. Schimmerl & Company, Inc., electrical supply jobbers; Walter Cary, vice-president of the Westinghouse Lamp Company, and Douglas Dewar, of Marwick, Mitchell & Company, accountants for the General Electric Company.

August E. Wiest, head of the Crystal Manufacturing Company of Union Hill, N. J., and as such a stockholder in the United Lamp Manufacturers' Corporation of New York City, proved to be the principal witness on Jan. 10. His connection with the electric bulb business began in 1915 with the American Appliance Company of Indianapolis, agent for the Franklin Electric Manufacturing Company, which in turn was a class B licensee of the General Electric Company.

According to the witness, the company "got caught" selling lamps below the price fixed by the General Electric Company, whereupon the Franklin company discontinued supplying it with lamps. Efforts were made, the witness said, to establish a source of supply from independent manufacturers, but the supply was being restricted, and in February, 1920, the General Electric Company published a notice in a New York newspaper that it intended to prosecute all manufacturers of lamps infringing on its patents. Rather than involve the company's assets of $250,000 in litigation, Mr. Wiest said, it closed its branches when it was doing an annual business of more than $1,000,000. He severed his connection with the concern in October, 1920, taking for his interest the Crystal Light Company of Union Hill, which was controlled by the American Appliance Company.

In the spring of 1921, the witness continued, when his new venture was running along nicely, he was called on the telephone and asked to go to the office of F. S. Terry, one of the managers of the National Lamp Works of the General Electric Company. He said he was informed by Mr. Terry that his company was one of those infringing on the General Electric Company's patents. Negotiations were begun then for a license under which the witness would continue manufacturing and pay the General Electric a royalty, but his quota was to be fixed at $75,000, although he had been doing a business of $175,000. Eventually, he said, he was informed by Mr. Terry that his proposal for a license for the Crystal Light Company had been turned down.

ORGANIZATION OF INDEPENDENT COMPANIES

Last August, Wiest, with several other independent manufacturers, organized the United Lamp Manufacturers' Corporation to market a complete line of lamps in uniform packing. Inside of two months the corporation was doing a business of $65,000 a month. The company since has been made defendant in a patent suit begun by the General Electric Company.

A. J. Liebmann, a former independent lamp manufacturer and part owner of the Independent Lamp & Wire Company, who sold out to the General Electric while his case was in the higher courts on appeal, admitted that the validity of the Coolidge patent which the General Electric claims to control had never been carried to the highest courts in this country, although the English court had declared the patent invalid. Although C. C. Billings, the patent lawyer for his company, had stated that there was a chance of winning the appeal from the adverse decision of the lower courts, the appeal was not pushed, but his company sold out to the General Electric while the case was on the calendar.

Lambert Schmidt, secretary of the licensees' association and president of the General Illuminating Company, was questioned by Mr. Untermyer. He is a minimum-quota man—that is, he is licensed to manufacture not more than $75,000 of tungsten lamps a year. Mr. Schmidt asserted that his profits on a business of this amount would not exceed 10 per cent. He has overstepped his quota of $75,000 and incurred the fine of the General Electric Company, which consists of a payment of 20 per cent of the amount by which the quota is exceeded and a reduction in the next year's quota by the amount of the excess. This wipes out his profit. He said the General Electric had never allowed one of its infringement suits to go to the Supreme Court on appeal, but had always bought out the alleged offender.

The only glass works in the country making bulbs outside the General Electric was the Corning Glass Company, he said. When he failed to get his orders filled by the Corning Glass Company he asked the General Electric to sell him bulbs. The first time the General Electric filled his order for bulbs he was billed by that concern, but the second time he was billed by the Corning Glass Company.

PRICES OF LAMPS COMPARED

From Louis E. Kahle, manager of the Crystalite Manufacturing Company of East Orange, and Thomas Spina, manager of the Continental Lamp Works of New York, the committee learned of the profits in the manufacture of lamps.

Kahle said that when the General Electric bought out the companies included in the Independent Lamp & Wire Company the factories were closed. He was questioned on the cost of the tungsten filament lamp sold by the General Electric as the "Mazda" lamp, type B. The cost of a lamp made by his concern similar to the type B lamp of the General Electric was 16½ cents for the period ended Dec. 5, 1921, said Kahle. The cost was 15.7 cents somewhat earlier in the year, but the litigation begun by the General Electric against his company caused the increase in price.

The type B lamp of the General Electric Company was sold to the consumer for 40 cents, he said. Although the consumer pays 40 cents for the lamp, it is sold by his concern to the retailer for 19 cents.

Mr. Spina testified that lamps he manufactured, similar to those made by the General Electric, sold to the consumer from 200 to 300 per cent above the manufacturing cost, the resale price being fixed by the General Electric Company.

Here are some of the prices he gave to the committee: Type C 50-watt lamps, which cost Spina 22½ cents to make, were sold by the General Electric for 60 cents; 75-watt lamps, costing 24.127 cents, sold for 70 cents; 100-watt lamps, costing 28.4 cents, sold for $1; 150-watt lamps, costing 31.9 cents, sold for $1.40; 200-watt lamps, costing 40 cents, sold for $1.90; 300-watt lamps, costing 60.5 cents, sold for $2.80; 500-watt lamps, costing $1.09, sold for $4.15; 750-watt lamps, costing $1.67, sold for $5.75; 1,000-watt lamps, costing $1.72, sold for $6.70.

It was pointed out that the cost prices of these lamps were the cost to small independent manufacturers and that the General Electric Company by mass production and by controlling the constituents of lamps was enabled to reduce costs considerably.

William A. Kennedy, sales manager of the Sibley-Pittman Company, and Charles Scott of the Royal Eastern Electric Supply Company, jobbers for the General Electric Company, and Myer Zucker, a wholesaler for the Westinghouse Electric Company, told of their working sales contracts and their relations with "retailer-agents."

ARRANGEMENTS WITH WESTINGHOUSE LAMP COMPANY

Mr. Cary of the Westinghouse company signed a waiver of immunity on taking the stand. He said that the Westinghouse Lamp Company was licensed to do 17.25 per cent of the lamp business and that if it exceeded that quota it had to pay 10 per cent royalties on the excess. The Westinghouse Lamp Company observed the price of the General Electric because of this agreement, but he testified that its quota was not reduced when it exceeded it. In 1920 the Westinghouse company exceeded its quota by $200,000, he said. Mr. Untermyer brought out that this was one-half of 1 per cent of its business.

The witness was examined on the Toledo decree and admitted that the Westinghouse and the General Electric were defendants and were enjoined from conspiring to do business under the resale plan. He readily admitted that his company had a resale arrangement, but denied that the consignment was the same as the resale plan.

"You claim they are consignees, and we claim that is a mere cover," commented Mr. Untermyer.

"I don't know what you claim," Mr. Cary declared.

"I am telling you now," added Mr. Untermyer. "We claim it is a transparent, frivolous cover and you are claiming they are consignees. Isn't that about it?"

"We claim they are agents," the witness replied. "We consign lamps to them."

It was brought out that the Toledo decree forbade the General Electric from acquiring the Franklin Electric Company. However, in 1918, the Franklin company was absorbed by the Westinghouse. Mr. Cary did not consider this act an evasion of the spirit of the decree. It then appeared that after the Westinghouse company acquired the Franklin concern it closed down the two plants of the latter organization. The Franklin company had previously, in its turn, absorbed several electric companies and closed them down.

Mr. Cary admitted that in making consignments to class B agents, as jobbers are designated, and class A agents, as retailers are termed, losses to class B agents had to be made up by them even though they were consignees. He asserted that this has been averaged over a period of years and had been figured in the compensation paid class B agents. The witness was asked how the agents of the Westinghouse Lamp Company knew the prices they were expected to pay when goods were sent on consignment. He said that a consignment bill was sent along with the goods. The agent received a list price showing his "schedule of compensation" when he is appointed as an agent, he added.

"And that is his fixed price?" asked Mr. Untermyer. "It is not any fixed price at all; it is a commission," replied the witness.

It developed that the Westinghouse, under its agreement with the General Electric, paid the same commissions to agents as the General Electric. Cary said if he paid less compensation he would not have any agents. Mr. Untermyer suggested that if he paid more compensation the General Electric would not have any agents. It was here that Mr. Cary declared that would mean breaking an agreement, asking whether the committee would ask him to do that. Mr. Untermyer then made a statement about the desirability, to his mind, of "smashing" the agreement.

The Westinghouse Lamp Company did a business last year of $10,000,000 in bulbs, being the largest licensee of the General Electric, the witness said.

Through the testimony of Douglas Dewar, a public accountant employed by the General Electric to audit its books, Mr. Untermyer developed that in the twenty-eight-year period ended Dec. 31, 1920, the company had spent more than $182,000,000 for its various plants. Despite the fact that about $60,000,000 of this was spent for improvements within the last two years, he pointed out, the total value of all the company's property was set down in its 1920 report as only $66,000,000.

Mr. Untermyer characterized this "writing down" process as "grossly misleading," saying it was done "in order to keep the profits of the General Electric Company from looking too big."

Dewar denied that the General Electric Company was trying to evade the federal taxes, saying that the figuring in the reports was based on war-time depreciation.

Department of Justice to Investigate General Electric Company

ANNOUNCEMENT was made in Washington on Tuesday that as a result of letters to the Department of Justice from counsel of the General Electric Company and also of charges made by Samuel Untermyer, counsel of the Lockwood legislative committee, the Attorney-General has ordered an investigation of the General Electric Company to ascertain if it has violated any federal laws.

The Attorney-General said that he expected that the minutes of the Lockwood committee would be available to Department of Justice investigators. If violations of federal laws are uncovered, the department will proceed against the company in the United States courts, while if any departures from state statutes are found, this information will be turned over to counsel of the New York State investigating committee.

Acting upon the Lockwood committee charges, the department will investigate the following questions involved in accusations against the company: Whether it maintains an unlawful monopoly of tungsten incandescent lamps; whether it has made unlawful contracts; whether it has manipulated its accounts and evaded the payment of excess-profits taxes, and whether it has been operating in violation of a decree handed down by federal courts in Ohio in 1911.

Experts from the Internal Revenue Bureau will be called upon to assist the Department of Justice in examining the General Electric's books and tax returns. The Attorney-General said that he would detail three members of his department to conduct the investigation.

Ohio Brass Gets the Final Decision in Suspension-Insulator Case

WHILE affirming the decision of the United States District Court of New Jersey in the suit brought by the General Electric Company against the Ohio Brass Company for contributory infringement of the Buck-Hawlett patent, No. 2,925,561, for a system of suspension of high-tension lines, the United States Circuit Court of Appeals has based its finding for the defendant on an entirely different ground. The lower court in its decision, in November, 1920, refused to consider the validity of the patent, holding that the evidence showed no infringement. The higher court, however, found the patent to be invalid and that consequently there could be no infringement.

The case has been in the courts for the past eleven years, and all told about 6,000 pages of testimony have been taken. Witnesses came from all over North and South America. The record is virtually a complete history of suspension insulator practice prior to 1906, when the patent was applied for.

The patent involved a freely suspended system operating at from 60,000 volts to 100,000 volts, periodically dead-ended to cross-arms using a special type of disk insulator and a freely suspended jumper. The Hewlett insulator is the subject of another patent, and infringement thereof was not claimed, but merely of the system of suspension.

The Court of Appeals held that the invention in suit was anticipated by a line erected in 1900 in Indianapolis. The court further held that an insulator of a specific type and an insulator of a more general type in combination with expedients appropriated for the art are not inventions, first because they are not a combination that, in the patent sense, is new, and second because otherwise the common expedients of the art, such as poles and conductors, would be foreclosed to the industry on systems falling within the claims of the patent.

"As drawn," says the court, "the patent to Buck and Hewlett grants them not merely a monopoly of a system of electrical transmission, but, in effect, expands the Hewlett patent for an insulator and permits it to embrace and monopolize the named expedients of the art, thereby bringing about infringement whenever these expedients are used in combination with insulators of others, which, though not infringing the Hewlett insulator, fall within its broad description. The Buck and Hewlett patent for a system, built around the Hewlett insulator pretty nearly, if not entirely, covers the whole art, present and prospective, of insulators in series flexibly connected, whether the insulating members be disks, globes or other shapes."

International Joint Commission Reports on St. Lawrence Developments

IMPROVEMENT of the St. Lawrence River as recommended in the report of Col. W. P. Wooten and W. A. Bowden, engineers appointed by the United States and Canadian governments respectively, is indorsed by the International Joint Commission in a report submitted to Congress on Jan. 16. In the Senate the report was referred immediately to the committee on foreign relations. In the House no disposition was made of the report pending the outcome of a fight as to its reference.

The commission believes that the greatest beneficial use of the waters of the St. Lawrence River between Montreal and Lake Ontario may be obtained by a combination of navigation and power development in the international section and of navigation alone in the national section with power development therein at some future date.

The estimated cost of the completed work between Montreal and Lake Ontario, as recommended by the Engineering Board, is about $252,000,000. To this must be added the cost of the new Welland Ship Canal in order to ascertain the total expenditure involved.

With regard to water source the report says: "The terms of the reference make it clear, in the opinion of the commission, that the intention of the two governments was that the proposed improvement of the Upper St. Lawrence should serve primarily the interests of navigation and commerce and only incidentally those of water power. The first and principal question reads: 'What further improvement in the St. Lawrence River between Montreal and Lake Ontario is necessary to make the same navigable for deep-draft vessels of either the lake or ocean-going type, what draft of water is recommended, and what is the estimated cost?' In answering this question the commission is requested to consider two alternative schemes, one providing for navigation interests alone and the other for a combination of navigation and power interests 'to obtain the greatest beneficial use of the waters of the river.' The scheme recommended—that is, a combination of navigation and power in the international section of the river—does, in the opinion of the commission, insure the maximum efficiency from the waters of the St. Lawrence both for navigation and water power."

In regard to the electrification of railways the report holds that there is much force in the argument that, given a sufficient and conveniently located supply of power at a reasonable cost, railways would be transformed from steam to electricity, but it must not be lost sight of that other factors enter into the problem, particularly the capital cost of the proposed change. In any event the question is one for the railway companies, which are the best judges as to the circumstances under which electrification would be economically a sound policy, and while the commission believes that ultimately electrification will be applied to all the principal railway lines, there does not appear to be any immediate prospect of a movement in that direction on the part of railways that might be served with power from the St. Lawrence.

The commission is of the opinion that in so far as markets are likely to be available for St. Lawrence power within a reasonable period after the St. Lawrence improvements have been completed, the situation is substantially as follows:

Those who have given particular attention to this matter, both in the United States and Canada, are for the most part of the opinion that markets will be available to absorb all the power that can be developed on the international section of the St. Lawrence within a reasonable period after the completion of the proposed works. The commission has before it graphs Nos. 3 and 5, showing the present use of power on both sides of the boundary within a radius of approximately 300 miles of the Long Sault Rapids, and also the probable future demand. It appears from these graphs that at the present time (1921) the total primary power installation on the United States side of the 300-mile area is approximately 9,900,000 hp. and on the Canadian side 1,900,000 hp. The estimated demand on the United States side in 1925 is 11,000,000 hp. and on the Canadian side 2,350,000 hp., and in 1930, on the United States side 12,500,000 hp. and on the Canadian side 2,875,000 hp.

The director of the United States Geological Survey is of the opinion that "the demand in New York and New England would take care of all the power that might be developed on the St. Lawrence as soon as it was made available," and this opinion is confirmed by the report on the proposed Superpower System. Evidence as to the demand on the Canadian side of the area goes to show that ultimately Canada will be in a position to use her share of the available power on the international section of the St. Lawrence, although obviously for some years after the works are completed there will be a much greater demand for power by the United States than by Canada.

Congress to Pass on Ford's Muscle Shoals Offer

HENRY FORD'S offer for purchase and lease of the government's nitrate and water-power projects at Muscle Shoals, Ala., will be referred to Congress for final decision, it was announced at the conclusion of a conference between government officials and Mr. Ford last week. Accompanying the Ford proposal when it is transmitted, Secretary Weeks said, probably would be the two offers received from Frederick Engstrum of Wilmington, N. C., and C. C. Tinkler of San Francisco.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Booklet of Society for Electrical Development.—"More Leisure Time" is the title of a booklet just issued by the Society for Electrical Development and now ready for distribution. In twenty-four entertainingly written and illustrated pages the booklet tells how hours of drudgery may be eliminated by the use of electric service and appliances. The booklet, which was written by a woman, makes an especial appeal to housewives.

World's Wireless Stations.—The International Telegraph Bureau at Berne, Switzerland, has just published a report about the world's wireless stations. According to these figures, there existed at the end of the year 1920 in the whole world 13,694 wireless stations, of which 977 were on land and 12,622 on board ships. The total number of wireless stations in 1913 was 508, in 1918 3,998 and 1919 6,320. It will be seen that the largest increase took place during the year 1920.

Railroad Electrification in South Africa.—The government of the Union of South Africa is to proceed with the electrification of the section of the Durban-Pietermaritzburg Railway between Pietermaritzburg and Glencoe, a distance of 171 miles. The direct-current system at 3,000 volts will be employed, and the total cost will be between £3,000,000 and £4,000,000. Eventually it is hoped that the entire railroad as well as the line from Cape Town to Simonstown will be electrified.

Accidents from High-Tension Lines.—Forty-two deaths and forty-eight cases of injury, exclusive of accidents on electric railways, are reported as occurring in Switzerland in 1920 from electricity. Accidents numbered eighty-two. This increase over previous years was of course due to the rapid extension of electrical development, and it is gratifying to note that the figures for 1921, so far as they are known, show a marked reduction as safety methods have become more generally understood. An interesting classification of the accidents has been made on the following basis: Persons who came in contact with tensions not exceeding 250 volts, fourteen injured, four killed; with tensions between 251 and 500 volts, nine injured, twelve killed; with tensions between 1,000 and 5,000 volts, two injured, four killed; with tensions between 5,001 and 10,000 volts, nine injured, four killed; with tensions exceeding 10,000 volts, fourteen injured, eighteen killed. In all save two cases the current was alternating.

Winnipeg Duplicates Transmission Line.—Owing to the fact that all the civic utilities of Winnipeg, Manitoba, depend upon a continuous supply of power for their operation and to the tremendous growth of domestic load caused by the general use of electric ranges and other conveniences, the hydro-electric system of the city has found it necessary to take every reasonable precaution to insure continuity of service. With this aim it has recently completed a duplicate transmission line between the power house on the Winnipeg River and the city, a distance of 77 miles, making a total of four circuits. The new line uses three types of towers—a latticed pole, a standard braced tower and a special dead-ending and angle tower.

World's Greatest Lighthouse to Be Built in France.—A billion candlepower is to be the rating of a new electric lighthouse to be built by the Technical Aëronautic Service of France on top of Mount Afrique, near Dijon, to aid the pilots of airships flying at night between Paris and Algiers, Mediterranean ports and points in Italy, Switzerland and elsewhere. This, it is said, will be by far the most powerful lighthouse in the world, from 30,000,000 cp. to 40,000,000 cp. having been found adequate for maritime lighthouses. Hitherto the lighthouses built to aid aërial navigation in France have been served by acetylene gas or by incandescent lamps and have been able to throw their beams only 25 or 30 miles. This has failed to make it possible for airplanes flying at a height of 10,000 ft. and at a speed of 124 miles an hour to pick out important points, such as the junctions of routes. The new lighthouse, as described in *Le Genie Civil*, will contain eight great lenses, each illuminated by a continuous-current arc lamp rated at 65 volts and 120 amp. at maximum capacity.

Hydro-Electric Steam Generators Cost Less than Coal-Fired Boilers.—The employment of high-power electric steam generators instead of coal-fired boilers, reports of which have come from Europe, is said to be attracting great interest, particularly among paper manufacturers, in this country, and apparatus of this kind is being developed by American manufacturers. A large Canadian paper mill has, it is reported, obtained 60,000 lb. of steam an hour twenty-four hours daily for four months from a 20,000-kw. hydro-electric steam generator. This is rated as the largest plant of the kind known and was the first put into commercial operation in the Western Hemisphere. Engineers of the paper company are said to estimate a saving of $4,000 a month with the new system, which will save 75 tons of coal a day. Installation costs, about $25,000, were 40 per cent less than the cost of installing the coal-burning plant that has been replaced. The efficiency of the electric steam generators is put at 90 per cent, while that of the largest coal-fired boilers only approximates 7 per cent. The American-built apparatus is larger than that so far made abroad.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

St. Louis Section, A. I. E. E.—C. C. Robinson, electrical engineer for the Union Electric Light & Power Company, has been elected as chairman of this section, succeeding J. L. Woodress.

American Society of Heating and Ventilating Engineers.—The annual meeting of this society will be held at the Hotel Pennsylvania, New York City, on Jan. 24-26. At the industrial session on the last day "The Control of Blower Motors," by Henry H. Issertel, and "The Under-Feed Stoker," by Frank A. DeBoos, will be among the papers presented.

Empire State Gas and Electric Association.—The Electric Meter Section of this association will meet in New York City on Feb. 24. The two principal topics for consideration at this meeting and for study during the year will be, first, the demand-meter situation, including a compilation of data as to the types in use and the experience of the companies with them, and, second, Public Service Commission Order No. 278, relative to periodic testing of watt-hour meters.

Rocky Mountain Electrical Co-operative League.—At the annual meeting of the advisory committee of the Rocky Mountain Electrical Co-operative League the following officers of the committee were unanimously elected for the coming year: Chairman, P. M. Parry; vice-chairman, J. A. Kahn; secretary and treasurer (re-elected), R. M. Bleak. Mr. Parry is commercial manager of the Utah Power & Light Company. Mr. Kahn is president of the Capital Electric Company, and Mr. Bleak is superintendent of lighting and appliance sales of the Utah Power & Light Company.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, Jan. 21; Chicago, Jan. 27; Birmingham, Jan. 28; Philadelphia, Feb. 4; Cleveland, Feb. 13.

American Society of Heating and Ventilating Engineers—New York, Jan. 24-26.

A. I. E. E. Section Meetings—Boston, Jan. 24; Atlanta, Jan. 26; New York, Jan 27; Utah, Jan. 27; Vancouver, Feb. 3; Providence, Feb. 3; Los Angeles, Feb. 13.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan 7, page 51.)

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

When Court May Dismiss Damage Suit Upon Demurrer.—It is only where it clearly appears from the petition that the negligence charged against the defendant was not the proximate and effective cause of the injury that the court may, upon general demurrer, as a matter of law, so determine, declared the Georgia Court of Appeals in reversing the lower court in Larkin vs. Andrews, a case which had been withheld from the jury as failing to set out a cause of action, notwithstanding that the plaintiff swore that in avoiding an automobile he had stepped a few feet from a roadway and come into contact with a heavily charged electric wire which had lain for weeks where it had fallen, hidden under weeds, as, it was averred, the defendant in the exercise of ordinary diligence should have known. (109 S. E. 518.)*

Municipal Powers Under Ohio Law.—The Supreme Court of Ohio, in United Fuel Gas Company vs. Public Utilities Commission, a suit brought to upset a decision of the commission dismissing the company's appeal against a rate ordinance of the city of Ironton, found that under the Ohio statutes the City Council could regulate from time to time the price a gas company might charge by ordinances establishing a rate for ten years, and on the expiration of such period the city could by ordinance regulate the price for the three years remaining under the original franchise contract, and the company's refusal to accept the ordinance did not nullify the city's power. A provision of the ordinance requiring the furnishing of gas free for certain municipal purposes was, however, beyond the Council's power unless agreed to by the company. (132 N. E. 845.)

Water-Power Contract Held to Permit Abrogation by Either Party When Supply Proved Unsatisfactory.—In an action brought by the Kansas Electric Utilities Company against the Bowersock Mills & Power Company to restrain the defendant from abrogating a twenty-one-year contract entered into in 1909 to furnish power to the plaintiff, the Kansas Supreme Court, reversing the prior judgment, found that a provision in the contract for ascertaining after careful trial whether the water power was satisfactory did not refer to a single specific test, or mean that if such a test was satisfactory, then the defendant must continue to furnish all the energy required by plaintiff to the end of the contract period, but, on the contrary, referred to a continuous possibility of the water power proving unsatisfactory at any time and permitted either party to abrogate the contract in such a contingency. (202 Pac. 92.)

Constitutionality of Kansas Industrial Court Again Affirmed.—The Supreme Court of Kansas has once more affirmed the constitutionality of the Industrial Court of that state, which was again assailed in State vs. Howat, the court declaring that no reason existed to lead it to alter its previous attitude. (202 Pac. 72.)

Order Continued in Dispute Between Southern Power and North Carolina Public Service Companies.—Pending trial settlement of mandamus proceedings in the United States Circuit Court of Appeals, the Southern Power Company must continue selling electricity to the North Carolina Public Service Company, which supplies the cities of Greensboro and High Point with electrical energy, an order to that effect having been entered in the appellate court at Charlotte, N. C. The order simply continues the order of the district court, which, after refusing a mandamus at Greensboro, directed that the Southern Power Company should continue selling energy to the North Carolina Public Service Company for a period of six months from June 29, 1921. The Southern Power Company, with headquarters at Charlotte, N. C., is resisting efforts of the other company to compel it to furnish it with energy. A final decision is expected at the February term of the appellate court.

Implied Promise to Pay for Right-of-Way Where Written Agreement Is Lacking.—The case of Krueger et al. vs. Topp-Stewart Tractor Company et al. concerned payment for a right-of-way granted by plaintiffs across their farm and occupied by defendant's power-transmission line, nothing having ever been paid for the grant and no price having been named. The Supreme Court of Wisconsin held that under such circumstances the law implies a promise to pay what the grant is reasonably worth. Market value did not enter into the question, and the sum due should be determined by evidence including the same elements of damage as are involved in fixing compensation under condemnation proceedings. It appeared that the plaintiffs had granted the right to the Topp-Stewart company, relying on what they understood to be oral promises to furnish them with light and power in return, and that on the sale of the line to the Central Wisconsin Power Company, a co-defendant in the suit, they were informed that the only way they could obtain light and power was either to build a line from the power house to their premises or to purchase a transformer. The Central Wisconsin company disclaimed all knowledge of the alleged oral agreement. (185 N. W. 249.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Penalty for Slow Payment.—In passing upon a complaint against a gas company the Missouri Public Service Commission held that the imposition of an additional charge or penalty to cover the expenses caused by the delay of customers to pay their bills is reasonable and lawful. Its purpose, the commission pointed out, is to bring about prompt payment, thereby diminishing collection expenses and placing upon the delinquent customer the extra cost of the service caused by his failure to pay promptly. There is no difference in principle between a discount for prompt payment and a penalty for delay. Such a penalty is not a double charge, and the public throughout the country has very generally acquiesced in the fairness of its collection. The commission, however, in another instance, has refused to allow a telephone company to discontinue service to a subscriber on account of former delinquency and poor credit standing.

Telluride Power Company Granted Rate Increase.—The Telluride Power Company, which serves a large portion of southern Utah, has been granted an increase in rates by the Public Utilities Commission of Utah, which will increase its revenues by about 16 per cent, or about half the sum asked for. The new rate for residential lighting runs from 14 cents per kilowatt-hour for the first 30 kw. of monthly consumption down to 9 cents per kilowatt-hour for all consumption per month in excess of 60 kw. Commercial lighting rates have a similar range, but with different consumption factors. The town of Panguitch, which had been on a separate schedule somewhat higher than that in effect elsewhere on the system, now goes on the same schedule, though not on the interconnected system of the Telluride. The commission criticised unreasonable opposition to rate advances, saying: "During the war period a customary objection made by a class of protestants at rate hearings was to the effect that prices of every kind were advancing with great rapidity and the public generally was carrying heavy burdens. This being true, the commission was asked to deny relief, regardless of the showing made, until after the war was over; then rates might be adjusted to meet outgo. Since the war this class of objection has taken the form that, though the war is over, the time is not yet to adjust rates, but that some time, when prices are stabilized, income might be adjusted to outlay, and, further, that in unregulated industries prices are now declining."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

C. E. Calder has recently been elected president of the Dallas Power & Light Company and the Texas Power & Light Company. Mr. Calder comes to this new position after some sixteen years of varied experience in public utility operations. In 1906 he became cost analysis engineer on construction and reconstruction of the street railway, electric light and gas properties of the Tri-City Railway & Light Company at Davenport, Iowa, and Rock Island and Moline, Ill., which work was being carried on by J. G. White & Company of New York. In December, 1907, he became associated with the Eastern Pennsylvania Railways Company and Eastern Pennsylvania Light, Heat & Power Company as assistant treasurer in charge of the accounting for these companies. Later he was appointed purchasing agent in addition to his accounting duties and elected secretary and treasurer of the Eastern Pennsylvania Railways group of properties. In March, 1913, Mr. Calder became connected with the Electric Bond & Share Company of New York as secretary of the Texas Power & Light Company and affiliated companies, with headquarters at Dallas, Tex. In 1917 the Dallas Railway Company and Dallas Power & Light Company came under the management of the Electric Bond & Share Company, and Mr. Calder was elected vice-president of all the companies of which Colonel J. F. Strickland was then president. These consisted of the Texas Power & Light Company, Dallas Power & Light Company, Dallas Railway Company and Texas Electric Railway. Upon the death of Mr. Strickland Mr. Calder was elected president of the Dallas Power & Light Company and Texas Power & Light Company and discontinued his connection with the Dallas Railway Company and Texas Electric Railway.

C. E. CALDER

C. C. Levis, manager of the New York office of H. M. Byllesby & Company, Inc., and the company's Eastern representative, has been elected to the directorate of the Standard Gas & Electric Company. Mr. Levis has been connected with the electric light and power industry for the past fifteen years. From 1907 to 1914 he was connected with the General Electric Company and its allied interests in England, taking a two years' course in the works of the British Thomson-Houston Company, Ltd., and later handling the Far Eastern business of the company. In 1914 he joined H. M. Byllesby & Company, Inc., and he has been connected with this company since that time, with the exception of two years' service in the army.

Joe Carmichael has been selected to head the Iowa Committee on Public Utility Information, with headquarters at Des Moines. Mr. Carmichael, who is a veteran newspaper man, has been editor of the *Daily Times*, Davenport, Iowa, for the past eighteen years and for the last eight months has been the advertising manager of that publication. This newly organized bureau will co-operate with the Iowa Sections of the American Electric Railway Association, the American Gas Association and the National Electric Light Association. It will collect consolidated authoritative data on the industry and will disseminate it impartially.

JOE CARMICHAEL

R. O. Launey, recently appointed auditor of the Brooklyn (N. Y.) Edison Company, is one of the most widely known accountants in the electric light and power industry. Mr. Launey has been a public utility accountant for the past eighteen years. His first position, beginning in 1904, was with the Birmingham Railway, Light and Power Company. In 1913 he was appointed auditor of that company after having held nearly every position in the accounting department. On April 1, 1917, in addition to the post just named, he was made auditor of the Southern properties of the United Gas & Electric Engineering Corporation, which included the Consumers' Electric Company of New Orleans and the Houston (Tex.) Gas & Fuel Company. He also had under his supervision the auditing for the American Cities Company's properties, comprising six of the largest electric light and power companies in the South. After the termination of the United Gas & Electric Engineering Corporation's supervision, on account of the American Cities Company, the Birmingham Railway, Light & Power Company and other Southern properties going into a receiver's hands, Mr. Launey was continued as auditor of the Birmingham Railway, Light & Power Company until April 1, 1921, when, as stated above, he was appointed auditor of the Brooklyn Edison Company.

R. O. LAUNEY

E. W. Markle, who had been connected with the educational and recreation work of the United States Army as principal and senior instructor of the electrical department, vocational schools, Camp Funston, Kan., has been appointed assistant professor of electrical engineering at the Agricultural and Mechanical College of Texas. Prior to his connection with the educational branch of the army, Mr. Markle was employed as instructor at the Kansas State Agricultural College. He is a graduate of Pennsylvania State College. His practical experience was gained with the Westinghouse Electrical & Manufacturing Company, East Pittsburgh, Pa.

W. C. Minier resigned as Pittsburgh district sales manager of the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., on Jan. 1. His successor is N. P. Farrar, formerly Baltimore district manager of the company.

H. B. MARSHALL

H. B. Marshall, for thirteen years manager of the St. Louis branch of the Electric Storage Battery Company, has been placed in charge of all railway sales work of the company. Mr. Marshall, who will have his headquarters at the main plant in Philadelphia, has been connected with the company for the past sixteen years. He was graduated from the Armour School of Technology in 1905 and shortly afterward entered the employ of the Electric Storage Battery Company, taking a clerical position in the Chicago branch. He was appointed manager of the St. Louis branch in 1909. Mr. Marshall has devoted a great deal of attention to the question of use of batteries by all classes of railways and is well known in that field.

Edward Worcester, vice-president in charge of sales, National Tube Company, Pittsburgh, resigned on Jan. 1. Mr. Worcester has been identified with the tubular-steel trade for more than thirty years and is well known in the industry. His first business connection was with the Chapman Valve Company, Boston, in 1870. In 1875 he became head salesman in the Chicago agency of the National Tube Works Company and later was connected with the sales force of the Walworth Manufacturing Company. During the period from 1882 to 1888 he was assistant secretary and secretary of the Crane Brothers Manufacturing Company, Chicago. At that time he became connected with the National Tube Works Company again and remained with the company, absorbed later by the United States Steel Corporation and renamed the National Tube Company, until the present time. Since 1903 he has been vice-president of the company in charge of sales. His place will be taken by John H. Nicholson, who has been vice-president in charge of operations of the seamless-tube plants of the National Tube Company.

Thomas Lavier, Jr., formerly vice-president and chief engineer, has been made president of the Ray Battery Company, Ypsilanti, Mich.

T. W. Frech has been appointed general manager of the National Lamp Works of the General Electric Company. Mr. Frech's association with the National company began in 1901, when he left a position with the Western Electrical Instrument Company to become an assistant of F. S. Terry. There followed a year of production experience in the glass and lamp factories of the company. Later, during several periods, he was superintendent of the California Incandescent Lamp Company, of the St. Louis factory, of the Cleveland factories on Forty-fifth Street and of the first tungsten-lamp factory. In 1906, when the tantalum lamp was developed in Europe, Mr. Frech went abroad with W. H. Roberts, and a year later, at the time of the development of the tungsten lamp, he went again, with J. E. Randall, to learn the process of making these lamps for the National interests. In 1910, when the process of drawing ductile tungsten was discovered, Mr. Frech was appointed to commercialize it for the National. Mr. Frech continued in the development work of drawn tungsten wire until 1913, when he became associated with the Peerless Motor Car Company, with which company he remained as vice-president and general manager until a few months ago.

J. R. KEARNEY

James R. Kearney, formerly sales manager of the electrical division of W. N. Matthews & Brother, Inc., St. Louis, has been made vice-president in charge of sales of the electrical division, the appointment taking effect on Jan. 7. Mr. Kearney has been associated with W. N. Matthews & Brother, Inc., for seventeen years. Before becoming associated with them he was superintendent of construction of the Topeka (Kan.) Edison Company.

Obituary

James Fairweather, Philadelphia representative of the American Jobbers' Supply Company, died of heart disease on Jan. 11.

Herbert S. Shaw, treasurer and general manager of the Webster & Southbridge (Mass.) Gas & Electric Company, died recently. Mr. Shaw had been manager of this company for many years and was known as a man of vigorous personality, sound technical knowledge and progressive commercial attainments. He was a firm believer in the intensive development of territory served by local central-station companies and achieved noteworthy success by his independence of method. Mr. Shaw was one of the earlier managers to appreciate the value of cultivating summer residential business, and developments along this line under his direction attracted wide attention.

William O. Fouch, president of the Western Electric Works, Portland, Ore., died recently. Mr. Fouch was affectionately known among the fraternity as the father of the electrical contracting business in Oregon, and many of the successful men in all branches of the industry today commenced their electrical career under him. Mr. Fouch first came to Portland about 1888 from Illinois and immediately started in the electrical business during the days when electric gas lighting, doorbell wiring and repairing represented almost its entire field. About 1891 he entered into a partnership with O. B. Stubbs. This partnership continued under the firm name of the Western Electric Works until about 1910, when the partnership was dissolved and Mr. Fouch established a manufacturing business under the name of the old firm. This business he conducted with his son, E. M. Fouch, until the time of his death. Mr. Fouch was instrumental in organizing the first state association of electrical contractors in Oregon, serving as president of the organization on two different occasions for a period of years. He continued to be one of the most active members up to the time of his fatal illness. He was also president of the Manufacturers and Merchants' Association of Oregon. At the time of his death he had served the organization in this capacity for about three years. The passing of Mr. Fouch is sincerely mourned by a host of friends in the electrical business, all of whom have known him as a true friend, an honorable competitor and a man who stood four-square on every question.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

General Conditions Show Tinge of Improvement

THE basic industries of the country started the new year quietly but with enough business in sight to warrant the hope that the December average of improvement would hold good for the next few months. The building industry is the most fortunate, for, according to the F. W. Dodge Company, contemplated new work reported in 1921 amounted to $1,176,000,000, while only $647,000,000 worth of construction was actually started. This leaves a deficit of more than $500,000,000 worth of construction to go forward in 1922, in addition to which there will be an equally large proportion of work not yet reported. During the first two weeks of January the railroads placed many important equipment orders with the steel industry. Orders for 28,000 freight cars alone were placed, while the steel companies entered the year with orders for 500,000 tons of rails on their books and as much more in prospect. The oil, construction and automobile industries also have bought largely from the steel companies during these first two weeks. Copper mining has been partly resumed with the prospect of most of the larger mines being opened by April 1. Increases in employment have been reported by a large number of trades, including the machinery, electrical goods, wood products, paper-making and cutlery industries. There was a large decrease in employment in the food-products industry, but on the whole the industrial undertone shows much improvement over that existing in the fall and as this improvement has been very gradual it is felt that it is permanent.

New Rigid Conduit Card Issued

MANUFACTURERS of rigid conduit have issued Card No. 49, which became effective Jan. 11 and superseded Card No. 48, issued on Sept. 16, 1921. Discounts have been increased eight points on conduit, ¼-in. to ½-in. galvanized conduit now being 47 per cent off list as against 39 per cent off under Card No. 48, and black pipe being 53 per cent off as against 45 per cent off formerly. It has been pointed out by one manufacturer, however, that, though discounts have increased, the price of conduit has actually increased from one-half of 1 per cent to 1 per cent, depending on size, through the discontinuance of several special discounts of 5 per cent each, which were not included on Card No. 48 but which have been in effect for some time. Another manufacturer stated that prices now were about 5 per cent lower than those put into effect Dec. 15, 1921. It is the general opinion, however, that the new card has been issued more as a step toward readjustment and stabilization of prices through the doing away with special discounts than as a move toward further liquidation. The steel industry, it is felt, has liquidated itself rather thoroughly, and with the issuance of the new card the rigid conduit market has been placed in a position to take advantage of the slightest upturn. The present discounts are the same as those in effect on Nov. 5, 1916.

Demand for rigid conduit has been somewhat quiet in the New York territory, but reports from New England, the Middle West and the Pacific Coast indicate good sales. Building there is going ahead rapidly, aided by the mildness of the season, and jobbers are carrying complete stocks, though not all of them have large stocks. Jobbers in New York and Chicago are carrying better stocks since the warehousing charge in those cities was raised. Some of the cards just issued give the warehousing charge as six points, but it is understood that for the time being the charge will remain four points, as announced recently.

Collections Improve in East, but Change Little Elsewhere

COLLECTION and credit conditions are reported to have shown some improvement in New England and the East generally in the last thirty days. The opinion is expressed that this part of the country, the first to feel financial pressure, is also going to be the first to recover. New York jobbing houses have noted a gradual shortening of collections. Large accounts which have been outstanding for some time are being liquidated wholly or in part, new accounts still are being scrutinized carefully and current billings are on a thirty-day to sixty-day basis.

Reports from a number of leading jobbers in New England show a decidedly encouraging outlook there for collections at this time. Notwithstanding the pressure of income taxation levies during December, collections were unexpectedly good, and even the holiday buying in fields outside the electrical did not absorb enough funds to cause much inconvenience. In some cases the outstanding accounts receivable at the close of the year 1921 showed a better condition of affairs than a year ago. This is all the more encouraging in view of the fact that many retailers and wiring contractors made little if any money in 1921. Underlying improvement in financial conditions, the introduction of better business methods by contractor-dealers and an improved business outlook warrant the expectation that the new year will see better credit conditions than the one just ended. Following a recent collection period of seventy-five to eighty days, sixty days is now being taken for payments to the jobber in representative cases.

CHICAGO JOBBERS FIND CONDITIONS FAIR

The credit situation in the Middle West has not changed materially, and present conditions among Chicago jobbers are fairly good. Collections are on an average of sixty days. Buyers either take advantage of the cash discount within the specified time limit or they wait the entire time allowed, thereby increasing the financial burden of the jobber. Conditions affecting the small out-of-town electrical dealer have not improved. Since he often depends upon the quick shipment of stocks from the jobbers' shelves to fill an order, he is hampered considerably when his purchaser cannot meet the bill within the set time of thirty or sixty days. Therefore, unless the electrical dealer has sufficient capital to tide himself over on a large shipment of goods, he is placed in a had financial position. Many large jobbers in Chicago expect that this winter will weed out many of these small dealers.

Credit conditions in St. Louis are declared to be about the same. One jobber reports poorer collections for the last few weeks, due chiefly to conditions in Oklahoma, where the small demand and low price for oil have had an adverse effect on general business conditions.

Liquidation of loans throughout the states covered by the Sixth Federal Reserve District has not progressed as well as was expected. The lagging in the price of cotton and its unstable condition has caused a great number of producers and others who have the staple on hand to withdraw from the market until the price recovers. This has had a tendency to reflect on all lines of industry, especially that of the electrical field. As an indication that the low level has been reached as regards liquidation, statistics show that the number of commercial failures in this section was larger in the months of November and December than in any other months in 1921 and considerably larger than the same period of 1920. It is of interest to note that the volume of trade acceptances shows considerable decrease over the same period last year, and this is not due so much to a lack of popularity as to the fact that creditors during 1921 pressed their open accounts with greater vigor on a cash and thirty-day payment basis. Taking the situation as a whole, collections show a slight improvement over the same period of last year with less restriction to credit.

PACIFIC COAST COLLECTIONS SLOW UP

Collections on the Pacific Coast have again slowed up, averaging from fifty-five to sixty days. Credit men are not only taking constructive steps to decrease this time to somewhere near last year's figure of forty-five to fifty days, but are also definitely asserting that offending firms which will not take similar constructive steps to improve their own collections and to act upon proffered suggestions along such lines will be dealt with summarily. The building strike of last summer induced many workers to go into business on their own account, particularly in the Oakland district, but as such men possessed limited capital and business experience they are gradually eliminating themselves.

Germany Outshining United States in Spanish Market

DURING the first six months of 1921, according to figures just made public by the United States Department of Commerce, Germany shipped more electrical goods into Spain than did any other country, including the United States. This condition is just the reverse of that in the same period of 1920, when German electrical manufacturers were at the foot of the list. At that time Germany was just entering the Spanish market and large increases were to be expected, but at the present time the market for dynamos, motors, transformers, etc., seems to be dominated by the German manufacturer. No such large increase can be expected in the future, but, on the other hand, there is no reason to think that imports from Germany will drop while the Central European republi keeps down its labor cost by means of the depreciated mark.

Great Britain appears to command the Spanish market for electrical cables, although Germany and Belgium registered substantial gains, especially in conductors of the larger dimensions. Germany nearly quadrupled her sales of telephone and telegraph apparatus during the period in question, although Sweden is an important factor in this class. Imports from France and Sweden also show large gains. Sales of American electrical equipment about held their own—a very creditable showing in view of the large stocks of American goods already in Spain and the general uncertainty existing among importers who for some time have been stocked with American material purchased at high prices.

The accompanying table shows the imports of electrical goods into Spain from principal countries for the first six months of 1921, with the total values and corresponding figures for the same period in 1920.

IMPORTS OF ELECTRICAL GOODS INTO SPAIN

Classes of Goods and Countries of Origin	January to June, 1920 Quantity, Kilos	January to June, 1920 Value, Pesetas (a)	January to June, 1921 Quantity, Kilos	January to June, 1921 Value, Pesetas
Dynamos, electromotors, induction coils, resistance boxes, transformers and regulators:				
United States	244,484		455,669	
Germany	60,286		1,494,285	
Great Britain	200,984		367,215	
Switzerland	28,229		63,975	
France	48,597		220,447	
Sweden	9,657		86,657	
Other countries	188,916		514,975	
Total	829,673	3,149,379	3,203,213	12,380,118
Electrical Cables:				
United States	75,848		14,092	
Great Britain	95,427		93,709	
France	7,857		27,751	
Germany	221		69,059	
Belgium	...		18,862	
Other countries	14,950		25,258	
Total	194,303	652,891	248,731	841,929

(a) Par value of the peseta is $0.193; exchange values for the first six months of 1921 averaged about $0.13.

Platinum Rises 35 per Cent in Few Weeks

THE value of platinum has recovered considerably in the last several months, according to refiners of that metal. From the low mark of $65 per ounce of regular platinum, which occurred late last summer, the price has risen to $105 per ounce. Several weeks ago the metal was quoted at $78 per ounce, the present price being about 35 per cent higher than that. Quotations increased as much as $12 in one day during this period. Refiners attributed the advance in prices to a small supply and an increasing demand.

There have been few shipments from Russia, one of the largest platinum-producing countries, in the last few years on account of its unsettled economic and political condition, and dealers have had to depend on Colombia for the greater part of the supply. The metal is chiefly valuable to the electrical industry for use in instruments.

Metal Market Situation

THE most important event that has taken place in the copper market in some time occurred on Jan. 16 with the resumption of operation of the mines of the Anaconda Copper Mining Company at Butte, Mont. The mines have been closed since last spring, and production on a large scale cannot be expected for several months. A production of 5,000,000 tons a month within thirty days is looked on as a reasonable start. With this producer active again discussion is concerned with the outlook in other districts. Calumet and Hecla, the largest producers in the lake region, will, according to report, reopen their mines about April 1. Now that a start has been made it is probable that practically all but the highest-cost mines will be opened within the next three months. The statistical position of copper could hardly be more propitious for the producer. The available surplus of the metal is now estimated as less than 450,000,000 lb., a figure which in the opinion of some leaders of the industry would presage a copper famine under normal conditions.

Present demand remains quiet both abroad and here. France and Germany have bought small amounts recently, but few other sales are heard of. Only one domestic order of any consequence has been noted recently, a large brass company having been in the market for second-quarter delivery. Prices of electrolytic copper for domestic consumption is 13¾ cents per pound delivered for first quarter and 13⅞ to 14 cents for second quarter shipment.

NEW YORK METAL MARKET PRICES

	Jan. 10, 1922	Jan. 17, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	66 2 6	65 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.75-13.87½	13.75-13.87½
Electrolytic	13.62½	13.62½
Casting	13.00	13.00
Wire, base	15.00–15.25	15.00–15.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.45	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.50	8.50
Zinc, spot	5.12½–5.17½	5.07½
Tin, straits	32.37½	32.12½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.25–11.50	11.25–11.50
Brass, heavy	5.25–5.37½	5.25–5.37½
Brass, light	4.87½–5.00	4.50–4.87½
Lead, heavy	4.00–4.12½	4.00–4.12½
Zinc, old scrap	2.50–2.75	2.50–2.62½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

More or less uncertainty prevails as to how long it is going to take the electrical industry to get back into its pre-holiday stride. By this time annual inventories are almost all completed and replenishing of stocks should commence, but contrary to expectation hand-to-mouth buying still persists. Either stocks are not so low as was thought or retailers and jobbers have not regained full confidence.

Trade in New England is spotty with few changes of consequence. Lamp sales there are good with most other lines moving slowly. The event of the week in Chicago has been the support of the Landis building wage award by the rank and file of several of the unions affected. Business is still quiet and jobbers there are reported to have low stocks of metal molding. The word comes from Atlanta that the sale of electrical supplies salvaged from the United States Army cantonments in the South is hurting jobbers' business there. St. Louis jobbers report quiet business but a steady influx of inquiries for pole-line materials and motors. In the Northwest sales for the first two weeks of January are said to be ahead of those for the same period last year. There has been a slight readjustment of discounts on miniature lamps.

NEW YORK

Business in the electrical trade has been somewhat spasmodic during the past week. Immediately after the first of the year quite a lot of after-inventory buying appeared which accounted for the rather unusual activity in this section. The jobbers feel well satisfied with present conditions, and the general sentiment is that business will show a very gradual but steady increase for the next two and a half months, when it will open up in earnest. Just at present price competition on some items is rather keen. There is, however, a fair demand for the general line of wiring supplies.

Prices remain about as last quoted. Announcement of a new discount card on rigid conduit was made by the manufacturers late last week. This, however, has had little if any effect on jobbers' quotations as the new prices are virtually the same as those arrived at by discounts on the previous card. Quotations on flexible armored conductor are a little easier this week as there appears to be a plentiful supply on the market.

Household appliances continue to move better than would naturally be expected after the holidays. Jobbers report that there has been an active demand for heaters of the reflector type. Stocks carried over from last year have been completely exhausted, and this, together with the lower prices which went into effect recently, have materially stimulated sales. Vacuum cleaners, in the popular-priced sizes, are moving steadily, and this appliance appears to be relatively as staple as the electric flatiron.

Conduit. — Jobbers' stocks are good and there is a moderate demand for the smaller sizes. Although the manufacturers issued a new discount card, No. 49, effective on Jan. 11, quotations remain virtually unchanged as additional discounts on Card 48 brought the net price down to the present figures. Quotations this week ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $45 to $47; ¾-in., $58 to $59, and 1-in., $83 to $85 per 1,000-ft. Galvanized pipe in the same sizes and quantity was quoted at $50 to $51, $65 to $66 and $92 to $94 per 1,000 ft.

Rubber-Covered Wire.—Little change in conditions in the wire market was noted. Demand is moderate. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks are good to large, and it is rumored that in some quarters orders for larger quantities than quoted here have been taken at a slightly lower figure.

Flexible Armored Conductor.—While the demand for this material continues very active, prices are somewhat easier and price cutting is in evidence. Quotations on No. 14, two-wire, single-strip, are from $43 to $45 per 1,000 ft. in that quantity. Double-strip is quoted from $45 to $47 per 1,000 ft. Jobbers' stocks are fair to good, and manufacturers are now well able to meet the demand.

Lamp Cord. — Jobbers' stocks are good to large, and demand is only fair. Prices remain as last quoted. No. 18, cotton, twisted, sells for $12.90 per 1,000 ft., and the parallel at $15.60 per 1,000 ft. in that quantity.

Heaters.—Sales of air heaters continue to be fairly active. Jobbers who carried over stocks of these appliances from last year report that they have all been disposed of and additional orders placed. The lower prices have apparently made sales much easier.

CHICAGO

The dullness of the electrical trade due to the inventory season has continued another week, but a few jobbers report that business is better out in the suburbs than in Chicago itself. The opinion has been offered that some of this holding back in city business may be due to the unsettled building situation. During the week a group of unions, among them that of the electricians, refused to support the decision to strike and upheld the Landis wage award. This change of front among the rank and file of the unions has an important bearing on the proper settling of this controversy.

The total number of residential building permits in Chicago for 1921 was 10,870, an increase of 8,369 over 1920. Permits for new industrial plants reflected the slowing up of business since only 1,294 were issued in 1921, as compared with 1,426 during 1920. The total cost of all building permits had a value of $123,450,210 for 1921 as against $79,102,650 for 1920. Some of the big permits for 1921 were for the new Federal Reserve Bank building, the Illinois Merchants' building and the State Bank of Chicago.

Wire.—Several jobbers report a good out-of-town buying of wiring materials but only a fair movement to Chicago buyers. No. 14 rubber-covered wire has remained firm at $6.75 to $6.85 per 1,000 ft. in 5,000-ft. lots. Call for bare and weatherproof wire has not changed materially since last week and jobbers state that their stocks are ample. Bare wire still sells for 16¾ cents and weatherproof is quoted at 16¾ cents per pound in 1,000-lb. lots.

Flexible Armored Conductor.—Movement has been slow during the week, although a few jobbers report fair sales. No. 14, two-wire, double-strip, sells for $47 per 1,000 ft. in 5,000-ft. lots.

Conduit.—Movement on conduit has been spotty, although in a few cases some good orders have been obtained. Prices vary from $46 to $47 per 1,000 ft. in 5,000-ft. lots. Stocks are fair but not excessive.

High-Tension Equipment.—An order of fifty cut-outs for a central-station company in Massachusetts was delivered during the week by one manufacturer. Another company has received inquiries from central-station companies contemplating installation of new equipment.

Wiring Material. — Buying of this material has not changed much, although in a few cases it is found that the jobbers have placed some good orders. Considering the field as a whole, very few buying flurries have been discovered, dealers buying only in small lots. Key sockets list at $19.80 per 100 in standard-package lots of 500, while keyless sockets in the same quantity are quoted at $18 per 100. Pull sockets sell for $34 per 100 in lots of 250.

Metal Molding.—Stocks of most jobbers are low, since very little call for this material has been noted. The three-wire size sells for $56 per 1,000 ft. in lots of that quantity.

BOSTON

Trade has been spotty during the past fortnight, with considerable delay in ordering for stock in retail circles resulting from inventory activities. Jobbers' stocks have been so well reduced in many lines that a very little increase in demand would almost at once be felt by manufacturers. The demand for wiring supplies is unusually dull this week, but in some places appliances are moving well and there is also an increased interest in motors. Lamp sales continue one of the brightest spots in trade. General business in New England has hardly got started for 1922, but the textile mills are pushing vigorously ahead on orders, and in the machine-tool field business is apparently held back chiefly by price uncertainties. Electrical prices have changed little this month thus far. Central-station business is decidedly better, and building operations reflected in New England contracts show marked improvement over this time last year. Contracts last week were the best in twenty years with one exception. For December the F. W. Dodge Company reports New England building and engineering contracts to have been 44 per cent better than a year ago. A marked increase in building is expected this year in the Northeast.

Lamps.—Exceptionally good business has been experienced for the past three months, and the trade is starting well this year. Discounts on miniature lamps have recently been modified. The garage man who buys 100 lamps now receives a discount of 33⅓ per cent off list instead of 40 per cent, and this gives the jobber a better opportunity to move his lamp stocks. Sign lighting is progressing well, and plenty of lamps of all standard sizes and types are to be had.

Motors.—Revived interest in motor propositions has appeared since Jan. 1, and several fair sales have been made. While pick-up business still dominates a somewhat unsteady market, the outlook is improved. Sharp competition is apparent in the second-hand market.

Wire.—Sluggish trade is the story of the New England insulated-wire market this week. Some cable production is under way in New England plants, but orders on jobbers are light. No. 14 rubber-covered wire sold Monday at $6.75 per 1,000 ft. in 5,000-ft. lots, and weatherproof base was steady at 16½ cents. Contractor-dealers are buying little wire during their inventory periods.

Washers.—A spurt of real activity has been taking place within the past fortnight among some of the more energetic central-station companies. No very active transfer of machines from dealers' stocks to the public is evident in the territory as a whole, but here and there vigorous commercial work is yielding its reward.

Flexible Armored Conductor.—This material has also been hit by the inventorial siesta which many contractor-dealers are indulging in. No. 14 single-strip is featureless at $47 per 1,000 ft., in 1,000-ft. lots.

Knobs and Tubes.—Light sales are taking place, with ample stocks to meet current requirements. "Nail-it" knobs are selling at $18.50 per 1,000 in barrel lots and 3-in. x $\frac{5}{16}$-in. tubes at $6.20 per 1,000 in the same quantity.

Socket Appliances.—Vacuum cleaners are moving somewhat faster in retail circles. Table appliances are selling better than might have been anticipated after the December drives. Constant sales efforts are making their impression on the public in retail fields.

Rigid Conduit.—Prospects for moving this material are a bit better with the improving building outlook.

ATLANTA

Judging from the decreased volume of business reported by jobbing firms, a great many dealers did not reduce stocks before inventory sufficiently to warrant immediate restocking, or else their purchases are on the hand-to-mouth basis and the volume of orders being received continues below normal. The size of individual orders is also reported to be decreased, thereby indicating hand-to-mouth purchases rather than restocking. The salvaging of electrical material in a number of government camps in the Southeast is having a depressing effect on the volume of sales, as this salvaged material is being placed on the market at prices far below market quotations. This situation will undoubtedly make itself felt for several months to come as the majority of the large government camps were in this section. While no spirit of pessimism is in evidence, nevertheless the opinion is generally expressed that no sharp resumption of sales can be expected until early spring. Engineering firms, however, hand in optimistic reports regarding inquiries looking toward developments and expansions to industrial plants.

Steel Telephone Wire.—A price reduction of 5 per cent is reported, effective this week, this reduction also applying to guy strand. The demand has slumped somewhat, while stocks are reported in excellent shape.

Farm-Lighting Equipment.—This line continues to show very satisfactory gains, both in sales and inquiries, due undoubtedly to sales campaigns being conducted throughout the district. Stocks in popular sizes are in fair to good condition and no price changes are anticipated.

Panelboards.—This line continues quite active, jobbers reporting satisfactory orders in a wide variety of sizes during the past two weeks. Shipments are satisfactory, varying from stock to six weeks. Prices are steady.

Cross-Arms.—Little activity among heavy purchasers is reported, but orders for small lots are reported quite satisfactory. A price advance of 10 per cent is effective this week. Stocks are in first-class condition.

Safety Switches.—Sales are very good, the 100-amp. and 200-amp. three-pole types being particularly popular. The 30-amp. entrance switch, of course, continues in steady demand. Stocks are somewhat spotty because of being reduced for inventory, but will be up to standard within the next ten days.

Oil Switches.—A fair movement of the standard types up to 2,300 volts and 200 amp. is to be noted, both the full automatic and the semi-automatic types being in demand. Local stocks are reported in fair condition.

Telephone Equipment.—An encouraging volume of inquiries is reported with sales averaging fair to good, most of the purchases calling for the less expensive equipment. Stocks are reported as quite heavy.

Conduit.—Little variation is to be noted, but the past few weeks have seen an increase in the proportion of purchases for the larger sizes of 2-in. to 4-in. No recent change in price is reported.

Wiring Material.—A rather lessened movement is in evidence, purchases being confined to small quantities for immediate requirements. There is no material change in prices and stocks are reported quite satisfactory.

ST. LOUIS

The rejection by the carpenters of a reduction in wages from $1.25 to $1 per hour was a disappointment to those interested in furthering construction work in St. Louis. Although the carpenters are the only ones who have voted, their organization is about the largest of those in construction work, and it is anticipated that the other unions will be influenced in their votes by the carpenters' action. If the final result of all the elections in the Building Trades Council is against this reduction, efforts for compromise will probably be made, but many feel that spring will find the situation as it now stands. In the meantime construction work amounting to more than $20,000,000 is waiting only for lower costs.

The electrical jobbing business for the week was extremely quiet, almost every line being affected. However, if inquiries are any indication, improved business should soon be observed. Strong interest is being shown in pole-line materials, to some extent by the power companies but more particularly by the telephone companies. Numerous inquiries on motors are also received.

Wire.—Bare and weatherproof increased in price last week, while rubber-covered showed a tendency toward easier prices. The St. Louis base on both bare and weatherproof is 17 cents per pound. No. 14 rubber-covered, in

5,000-ft. lots, is quoted at $6.50 to $6.75 per 1,000 ft. Stocks have not changed much in volume for several months. Demand for the week was quiet, but quotations were being made on a large block of weatherproof.

Wire Mold.—The demand, except for the last two weeks, has continued to hold up well, and stocks, though low for a while, are now on a normal basis. The three-wire size is selling for $5.70 per 100 ft. and for $5.25 per 100 ft. in lots of 1,000 ft.

Lock Nuts and Bushings.—An advance of about 10 per cent is reported. The following prices are now quoted, each item being per 100 in lots over 100: ½-in. lock nuts, 60 cents; ½-in. bushings, $1.50; ¾-in. lock nuts, 85 cents, ¾-in. bushings, $2. Sales have been reasonably steady and stocks are in good shape.

Dry Cells.—Railroads are buying the regular cells in good quantities, and dealers are ordering ignition cells steadily, particularly those in sets. The regular is priced at 31 cents and the igniter at 32 cents, both in barrel lots. Stocks are in first-class condition.

Motors.—Sales remain sluggish, but inquiries received would indicate some resumption of demand in the next few months. The recent price reductions have stimulated interest. Stocks have a tendency toward heaviness.

Condulets.—The demand holds up well and is expected to show gradual improvement. Contractor stocks are very low, and jobber stocks are complete but not at all heavy. The prevailing discounts in standard packages, for one order and one delivery, are: Less than $15, 15 per cent; $15 to $100, 20 per cent; $100 and over, 28 per cent.

SEATTLE—PORTLAND—SPOKANE

From all indications 1922 will probably be a very active year in construction throughout the Northwest. In Seattle contracts have already been let or permits issued for large business and office buildings which will cost about $2,000,000, and it is expected that this year will be the most active in building construction in the last decade. Several apartment houses and hotels are under construction or have been announced in Portland, and from Spokane comes report that buildings to cost about half a million dollars have been announced. It is reported also that several million dollars will be spent on highway construction around Spokane.

With a good domestic and export business in sight the lumber industry of the Northwest is preparing itself for a very good year. Production for the week ended Jan. 7 was 26 per cent below normal, while new business was 27 per cent below production and shipments were 10 per cent below production. It is understood that the railroads are setting aside funds for reconstruction during the coming year which will involve large purchases of lumber. Millions of bushels of grain are awaiting shipment from Portland as soon as the market can be opened up. The electrical business has been rather quiet since the passing of the holidays. In the retail trade the usual January sales are taking place. They are perhaps a little more conspicuous than usual and perhaps somewhat more prolonged as well. As a stimulus to buying they apparently are less successful today than a year ago. In common with other lines the electrical jobbers' business has likewise been somewhat slow, but this is natural for January. Business this January is somewhat better than it was a year ago. Country trade in various sections is reported reasonably active. There has been a slight lowering of prices in heating devices in some lines. Six-pound irons were reduced from $6.95 to $6.75. The reduction in headlight heaters amounted to about 10 per cent.

Rubber-Covered Wire.—Demand during the week was slow. Prices remain firm. Quotations are: No. 14, $7.40; No. 12, $9.80 per 1,000 ft. in 5,000-ft. lots.

Ranges.—Electric ranges are somewhat quieter than during December, but inquiries are active and it is expected that the demand will be active again within a short time. Prices installed range from $185 up, averaging about $210. Prevailing prices of ranges and wiring put them out of reach of many at the present time.

SAN FRANCISCO

San Francisco building has not increased so tremendously as has that of Los Angeles. The gigantic construction plan promoted by the Chamber of Commerce and backed by all the leading business institutions is still virtually in the survey stage and has not yet begun to be more than dimly felt. It is a fact, however, that many of the long-standing gaps which were left in the downtown district after the fire of 1906 are now being steadily filled with large buildings.

Fans.—New contracts are now being mailed and road salesmen are actively soliciting the business. Last season was excellent for nearly all firms and carry-overs are low. The new prices average about 15 per cent decrease from those of last year with the burden of decrease borne by the larger desk sizes.

Washers.—Washer business has been rather slow, the bulk of the house-to-house solicitation being confined to vacuum cleaners because of their lower first cost. Prices, after some rather remarkable fluctuations, now appear steady, averaging from $130 to $140 for the family-size, swinging-wringer type.

Lamps.—Lamp conditions are normal, considerable attention being paid to the problem of reducing overhead handling charges. Probationary agents, for instance, have proved to be unsatisfactory in many cases because of their really limited outlet, and hereafter they must prove themselves capable of handling lamps to a value considerably larger than the value of their probationary contract. Further efforts will be made to reduce outstanding stock in the hands of agents. Agents' business is to be made more profitable by educating them to use the excellent advertising furnished them. Generally speaking, it may be said that the endeavor is not to find new outlets so much as to improve old ones.

SALT LAKE CITY—DENVER

A summary of the past week in trade would show consumer demand generally at a low mark. Stock-clearance sales following inventory taking are the outstanding feature of merchandising. The public responds only indifferently to cut-price appeals. Meanwhile the stores are stocking well at prevailing prices preparatory to the spring trade. The electrical merchant is to some extent an exception. He will probably go on pursuing the policy of hand-to-mouth buying because of lack of capital to stock adequately. If trade should show a material improvement, he would find it necessary to buy about as much electrical merchandise as he sold.

Manufacturers of switchboard and other electrical materials that figure in construction report business exceedingly dull. In some plants they have found it necessary to operate on a four-day-week basis. There are many tentative building programs outlined, involving the ultimate expenditure of millions of dollars. The more important jobs will not be launched until there has been complete adjustment of disputes between employers and workers. Pole-line construction is practically at a standstill, and consequently there is scarcely any movement in pole-line hardware and wire, though prices are believed to have reached bottom. The growing use of electrical pump systems in irrigation is creating a demand for reduced power rates. The arrangements of a satisfactory schedule will probably rest with public utility commissions.

The National Wool Growers' Association has just closed an important annual convention at Salt Lake City. The big issue before the conference was the proposal to eliminate the present commission house as a link in the chain of marketing, the contention being that the growers could market co-operatively to much better advantage. The association went on record as favoring the change, though the wool industry is in a bad way. A rapid recovery is hoped for as a result of federal loan aid and the timely interest of Intermountain banks. There is a noticeable improvement in collections in nearly all lines of business. There is at the same time a lessened demand for money and few requests for renewals.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Western Electric Sales 90 per Cent of 1920

Sales of the Western Electric Company for 1921 were approximately $185,000,000, a greater amount than in any previous year excepting 1920, when they totaled $206,000,000, according to a statement by Charles G. Dubois, president. The statement, discussing the outlook for 1922, estimated that the volume of business will be substantially the same as in 1921.

Addition for Lincoln Company Plant

The Lincoln Manufacturing Company, 2630 Erskine Street, Detroit, manufacturer of lighting-fixture parts, is erecting a three-story addition, 30 ft. x 115 ft., adjacent to its present plant. When completed the addition will more than double the present output of the company and is to cost approximately $100,000. It is expected to have the new plant in operation by March 1. The company now manufactures popular-priced electric lighting fixtures, and it is intended to add to this a line of portable table lamps. Robert S. Aspinwall is president, Nathan Silberstein treasurer, Joseph Kahen vice-president.

For the last six months, according to Mr. Aspinwall, the plant has been working to full capacity with both a day shift and a night shift. There were enough orders on hand on January 1, he stated, to operate at capacity for two months.

Phillips Announces Further Plans for Brockville Works

Further plans have been announced for the erection of the Brockville (Ontario) plant of the Eugene F. Phillips Electrical Works, for which the first contract was let recently as noted in the Electrical World. A copper-rod rolling mill will be erected. At the present time there is no mill of this sort in operation in Canada. Contracts have been let for this building. Bids for the electrical equipment, which will include a substation for stepping current down from 44,000 volts to 2,200 volts and for a pumping station and equipment at an estimated cost of $300,000, are in, and it is expected that this work will go forward shortly.

The company, whose main plant and headquarters are at Montreal, has acquired a site of 132 acres at Brockville and has announced its intention of building a cable-manufacturing plant as soon as the rolling mill is finished. When business conditions warrant, according to Lawford Grant, managing director, the entire manufacturing end of the company will be moved to the Brockville site. The total plant and equipment when complete at Brockville, Mr. Grant stated, will cost in the neighborhood of $3,000,000.

Worcester Wire Mills Busier

A gain in production is in evidence at the three Worcester (Mass.) plants of the American Steel & Wire Company according to a statement emanating from officials there. These plants are now operating on a basis of 55 to 60 per cent of normal and employing 5,000 persons, as compared with an average of 40 per cent for 1921. Most of the departments are running on a ten-hour day basis and are also working Saturday mornings. The cable department at the South Works is reported to be running on day and night shifts.

Carmean to Have Pacific Coast Distribution

The Carmean Electric Company, Kansas City, Mo., has appointed Pacific Coast distributers to handle its motor-driven electric heaters. The California Electric Heating Company will have establishments in San Francisco and Los Angeles and, effective Feb. 1, will have charge of the distribution of Carmean products in California, Arizona, Nevada and Utah. The Goodman Electric Company, Tacoma, Wash., will distribute the company's products in Washington and Oregon.

W. H. Vance, vice-president of the Carmean company, will go through the Pacific Coast territory, starting Feb. 1, to investigate factory facilities there. The Pacific Coast and foreign business of the company, it is stated, is increasing rapidly, and the establishment of a branch factory in the West to supply this demand for the Carmean motor-driven electric heaters, is being considered.

Supply Jobber Opens Long Island City Branch

The Starobin Electrical Supply Company, Twelfth Street at Fourth Avenue, New York City, has just opened a branch at 173 Hunter Avenue, Long Island City, N. Y. Besides stocking a general line of electrical supplies at this new address, Mr. Starobin has put in a stock of commercial and residential lighting fixtures on both properties. William Haag is in charge in Long Island City.

Westinghouse Starts Work on Japanese Order

Work has been started at the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Company on what is declared by the company to be the largest single transformer order ever placed. The order was received through Takata & Company, the Japanese agents of the Westinghouse company, from the Daido Electric Power Company. The contract calls for thirty-four transformers, averaging 9,400 kva. each, a total of 316,400 kva. They will be single-phase, 60-cycle, oil-insulated and water-cooled and will have a total high voltage of 154,000. Each will weigh approximately 50 tons installed. The equipment will be installed in a superpower system in the industrial district about Tokio. Eleven months will be needed to complete the order, the company states, at an estimated cost of $2,000,000.

Anaconda to Increase Capacity of Great Falls Wire Mill

The Anaconda Copper Mining Company has announced plans for increasing the capacity of its large wire mill at Great Falls, Mont. The action is the result of the merger of the American Brass Company with the Anaconda company, and the Great Falls plant will operate virtually as an American Brass auxiliary. Thus the Western trade of the American Brass Company will be supplied with fabricated copper products from the Great Falls plant while the remainder of the business in these commodities will be taken care of by the Eastern plant.

The plan probably will go into effect in the near future as the merger of the two companies is in process of completion, more than 51 per cent of the total outstanding stock of the Brass company having been deposited in accordance with the Anaconda company's offer to purchase these shares.

Lighting Fixture Convention and Market Plans Announced

Plans for the joint conventions of the National Council of Lighting Fixture Manufacturers and the Lighting Fixture Dealers' Society of America and for the "lighting fixture market," to be held in Milwaukee, Jan. 30 to Feb. 4, have been announced by the various organizations. Both the conventions and the fixture market will be held at the Milwaukee auditorium, registration starting on Monday, Jan. 30. The third annual meeting of the National Council of Lighting Fixture Manufacturers will have its first business session on Tuesday morning, at which the following topics among others will be discussed: "The Industry Seeing Iself," "What We Need Most," "Things We Should Throw Overboard" and "As Others See Us." At other business sessions will be discussed fixture design, design registration and means of making the industry more profitable. The report of the standardization committee of the association is to be given on Friday morning, Feb. 3.

The convention of the Lighting Fixture Dealers' Society will be addressed by a number of speakers prominent in the industry, among them being M. H. Aylesworth, executive manager of the N. E. L. A.; P. S. Zimmerman, manager of the publicity department of the National Electric Lamp Association, and W. L. Goodwin, assistant to the president of the Society for Electrical Development. The questions of national advertising, costs and proper methods of cost accounting and co-operative publicity are some of the more important to be on the program for discussion.

The fixture market will be open from 2 p.m. until 6 p.m. each day to those connected with the industry and from 7 p.m. to 10 p.m. each day to the general public. A large attendance is expected at the conventions and market, reservations for display space being practically complete. Dealers from all parts of the country and even as far away as Hawaii have announced their intention to be represented at the dealer convention.

Westinghouse International Sees Foreign Outlook Improving

The outlook for foreign business is encouraging, according to the Westinghouse International Company, which bases its optimism on inquiries running about 25 per cent greater than during the last quarter of 1921. Bookings of that company for 1921 exceeded those of 1920, when orders totaled approximately $14,000,000. As was the case with business during the past year, inquiries now seem mainly to cover railway electrification material.

Kruse Electric Company Sells Manufacturing End

The Mid West Metal Products Company, Muncie, Ind., has taken over the manufacturing end of the Kruse Electric Company, Fort Wayne, Ind. The rights obtained by the Mid West company permit the manufacture of a patented switch-box supporting strip and lath holder. The plant of the Kruse company has been moved to Fort Wayne, and its successor has started production and distribution of the device. A. E. Wilson is sales manager of the Mid West company.

Engineering Company Formed

A partnership under the firm name of Hudson & Myron has been formed to practice consulting engineering with offices at 808 Wabash Building, Pittsburgh, Pa. The partners are John P. Myron and Leo P. Hudson, who for the last fifteen years has been in private practice, working mainly on power plants, waterworks, valuations and rates. Mr. Myron was connected for seventeen years with the Pittsburgh Filter & Engineering Company as secretary and engineer.

Sound Optimistic Note at Schimmel Sales Dinner

The electrical industry will perhaps overtop all others in its development during the year, according to speakers at the annual dinner given Jan. 6 to the sales organization of the Schimmel Electric Supply Company, Philadelphia. The speakers included William G. McKitterick, general sales manager National Lamp Works of the General Electric Company; William L. Goodwin, assistant to the president of the Society for Electrical Development; Harry Kirkland, vice-president American Wiremold Company; C. C. Skiles, sales manager Shelby Lamp Division, and Samuel Schimmel, president Schimmel Electric Supply Company. The dinner took place at the Hotel Adelphia.

ANNUAL GATHERING OF SCHIMMEL COMPANY SALES ORGANIZATION

The speakers pointed out that while the Eastern part of the United States has been rather slow along lines of electrical development, it is gradually catching up with the West. In the last six months of 1921 the electrical industry in the East made wonderful progress. This, it was predicted, will continue through 1922.

"Because of faith in the future," Mr. Schimmel said, "the Schimmel company has carried out a program of expansion. Because of faith in the future there are many new men with the company. This is an optimism of preparedness. We are gradually realizing the importance of readjustment, and as we realize it we are getting on a sounder basis. While we have not yet touched bottom, and in some instances may not for a while, we are getting more and more away from the inflated basis. This is true of every line and it is also true of the electrical line. I believe better days are coming. I do not believe, however, that a wave of insane buying is heading this way. I hope we are through with war and with its brand of prosperity."

Speaking of the work of the salesman in the coming year, Mr. Schimmel said the salesman of tomorrow would have to do more than merely take orders. He must render real service, know his customers, know their needs, their limits, their possibilities, and cater to all these. And, above all, Mr. Schimmel continued, he must be a persistent plugger.

The Coffin Valve Company, Boston, has appointed Theo. F. Dredge as Western representative, with offices in the Monadnock Building, San Francisco.

The Quigley Furnace Specialties Company, New York, has appointed the Federal Supply Company, Cleveland, as its sales representative.

The Bleadon-Dun Company, 213 South Peoria Street, Chicago, manufacturer of Violetta "Violet Ray" instruments, has moved its New York office to larger quarters at 47 West Thirty-Fourth Street. This office carries a large stock of all types of "Violet Ray" machines and is managed by M. H. Sarben, H. Burger and T. J. Voneschen.

The Cutler-Hammer Manufacturing Company has moved its New England sales office to larger quarters at 52 Chauncey Street, Boston. C. W. Yerger is manager.

The Mechanical & Electrical Manufacturing Company, Bethel, Me., has been organized to manufacture electrical products. The company is capitalized at $100,000. Theodore Morin is president.

The Radio Manufacturing Company has removed its general offices and sales department to 170 Fifth Avenue, New York.

The Hall Kitchen King Company, manufacturer of electrical kitchen equipment for hotels, has moved its offices and works to larger quarters at 1130-1134 Race Street, Philadelphia.

The Kent Company, Inc., Rome, N. Y., has opened a New York office at 147 West Fifty-seventh Street. The office will be in charge of F. T. Kent. The company manufactures and sells the "Utility" electric floor machine, the Kent stationary cleaner and the "Vacuna" portable cleaner.

Foreign Trade Notes

THE ELECTRIC LIGHT & POWER SUPPLY CORPORATION, LTD., Sydney, New South Wales, Australia, is issuing 143,900 new shares of capital stock of £1 each, the *Industrial Australian and Mining Standard* states, the proceeds to be used to provide funds for extensions to its distribution system, new substations, equipment, etc.

ELECTRIFICATION OF RAILROADS IN JAPAN. — The commission recently appointed by the Japanese government to consider electrification of the railroads in the country, according to reports in Japanese newspapers, has recommended as a first step electrification of over 2,000 miles of road. This is to include 186 miles of sections in suburbs where traffic is especially dense; 871 miles of sections having steep grades, where water power can be utilized; 146 miles where additional power is required to transport traffic that steam power has difficulty in moving, and 1,270 miles on other sections where electrical power can be used to better advantage than steam.

LOAN TO BERNE RAILWAY COMPANIES FOR ELECTRIFICATION.—Through a government loan plan, aid will be given for the electrification of the Berne railway lines, which are owned by private companies, according to a dispatch from the American Legation at Berne, Switzerland. The Department of Railroads, with the approval of the Federal Council, will submit to the Federal Chambers a request for a loan of 11,000,000 francs to be used for this electrification, which is in line with similar developments now being undertaken by the Swiss railroads.

CONCESSION FOR A TRAMWAY GRANTED IN INDIA.—The Dehra Dun-Mussoorie Electric Tramway Company, according to press reports, has been registered in India with the object of building a tramway between Dehra Dun and Mussoorie, for which a concession has been granted by the United Provinces government. The preliminary estimate of the cost of the work is 3,662,000 rupees. Further information can be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to Miscellaneous Exhibit No. 229.

DEMAND FOR MOTORS IN CHINA.—Owing to extensive developments of industrial manufacturing projects in China, the *Commerce Reports* states, the demand for electric motors is expected to increase. The exports of motors to China during the last six months show that the market there for this class of apparatus has been steadier during the present world depression than that of perhaps any other foreign country. The following figures show the value of the United States exports of motors to China during the six months from May to October, 1921: May, $95,881; June, $59,410; July, $26,432; August, $77,791; September, $36,458; October, $47,646.

EXTENSION TO ELECTRIC SYSTEM AT SALFORD, ENGLAND.—Plans for a new electric generating station at Agecroft to supply electricity in Salford, according to *Electrical Industries*, have been approved by the Salford Town Council and the Electricity Commissioners. The cost of the proposed plant, including the installation of three electric generating sets and transmission cables to the Frederick Road station is estimated at £847,000.

ELECTRIFICATION OF CHILEAN RAILWAY.—Work in connection with the proposed electrification of the 233 track miles of the state lines between Santiago and Valparaiso and Llay Llay and Los Andes, Chile, according to *Electrical Industries*, will begin within the next sixty days. Overhead wires of the simple catenary type, supported on bracket arms, will be used. Electricity will be supplied by five substations beween Saniago and Valparaiso, with a total capacity of about 60,000 hp. Energy will be furnished at 3,000 volts, direct current, to operate the locomotives, of which there will be fifty-nine, ranging from 39 tons to 112 tons each.

BIDS FOR ELECTRIFICATION OF BRAZILIAN RAILWAY.—Bids will be received until March 30, according to *Commerce Reports*, for the electrification of the Central of Brazil Railway. The proposed work will include the erection of three or four substations, the first between Mangueira and Sao Francisco, the second near Deodoro, and the third or fourth between Deodoro and Belem; thirty locomotives will be required, ten for freight and twenty for passengers; for the suburbs sixty-six electric cars and 100 second-class box cars will be purchased; for the SS and SD trains there will be thirty-two electric cars and forty-eight box cars.

PROPOSED ELECTRIC POWER PROJECT IN INDIA.—A scheme to utilize the water power of two rivers in the neighborhood of Shillough for generating electricity for lighting and power purposes is under way, according to *Electrical Industries*. Influential parties are interested and the government is said to be considering the appointment of a board of industries.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A request has been received from a firm in Italy (No. 572) for general agencies from manufacturing companies for the sale of electrical supplies and machinery, electrical novelties, telephones and telephone supplies engineering supplies, etc.

A mercantile firm in Switzerland (No. 607) desires to purchase sanitary installations, such as baths, washstands and toilets; laundry and hot-water installations for electricity and gas, and small ice machines for household use.

New Apparatus and Publications

TRANSFORMERS.—Bulletin No. 59 issued by the Sangamo Electric Company, Springfield, Ill., describes and illustrates the "Brooks" two-stage current transformers.

REFRACTORY LININGS.—"Hytempite in the Power Plant" is the title of a booklet published by the Quigley Furnace Specialties Company, Inc. 26 Cortlandt Street, New York City, dealing with refractory linings and the use of "Hytempite" in power plant work, as well as in connection with "Corbosand" for baffles, patching, boiler settings, etc. The booklet also gives some information on the uses of "Insulbrix."

OUTDOOR SUBSTATIONS.—The Delta-Star Electric Company, 2433-59 Fulton Street, Chicago, has issued bulletin No. 37, which contains sixty-four pages devoted to outdoor substations of all voltages up to and including 66,000 volts.

COMMERCIAL REGISTER. — The S. E. Hendricks Company, Inc., 2 West Thirteenth Street, New York City, has issued the 1922 edition of the Hendricks' "Commercial Register of the United States for Buyers and Sellers."

MOTOR.—A new-type ball-bearing "Norfolk" electric motor has been developed by Fred W. Walter, 215-217 Cumberland Street, Norfolk, Va., manufacturer of electrical machinery.

PORTABLE LAMP.—A new "Esrobert" boudoir lamp (No. 563) has recently been placed on the market by S. Robert Schwartz & Brother, 729-731 Broadway, New York City.

CIRCUIT BREAKERS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh Pa., has placed on the market the type "F-11" line of oil circuit breakers. These are of moderate capacity, manually operated, non-automatic and automatic, with one, two and three trip coils.

TAKE-UP REELS.—The Hayward Company, 50 Church Street, New York City, is distributing pamphlet 620, covering the "Hayward" automatic cable take-up reel and a coupler which is designed for use with either a magnet or an electric bucket.

FUEL ECONOMY.—The Uehling Instrument Company 71 Broadway, New York City, combustion engineer, is distributing bulletin No. 220, entitled "Magnitude of the Power Plant's Chimney Loss," and bulletin No 221, entitled "Relation Between CO_2 and Money Wasted Up the Chimney," in which it explains the loss in the combustion of fuel for industrial purposes and gives tables and curves showing same.

SHAFT COUPLINGS. — An improved type of the "Bartlett" flexible shaft coupling is being placed on the market by C. H. Breaker, general sales agent, 4226 Broadway, Indianapolis, Ind.

STEAM CONDENSING PLANTS.—The Ingersoll-Rand Company, 11 Broadway, New York City, is distributing a booklet entitled "Steam Condensing Plants," covering surface condensing plants and describing a new type of condenser developed by the company.

REFLECTOR SOCKET.—Descriptive leaflet 3443 issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, describes the "Cutter" luminous-top holder-socket reflector.

COMMUTATOR RESURFACERS.—The Ideal Commutator Dresser Company, 3229-31 Sheffield Avenue, Chicago, is distributing a two-page leaflet describing the "Ideal" commutator resurfacers.

CONDUIT AND CONDUIT BODIES.—The Sprague Electric Works of the General Electric Company, 527-531 West Thirty-fourth Street, New York City, are distributing two leaflets, one describing the "Greenfield Duct" conduit and the other the "Spraguelets" conduit bodies for exposed wiring.

OUTLETS.—The Merrill Company, Ipswich, Mass., manufacturer of electrical specialties, is distributing a leaflet describing and illustrating the "Merrico" outlets.

SEARCHLIGHT.—The "Excellight" searchlight used in tanks and motor transports during the recent war is now manufactured by the National Marine Lamp Company, Forestville, Conn.

BOXES.—The Electric Motor & Engineering Company, Canton, Ohio, manufacturer of power equipment specialties, switchboards, etc., is distributing price sheets pertaining to its third catalog, covering steel boxes for all electrical purposes.

FUSES. — The Bowie Switch Company, Nevada Bank Building, San Francisco, is distributing bulletin No. 14, describing the Bowie expulsion-tube fuses.

ROCK DRILL MOUNTING.—The General Electric Company, Rock Drill Department, Fort Wayne, Ind., is distributing a four-page circular describing its boom mounting for the Fort Wayne electric rock drill for installation on mine cars.

WIRE ROPE.—"Outspinning the Spider" is the title of a book issued by the John A. Roebling Sons Company, Trenton, N. J., giving a history of wire-rope making in this country from the beginning of the industry here in 1840. It also contains a description of the Brooklyn Bridge and of the wire-rope barrage laid down in the English Channel during the World War and of other engineering achievements.

LIGHTING FIXTURES. — The Herwig Art Shade & Lamp Company, 2140 North Halsted Street Chicago, has placed on the market an outdoor lighting fixture made entirely of cast metal for a 10-in. or a 12-in. globe.

TOASTER.—The Century Manufacturing Company, Inc., Elizabethtown, Pa., is marketing an electric toaster which will toast two pieces of bread on both sides at the same time.

SAFETY SWITCH.—The S. R. Fralick & Company, 15 South Clinton Street, Chicago, is manufacturing a new medium-priced safety switch rated at 30 amp., 125 volts.

New Incorporations

THE FORT ELECTRIC COMPANY OF HANCOCK COUNTY, Greenfield Ind., has been incorporated with a capital stock of $125,000 to furnish electricity for lighting purposes. The directors of the company are George W. Coffman, Edward S. Fort and Robert D Glazer.

THE AKRON (OHIO) ELECTRICAL MANUFACTURING COMPANY has been incorporated with a capital stock of $10,000 by Harry A. Miller and Harry Slosower.

THE TROJAN ELECTRIC COMPANY, Troy, N. Y., has been incorporated with a capital stock of $10,000 by Leland M. Surdan, Hoosick Falls, N. Y.; George D. Zinck, Irvington, N. J., and Joseph W. Flynn, Newark, N. J.

THE LORRAINE (N. Y.) ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 by O. W. Tucker, O. L. Smelmidine and C. A. Caulkins.

THE FRASER ELECTRIC LIGHT COMPANY, Boone, Ia., has been incorporated with a capital stock of $10,000. The officers are: C. H. Henle, president, and F. A. Cascotti, secretary and treasurer.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 20, 1921)

1,400,959. Process and Apparatus for Carrying out Chemical Reactions by Catalysis; Joseph Koetschet, Lyons, France. App. filed April 26, 1919.

1,400,988. Printing Telegraph; Foster Ritchie, Earling, England. App. filed Aug. 6, 1918. For two-wire telegraph or telephone line.

1,401,016. Commutator and the Like; Rene A. L. Volet, Paris, France. App. filed Oct. 6, 1920. Wires attached in eyelet formed by bending riser of bar.

1,401,021. Switching Box; Paul F. Williams, Chicago, Ill. App. filed Feb. 1, 1918. For underground cables.

1,401,035. Gas Generator; Martin Boisen, Sandusky, Ohio. App. filed March 19, 1921. Generates oxygen and hydrogen and passes gases through separate outlets.

1,401,049. Regulating Device for Dynamo-Electric Machines; Oliver F. Conklin, Detroit, Mich. App. filed July 10, 1917. Regulates current output of electric machines.

1,401,087. Silent Electric Signal for Banks; George W. Lancaster, Richmond, Va. App. filed Nov. 23, 1916. Silent signal from bookkeeper to teller.

1,401,112. Dynamo-Electric Machine; Alvin E. Buchenberg, Toledo, Ohio. App. filed June 25, 1917. Distortion of field flux reduced to a minimum.

(Issued Dec. 27, 1921)

1,401,121. Mounting for Vacuum Tubes; Roy M. Allen, East Orange, N. J. App. filed May 24, 1918. Sponge-rubber base.

1,401,186. Electric Resistance Unit; Herman F. Frenzlow, Johnson Creek, Wis. App. filed April 12, 1920. Terminals of the heat unit close together.

1,401,217. Switchboard Plug; Alfred H. Weiss, Wilmette, Ill. App. filed May 17, 1918. Split ring to hold protective sleeve.

1,401,276. Pull Switch; Arvid H. Nero, New Britain, Conn. App. filed Feb. 12, 1919. Quick break.

1,401,387. System of Motor Control; Charles H. Allen, Chicago, Ill. App. filed April 1, 1918. For reversing washing-machine cylinders.

1,401,447. Electric Side-Wall Heater; Oliver P. Scott, Tacoma, Wash. App. filed May 5, 1921. Installed between studding of wall.

1,401,448. Method of Joining Plates or the Like; Thomas J. Shea, Portland, Ore. App. filed Feb. 5, 1921. By electric welding.

1,401,451. Car-Lighting System; Leonard A. Watson, Sound Beach, Conn. App. filed Nov. 27, 1920. Regulates voltage of axle-driven generator.

1,401,472. Electric Heater; John E. C. Holmes, Ottawa, Ontario, Can. App. filed Sept. 22, 1920. Combined with water receptacle to diffuse humidity.

1,401,477. Resistance Unit; Leonard Kebler, Bronxville, N. Y. App. filed Feb. 15, 1919. Terminals permit handling without breaking enamel.

1,401,492. Regulating Device for Dynamo-Electric Machines; James B. Replogle, Detroit, Mich. App. filed Aug. 18, 1917. Machine driven at variable speeds.

1,401,493. Induction Coil; James B. Replogle, Detroit, Mich. App. filed June 13, 1919. Two magnetic circuits, each provided with an air gap.

1,401,495. Trolley Wheel; Samuel S. Rigby, New Castle, Pa. App. filed Oct. 24, 1921. Guard against dislodgment.

1,401,500. Electric Heater; Oliver P. Scott, Tacoma, Wash. App. filed Oct. 17, 1919. For air or water.

1,401,510. Electric Glow Lamp; Heinrich Baumhauer, Charlottenburg, Germany. App. filed Nov. 13, 1917. Lamp filled with argon.

1,401,531. Cable and Telephone-Wire Containing Rail; Frank Gaspar, Cupar, Saskatchewan, Can. App. filed Sept. 1, 1921. Third-rail telephone for trains.

1,401,544. Telephone Exchange System; George A. E. Lundell, Chicago, Ill. App. filed Nov. 1, 1919. Order circuit for operators.

1,401,548. Electric Motor; Thomas J. Murphy, Rochester, N. Y. App. filed Sept. 17, 1917. Aligning of armature and field elements.

1,401,564. Tetrahedronal Magnetic Unit; James B. Speed, New York, N. Y. App. filed Sept. 3, 1918. Loading unit for six related telephone circuits.

1,401,573. Battery Post and Method of Making a Seal; Harry L. Wood, Lakewood, Ohio. App. filed March 21, 1921. For storage batteries.

1,401,586. Electrical Searching Coil; Archie R. Comstock, Mount Kisco, N. Y. App. filed Jan. 24, 1920. To locate trouble in wire communication systems.

1,401,592. Device for Electrically Heating Hand Irons; David Donaldson, Leith, Scotland. App. filed Sept. 16, 1920.

1,401,596. Lightning Arrester; Edward A. Everett, Long Island City, N. Y. App. filed Sept. 15, 1920. For telegraph lines.

1,401,627. Testing Device; Jesse E. Mateer and Chester T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. For the insulating properties of oils.

1,401,638. Motor-Control System; Fred M. Parks, Murrysville, Pa. App. filed Feb. 13, 1920. To control the speed and direction of operation of motors.

1,401,644. Method of and Apparatus for Amplification of Small Currents; Chester W. Rice, Schenectady, N. Y. App. filed July 31, 1917. Radio tube amplifies in cascade.

1,401,645. Control Apparatus; Lynn G. Riley, Wilkinsburg, Pa. App. filed June 15, 1917. For motor-reversing switches of the power-operated drum type.

1,401,650. Trolley Hanger; William Schaake, Pittsburgh, Pa. App. filed May 7, 1917. For two wires.

1,401.654. Measuring System; Francis H. Shepard, New Rochelle, N. Y. App. filed July 10, 1918. Frequency meter indicating small changes in frequency.

1,401,657. Electric Heating Unit; Frank Thornton, Jr., Mansfield, Ohio. App. filed Dec. 2, 1918.

1,401,671. Emergency Source of Voltage; Lewis W. Chubb, Edgewood Park, Pa. App. filed Dec. 14, 1918. Galvanopile associated with deliquescent substances maintained in a dry state by vacuum.

1,401,673. Induction Heater; Ora A. Colby, Irwin, Pa. App. filed Feb. 25, 1919. Heat generated in liquid-carrying passage.

1,401,674. Electric Glass-Annealing Furnace; Ora A. Colby, Irwin, Pa. App. filed April 7, 1920. Plurality of spaced chambers, with resistor for each.

1,401,676. Storage Battery; Henry Csanyi, New York, N. Y. App. filed May 12, 1919. Primary cell with electrolyte between depolarizing material and case.

1,401,678. Apparatus for Nitrogen Fixation; F. Darlington, New York, N. Y. App. filed Nov. 23, 1917. Furnace for carrying out catalytic action.

1,401,679. Brush Holder; Dudley F. Dillin, North Canton, Ohio. App. filed Feb. 11, 1920. With detachable pigtail.

1,401,682. Electrical Distributing System; Giuseppe Faccioli, Pittsfield, Mass. App. filed Nov. 26, 1920. To control load on circuits.

1,401,685. Protective Device; Paul R. Fortin, Schenectady, N. Y. App. filed Oct. 21, 1919. Relay to open unbalanced circuits.

1,401,686. Electric Heating Device for Plunging; Fritz Frei, Berne, Switzerland. App. filed Oct. 16, 1920. Used directly in food dish.

1,401,688. Electric Waffle Iron; Frank F. Forshee, Flint, Mich. App. filed Jan. 30, 1920. Means for carrying and turning.

1,401,697. Commutating-Pole Construction; Philip E. Henninger, Edgewood Park, Pa. App. filed July 25, 1918. To secure large surface.

1,401,708. Commutator Cylinder; Willard H. Kempton, Wilkinsburg, Pa. App. filed May 28, 1919. Held together by molded rings of non-conducting material.

1,401,753. Telephone Receiver; G. Boissonnault, Hewlett, N. Y. App. filed Jan. 29, 1921. Loud speaking for wireless.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

BENTON, ME.—Plans are under consideration by the United Paperboard Company, Benton, for the construction of a 2,500-hp. hydro-electric plant below the dam of the Benton Falls mill of the company. H. R. Kimball is superintendent of the Benton Falls mill.

SOUTH PORTLAND, ME.—The Cumberland County Power & Light Company, Portland, has plans under way for the construction of an auxiliary power station on the site of the old dry docks in South Portland, on Casco Bay.

WINDHAM, ME.—The Windham Manufacturing Company is having plans prepared for the construction of a one-story power plant, to cost about $40,000. A. P. Safford, 66 Broadway, Lowell Mass., is engineer.

CAMBRIDGE, MASS. — Work will be started shortly by the Cambridge Electric Light Company on the construction of a switch house, 90 ft. x 140 ft., near the Blackstone Street generating station of the company. All regulators and switching equipment for this installation have been purchased, the total cost of the project being $450,000, with an outlay to date of approximately $175,000. Welles E. Holmes, treasurer and general manager of the company, informed the Electrical World that the new installation will be designed to handle 40,000 kw. at 6,600/2,200 volts, and the bus structure will be designed for an ultimate service of about 75,000 kw. in case the company should decide in the future to interconnect its system with others in the eastern Massachusetts network. All switching equipment will be removed from the generating plant to the new structure and about $280,000 will be expended in construction and cable work.

CAMBRIDGE, MASS. — A petition has been submitted to the City Council by citizens of Cambridge requesting the removal of all poles and placing of wires underground.

LOWELL, MASS.—A movement has been started for extensions to the ornamental lighting system. Edward W. Trull is clerk of the district court.

STRATFORD, CONN.—Plans are under way by Hollander Brothers, manufacturer of metal products, 360 George Street, Bridgeport, for the construction of a new three-story factory, 50 ft. x 100 ft., at Stratford. A one-story power house, 25 ft. x 35 ft., will also be built. Davis & Dane, Bridgeport, are architects.

THOMPSONVILLE, CONN. — The committee from the Board of Trade in charge of investigations for an ornamental lighting system in the business district has decided to investigate the cost of including in the lighting plan Franklin, Pearl and Main Streets from Furey's Corner in Enfield Street to the depot, and also North Main Street from the waiting station to Alden's Corner in Enfield Street. Mark W. Bushnell is chairman.

Middle Atlantic States

BUFFALO, N. Y.—The National Biscuit Company, Tenth Avenue and Fifteenth Street, New York City, contemplates the construction of a power plant in connection with its new plant at 217 Ellicott Street, Buffalo, for which foundation work has been started. The entire project, including machine shop and automobile service building, will cost about $1,000,000.

ENDICOTT, N. Y.—Arrangements are being made by the Binghamton Light, Heat & Power Company for the extension of its electric distribution lines into a new territory west of the village of Endicott and adjoining and south of the village of West Endicott.

SYRACUSE, N. Y.—The board of directors of the Crouse-Irving Hospital, 720 South Crouse Avenue, is considering the construction of a new power house.

WAPPINGERS FALLS, N. Y. — The directors of the Wappingers Electric Corporation have authorized the installation of a new set of waterwheels during the coming summer. The waterwheel now in use is in a closed casing and is operated under a pressure head varying from 55 ft. to 61 ft. and a draft of from 17 ft. to 20 ft. The company is also making considerable extensions to its pole line. Orville M. Whitehouse is president.

MAYS LANDING, N. J.—The construction of an electric and gas plant in Mays Landing, to be financed by Philadelphia capitalists headed by William Rosenbach, is reported to be under consideration. W. M. Leslie is president of the Chamber of Commerce.

DANVILLE, PA.—Plans are under way by the board of directors of the Danville (Pa.) State Hospital for the construction of a one-story power house, 50 ft. x 250 ft. F. Arthur Rianhard, Masonic Temple Building, Williamsport, is architect. William F. Shay, Watsontown, is president of the board.

POTTSVILLE, PA. — The Phillips-Jones Corporation has had plans prepared for the construction of a one-story power house, 50 ft. x 50 ft., at its plant.

SPRING GROVE, PA.—The P. H. Glatfelter Company is planning the installation of electric generating machinery, motors, paper-mill machinery and other equipment in connection with additions to its paper mill.

WILLIAMSPORT, PA.—Plans are under consideration by H. A. Moore, 114 Elm Street, Milton, for the construction of a two-story warehouse, supply shop and power house at Franklin and Fourth Streets in Williamsport. The cost is estimated at $50,000.

CHARLESTON, W. VA.—Plans are under consideration by the Stone Cliff Collieries Company, recently organized with a capital stock of $25,000, for the installation of electrical and other machinery at its properties. C. A. Brockman is president and manager.

FAIRFAX, VA.—The Fairfax & Loudon Light & Power Company, Fairfax, recently organized with a capital stock of $100,000, is planning extensions to its system, including the erection of a 23-mile transmission line connecting Fairfax, Vienna and Herndon. Other extensions are contemplated later on. Electricity will be purchased from the Alexandria County Lighting Company, Alexandria. The cost of the extensions is estimated at $60,000. Thomas R. Keith is president of the new company.

WASHINGTON, D. C.—Plans have been completed by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a motor-generator set and switchboard at submarine base. Applications accompanied by a deposit of $10 may now be filed for plans and specifications (4570), and necessary data for bidding will be forwarded in the near future. All communications should be addressed to the chief of the Bureau of Yards and Docks.

WASHINGTON, D. C. — Separate bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 26 for the installation of an ice-manufacturing and refrigerating plant in the United States Treasury Building at Washington, D. C. James A. Wetmore is acting supervising architect.

North Central States

HUDSONVILLE, MICH.—Business men of Hudsonville are reported to be negotiating with the Consumers' Power Company, Grand Rapids, for extension of the company's line to Hudsonville. The nearest connection is 5 miles away.

OTSEGO, MICH.—The MacSimBar Paper Company has awarded contract to H. L. Vanderhorst, Kalamazoo, for the construction of a new power plant, to cost, including equipment, about $350,000.

CLEVELAND, OHIO.—The City Council has passed an ordinance providing for an expenditure of $100,000 for the erection of police stations and the purchase of cable and other apparatus and instruments for extensions to the police signal system.

GENOA, OHIO.—The United States Gypsum Company has construction under way on six additional lime kilns at its local plant and plans to install equipment for electrical operation. Electricity will be furnished by the Northwestern Ohio Railway & Power Company, Toledo.

LAKESIDE, OHIO.—The Kelley Island Lime & Transport Company has work under way on the construction of a new crusher plant at Lakeside, to have a capacity of 1,000 tons per hour. The Northwestern Ohio Railway & Power Company, Toledo, will furnish 1,500 hp. for electrical operation of the new plant.

PORT CLINTON, OHIO. — The White City Beach Company has been granted a franchise by the Ottawa County Commissioners to erect a transmission line for the purpose of supplying electricity for light and power on Catawba Island.

BLOOMINGTON, IND. — The Showers Brothers Company is contemplating the construction of a one-story power plant in connection with the proposed addition to its present plant. The H. K. Ferguson Company, Vickers Building, Cleveland, Ohio, is architect. Charles A. Sears is superintendent.

COUDERAY, WIS.—Contract has been awarded to the Meyers Construction Company of Oshkosh for the construction of a large dam across the Chippewa River, 12 miles northeast of Couderay. The project is backed by the Minnesota-Wisconsin Light & Power Company, Eau Claire. The cost of the construction of the dam and the flowage will be shared equally by all the power concerns along the Chippewa River that will be benefited by the reservoir the dam will make. It will be known as the Pa Kwa Wang reservoir and will cover about 24,000 acres.

MADISON, WIS.—Improvements to be made by the Madison Gas & Electric Company during 1922, including additions to its plants, extensions to its lines and mains, are estimated to cost approximately $365,000. John St. John is vice-president and general manager.

MILWAUKEE, WIS.—An election will be held in the spring for the purpose of submitting to the voters the proposal to issue $200,000 in bonds for extensions to the street-lighting system. G. Staal is city engineer.

PLYMOUTH, WIS.—Most of the machinery and equipment including power-plant machinery, in the building of the Badger Cabinet Company was recently destroyed by fire, causing a loss of about $60,000. The company, it is understood, plans to build a fireproof factory early in the spring. George Brickbauer is president.

SHEBOYGAN, WIS.—The H. C. Prange Company, Eighth and Wisconsin Avenue, is planning the construction of a four-story power house and heating plant on Eighth Street to cost between $150,000 and $175,000.

KANSAS CITY, MO.—Plans are being prepared by S. S. Joy, architect, 2001 West Thirty-ninth Street, Chicago, Ill., for the construction of an eight-story cold-storage and ice plant, 150 ft. x 300 ft., in Kansas City, to cost about $1,000,000. The owner's name has been withheld.

ST. LOUIS, MO.—The Missouri Athletic Association is having plans prepared for the construction of a six-story service building, including power plant, at Fourth and Washington Streets, to cost about $150,000. G. F. A. Bruggeman, Liberty Central Bank, is architect. W. C. Boering, 407 Washington Avenue, is president.

HAMILTON, KAN. — The City Council contemplates the construction of a municipal waterworks and electric light system, for which bonds have been authorized. The project includes the erection of an 11-mile high-tension transmission line and a 4-mile low-tension line, outside substation, etc. F. E. Devlin, Eldorado, is engineer.

Southern States

BURLINGTON, N. C.—Eugene Holt is considering the installation of an electric light and power system.

RALEIGH, N. C.—Plans are being prepared by the board of directors of the State Hospital in Raleigh for the construction of a new one-story and two-story ice and refrigerating plant. H. A. Underwood, Raleigh, is engineer. Dr. Albert Anderson is superintendent.

COLUMBIA, TENN. — The Columbia Water & Light Company is considering improvements and extensions to its electric service.

ALTUS, OKLA. — At a special election held recently, bonds to the amount of $150,000 were authorized for the construction of a municipal electric light and power plant in Altus.

OKEENE, OKLA.—The City Council is considering extensions to the municipal electric light plant involving an expenditure of about $40,000. Equipment, including engine, generators, motors, pump, switchboard, wire and pipe, will be required.

WOODWARD, OKLA.—Black & Veatch, architects, Mutual Building, Kansas City, Mo., have been engaged to prepare plans for the construction of a municipal electric light and power plant, to cost about $100,000.

DENISON, TEX.—Plans are under consideration by the Missouri, Kansas & Texas Railway Company, St. Louis, Mo., for improvements and extensions at Denison, including new engine house, power plant, machine and repair shops, etc. The cost of the work is estimated at more than $2,000,000.

LIVINGSTON, TEX.—The local electric light and power plant is reported to have been damaged by fire.

Pacific and Mountain States

SPOKANE, WASH.—Arrangements have been made by the Washington Water Power Company for making a survey for a proposed extension to its electric transmission lines into the country between Ephrate and Stratford in Grant County. The present plans provide for 50 miles of high-tension lines and from 50 to 60 miles of feeder lines.

VANCOUVER, WASH.—The Lewis River Hydro-Electric Power Company, Vancouver, has applied to the City Council for a fifty-year franchise to furnish electricity for light and power, and eventually to supply water.

FRESNO, CAL.—Application has been made by the San Joaquin Light & Power Corporation to the Railroad Commission for permission to issue $5,000,000 in stock, the proceeds to be used for proposed hydro-electric development and extensions to its electric distribution and transmission lines.

MERCED, CAL.—Plans have been adopted by the City Trustees for the installation of an ornamental lighting system consisting of 455 electroliers, for which, it is understood, bids will soon be asked.

SAN DIEGO, CAL. — Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 2 for cold-storage and refrigerating equipment at San Diego, Cal. (Specification 4543.)

SAN FRANCISCO, CAL.—Specifications are being prepared for waterwheels, transformers and pressure pipes for the Hetch Hetchy power plant near Priest Portal and the Early intake, where it is expected to erect the power house in connection with the Hetch Hetchy water project. M. M. O'Shaughnessy is city engineer.

Canada

WEST VANCOUVER, B. C.—The Council is considering the construction of a 350-hp. hydro-electric plant at Cypress Creek, to cost about $90,000.

MONCTON, N. B.—Representatives of the Canadian National Railways Company, Toronto, Ont., and the Moncton (N. B.) Tramways, Electric & Gas Company decided at a meeting of the City Council held recently to enter into contract with the Hydro-Electric Commission of New Brunswick for a supply of electricity. The amount required at present is 5,000,000 kw.-hr. half of which will be used by the Moncton Tramways, Electric & Gas Company for city purposes, the other half to go to the Canadian National Railways Company.

CONESTOGO, ONT.—The City Council has plans under consideration for the installation of an electric lighting system in Conestogo, to cost about $25,000.

LONDON, ONT. — The Public Utilities Commission is considering placing underground the electric wires in the downtown business section. The cost is estimated at $100,000.

MERLIN, ONT.—A by-law providing for the establishment of an electric light and power system in Merlin has been authorized by the ratepayers.

NIAGARA FALLS, ONT.—The Michigan Central Railway Company, Detroit, Mich., is considering the electrification of its lines in Canada between Niagara Falls, Ont., and Windsor, Ont.

PALMERSTON, ONT. — The bylaw authorizing extensions to the electric plant in Palmerston has been passed by the ratepayers.

WALKERTON, ONT.—Plans are under consideration by the City Council for the installation of an electric distribution system in Walkerton, to cost about $40,000.

MOOSE JAW, SASK.—A bylaw providing for extensions to the municipal electric light plant, to cost about $77,000, has been authorized by the ratepayers. D. Craven is city clerk.

Miscellaneous

TAMPICO, MEXICO. — The Tampico Electric Light, Power & Traction Company has started work on double-tracking its lines on the principal streets and making important extensions into new territory. Among other improvements the company is reported to be considering the installation of new equipment.

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The Future of the Jobber

WHEN people ask the oft-heard question, "Is the electrical jobber coming or going?" it shows one thing. It shows that they have not thought down inside of it, that they do not understand what a real jobber is supposed to do. They fail to recognize the difference between an imitation jobber and the man who actually performs this economic function in our scheme of distribution.

The jobber—the real jobber of electrical supplies—does these six necessary things for the manufacturer:

1. He catalogs his product—sometimes 50,000 articles—in one book to make the purchaser's selection easy.
2. He carries these diverse products in large local stock and gives the manufacturer a nearness to the market that he could not maintain unaided.
3. He reduces the expense of selling through the activities of his own salesmen.
4. He assumes responsibility for quality, vouching for the distant manufacturer to many local customers.
5. He assumes a credit responsibility, carrying a great many small scattered accounts.
6. He buys in large-quantity and standard packages and assists the manufacturer to a uniform production and lower costs.

THE jobber—the real jobber—does these six necessary things for the central-station, the industrial plant, the contractor and dealer:

1. He functions as a purchasing agent by selecting and gathering from reliable sources the full variety of the materials they require.
2. He enables these purchasers to satisfy all their needs from one convenient point without the delay and detail of buying from many cities.
3. His large and varied stock relieves his customers of carrying many stocks in their own warehouses.
4. His catalog provides a practical directory invaluable to purchasing.
5. His salesmen travel the local territory intensively and bring the market to all doors.
6. He renders emergency credit and operating assistance and advice through his staff of specialists.

THIS is the true economic function of the jobber, and when he does these things he pays his way and is entitled to his profit. He makes it possible to distribute electrical materials more cheaply and to purchase them more easily and at no higher price. He deserves the recognition and support of every manufacturer and every man who buys in quantity. He will prosper and endure.

But the imitation jobber who does not render service with his warehouse and his catalog and assume responsibility for purchasing in bulk, for intensive selling and for carrying the credit burden—he is a parasite. He does not earn the jobber's profit. He will not endure.

The future of the electrical jobber is in two hands—the manufacturer's and his own. The jobber himself must carry his full load, do his job and render his full economic service. And the manufacturer must not destroy this needed service by paying jobber's profits to any one who does not function fully. For if he scatters jobber's profits to the men who merely gather orders for factory shipments, the jobber cannot live.

Samuel Ferguson

Utility executive, engineer and economist, whose knowledge of the industry and unusual vision of its future are nationally respected.

LEADERSHIP in industry today as never before demands a combination of qualities in which imagination and the ability to handle concrete problems are completely in phase. While this is essentially true of the electrical industry in every branch of the art, the power to coordinate possibilities with present actualities is peculiarly useful in the administration of public utilities. A number of unusual men who are devoting their lives to this service are scattered here and there about the country. Their insight into the ever-changing problems of the industry and their foresight as to trends are matched by their ability to realize the viewpoint of others and so to guide the properties under their management along soundly chosen paths in the fields of technical progress and commercial policy.

On Feb. 13 it will be ten years since Samuel Ferguson entered the Hartford (Conn.) Electric Light Company as vice-president, becoming closely associated with the late Austin C. Dunham, whose presidency during the formative years of that famous utility will always be a significant part of electrical history. Mr. Ferguson came to Hartford after a dozen years of service in the research laboratories of the General Electric Company at Schenectady, where he was closely associated with Dr. Steinmetz and other leaders in the engineering and manufacturing fields. He was born at Exeter, N. H., in 1874 and was educated at Trinity College, Hartford, and the Columbia School of Mines.

Mr. Ferguson's interest includes virtually the entire range of problems surrounding modern electric light and power company administration. Taking up the burden of greater responsibilities upon the passing of Mr. Dunham, the full play of his exceptional analytical powers and grasp of technical and commercial problems has been brought to bear, with those of his associates, upon the progress of the company, which still maintains its remarkable reputation for initiative plus practicality.

This diversified activity contributes to breadth of outlook, and Mr. Ferguson's absorbing interest in the economics of business is paralleled by his insight into public relations, sales activities and engineering. His accessibility to his employees and to the public, his capacity to listen, sum up and weigh divergent views in making decisions and his sense of fairness to customers are characteristic. Courage to advance along broad lines of development in the face of adverse conditions is his, with a participating and enthusiastic comprehension of what interconnection and co-ordination can do for utilities and the public. His judgment is sought in other than electrical undertakings.

Editorial Comment

Electrical World, January 28, 1922

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Harbingers of Electrical Prosperity

TWO annual reports issued this week indicate a most encouraging condition in the electric light and power field, and from them the rest of the industry should imbibe much that is comforting and reassuring. In both New York and Detroit the electric public utilities show magnificent gains in both income and output. The electrical properties of the Consolidated Gas Company—that is, the New York Edison Company and the United Electric Light & Power Company—sold 1,186,000,000 kw.-hr. last year, an increase of 17.25 per cent over the previous year, and net revenues also increased. As indicative of the large amounts of money required by the industry even in periods of depression, it is of interest to note that the capital expenditures of the Consolidated Gas Company for its electrical properties last year were $33,624,000, and it is estimated that almost as much will be required this year.

In Detroit, despite the great slump in the sale of automobiles, Detroit's chief industry, the Detroit Edison Company, managed to increase its net earnings 37.6 per cent over last year, a truly remarkable showing. Alex Dow reports that the operating ratio has fallen to 66.9 per cent from 77.6 per cent, although the operating ratio for 1916, which was considered to be a normal year before the war, was 54.5 per cent. The actual unit costs have also been reduced. Naturally any decrease in the cost of coal will redound to the credit of all coal-burning central stations, but in addition to that the Detroit Edison Company has also been more efficient, in that during 1921 it was able to reduce the amount of coal burned per unit of electricity produced. Inasmuch as both New York and Detroit are great industrial centers, this increase in output would indicate increased industrial activity, which central-station companies would be the first to experience.

When Information Given Means Money Gained

IN THE sale of machinery or other apparatus capable of being driven by an electric motor or a gasoline engine, the motor sale, and consequently a consumer of electricity, is now and then lost by apathy or delay in answering correspondence or oral requests concerning the availability and type of energy-consuming device to be supplied, the rules to be observed as to operating conditions and other information of a similar character. A large motor manufacturer writes: "It does seem as if the electric service companies are negligent in furnishing customers with the information they require in order to avail themselves of electric service. Of course, this reduces our sale of motors. We have a lot of dragged-out correspondence and unavoidable work every time we attempt to sell a motor, and we lose a good share of the orders owing to the difficulty of getting prompt information from the public service companies." From the character of the business done by the company in question, we judge that the condition complained of is not entirely local and therefore emphasize the necessity for promptness in such matters. There never should be a time when information is not freely, cheerfully and promptly given in the public utility field, and we know that any other tendency has only to be cited to be suppressed.

Penalizing Industry for the Sake of Government

WE SUPPOSE that as long as the world lasts and human nature remains as it is taxes of any kind will never be popular. There will always be those who pay taxes grudgingly, others who complain of discrimination in their application, and yet others who know of no reason why they should pay taxes at all. But until we reach that blessed Elysium where no mention of the tax is heard we must continue to pay taxes because we believe in government and government costs money. There are individuals, however, who recognize the burden that taxes place on industry, and many communities seeking new industries offer them freedom from taxes for a period of years. This the city fathers do, not because they expect to shoulder the burden, but because they know that new industries bring more people, more houses and more business and thereby spread the tax burden so that each individual's part of it becomes less. Government, in order to get its money cheaply, makes the income from its securities tax-exempt. It is very apparent now that if the practice continues we shall soon reach a point, if we have not already reached it, where the government not only imposes an unreasonable burden on industry through the issuance of its tax-exempt securities, but actually throttles it. Dr. E. R. A. Seligman, professor of political economy at Columbia University, estimates that there are outstanding a total of thirty billions of bonds entirely or partly tax-exempt, from which the government receives no revenue, and suggests that the government refund these into taxable securities, from which it will receive additional revenue of about three hundred millions annually.

In the public utility field particularly have the evils of tax-exempt securities been most apparent. These corporations, although they are in private hands, render a public service which is in most cases superior to and more efficient than the service meted out by competing municipally or governmentally owned utilities, and yet the securities of the latter are tax-exempt while the securities of the former, despite the fact that the earnings of the corporation and the service it renders are subject to public regulation, are given no such advantage. It would be reasonable to make the securities of all public utility organizations tax-exempt, but that is hardly possible since a burden already great is not mitigated by adding to it. The wisest and safest course to pursue would be to render the income from all securities, by whomsoever issued, subject to tax. This will eliminate all discrimination without detracting from the salability of government bonds, which always, by their very nature, will be the safest securities available. A movement of this kind has already been started, but the reasonableness and justice of it must be brought home to the average man if it is to be successful.

Future of Powdered Fuel in Power Plants

THE future of powdered coal rests on the development of methods of burning and the attainment of economies that will overcome the cost of powdering and drying and also the fixed charges that will be incurred in installing the equipment for these purposes. The amount of this increased cost was indicated to some extent in J. B. Johnson's article published in the Dec. 3 issue of the ELECTRICAL WORLD. Just what the real difference in fuel costs at the boiler will eventually be is something that no engineer can closely predict at the present time, since there has not been made public sufficient experience with actual installations over a long enough period to develop the information. Although Mr. Johnson's figures indicate a total operating cost in Arizona of $1.30 plus the fixed charges on the storage and powdering plant, it is not fair to charge all of this expense against the powdered-fuel plant unless the investment in equipment and the cost of handling and storing coal for the stoker plant with which it may be compared are also included.

The problem of the powdered-fuel engineer is the development of cheaper methods of fuel preparation and an elimination of some of the difficulties experienced in handling certain grades of fuel, clinkers and slag. Great promise is given in the figures of actual operation so far available, but there is a long road yet to travel that will call for real work. One field that is yet hardly touched is in the use of low-grade fuels that have hitherto been considered unusable. Several ambitious attempts to solve the problem are under way at the present moment, and the lack of serious difficulties so far encountered is the most hopeful sign of the future.

The Hoisting-Motor Problem Again Considered

THE proper motor to use for a given hoisting job is often a puzzle to the designing engineer. The principal considerations on which the selection of motors for such work are based are given elsewhere in this issue of the ELECTRICAL WORLD by Gordon Fox. The field of mine hoisting is not touched because this is a special field involving some factors by which the more common industrial uses are not affected. There are some users of hoisting equipment who prefer the steam-engine-driven type to any other because of its supposed better flexibility in speed control, notwithstanding the greater cost of operation and other disadvantages. The developments in speed control of the alternating-current motor, while they have been great, do not yet appear to have quite equaled those with the direct-current motor, and on this account the engineers having to do with industrial-plant design continue to favor direct-current drive in spite of the obvious disadvantage due to the almost universal use of alternating current in the distribution of central-station energy.

One of the most puzzling items in the taking over of power service from the isolated industrial plant to the central-station system is the provision to be made for the hoisting and other variable-speed motor service that has been largely if not entirely direct-current. The problem is akin to that in the steel-mill field, where low frequencies have held favor because of their obvious advantages in certain operations requiring low-speed motors. The great advantage of tying up steel-mill service with the big transmission systems, and the tendency to make low-frequency equipment non-standard and therefore more and more expensive, is bringing a development that will ultimately force these plants into line with the prevalent practice.

The direct-current motor problem is another of the same character, though it seems to be somewhat less complicated, because changes can be made more gradually as new equipment is developed and plant requirements change. Temporary maintenance of direct-current service for shop service has less complication than is involved in the use of two frequencies in the same plant. The economic reason behind the development of central-station service is forcing the solution of the problem, and this will become more apparent with the further development of the big transmission systems in industrial territory.

Is More Power the Only Solution of Longer-Distance Radio Communication?

OF THE many directions in which active investigation is being prosecuted in the field of radio transmission, the one most in the public eye at present is that of the extension of the distance of transmission. Both in this country and abroad new installations of great magnitude, and aiming to surpass all others in distance reached, are under way. It is characteristic of all radio problems that little is known of the underlying physical laws involved, and especially is this true of the action of these laws as affected by conditions on and above the surface of the earth. It is but natural therefore that the most striking features of the new long-distance plants, both here and abroad, are their increased size as regards aërial and power plant. The message must be put over, at whatever cost of equipment and energy, until the ultimate goal, transmission to all parts of the earth, is reached.

In considering the enormous size of these modern plants and the amounts of energy put into the antennas, and noting that radio engineers, for further extension of distance, appear to have only the one resource of higher power and more energy, one is tempted to ask whether a more careful intensive study, possibly by international co-operation, of the fundamental processes involved in radio transmission would not yield some new avenue of knowledge or method whereby equal results might be reached in a more elegant and more rational manner. Questions of this character are suggested by a description in the November number of the *Radio Review* of some remarkable results obtained by Dutch East Indian engineers in transmission from Java to Holland, a distance of 12,000 km. This was accomplished first with a Poulsen arc of only 100 kw. capacity, and the success was attributed to the discovery claimed by one of the engineers that at night and using short waves it is relatively easy to transmit between points distant by multiples of 3,000 km. The equipment was subsequently increased to 320 kw., with which certain communication with Holland is said to be possible and which provides basis for a claim to having surpassed all other stations in the matter of distance reached. Other interesting features of the station in Java are the aërial, which is suspended on steel cables from opposite sides of a natural gorge, 900 km. high, and a 3,600-kw. Poulsen arc, with equipment, now nearing completion. The arc is preferred by the engineers of this plant to the high-frequency generator, also installed, as transmitting means, because of the greater flexibility of the former as regards wave length and the difficulties of speed control with the latter. It is noted that the tenfold increase in the capacity of the new arc is solely for the purpose of increasing the amount of received energy in Holland to make the system free from disturbance by the large European stations, and so reliable for commercial service.

Additional point is given to this question by the results of the recent transatlantic tests open to all amateur operators and stations. The results of these tests were astonishing as regards the number of amateur stations which reached the other side of the Atlantic. As many of these stations were of low capacity and equipped with the simplest types of apparatus, it is obvious that high power is not always necessary for long distance. Perhaps after the world is encircled through the use of more and more power and the beckon of the first achievement is no longer present, a wider study of the nature of the processes underlying the instrument may be conducted.

Transformer-Oil Test That Is Susceptible of Development

OIL for insulating purposes is so seriously affected by even the slightest traces of water that high-voltage systems must of necessity be provided with equipment of considerable elaboration for the protection, testing and purification of the insulating oils. Thus power transformers are provided with so-called conservators for avoidance of moisture arising from internal condensation, permanent provision is often made for the periodical drawing off of the oil for drying, and some form of testing equipment for studying the moisture content is often provided.

Of the methods in use for measuring the moisture content of insulating oils, aside from various rough condensation tests, the best known are those using filtration, as, for example, through blotting paper, and for which special apparatus is available, and those in which the water is decomposed chemically and the gases evolved are collected. In another column we print an article by J. E. Shrader describing an interesting new method which the author asserts is free from serious errors pertaining to other methods. Briefly the method consists in spraying a known amount of the oil into a vacuum at high temperature, condensing the water and gas vapors in a liquid air trap, re-expanding them, measuring the volume and pressure, separating the water vapor with phosphorous pentoxide, and measuring the volume and pressure of the residual oil vapors. Two simple applications of Boyle's law enable the pressure volume and so the weight of the water vapor to be computed. While the article does not report in detail tests as to the accuracy of the method, and while it involves somewhat more elaborate measuring equipment and skill than are readily available for a routine operation, it is nevertheless simple in principle and appears susceptible of important development and use.

Co-operation of Architects and Engineers Needed for Proper Illumination

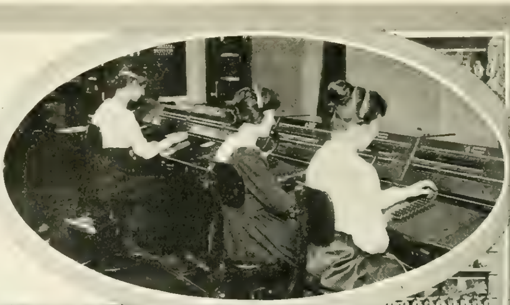
MANY building interiors and exteriors which might have been architecturally beautiful have been spoiled either because an architect who was not an illuminating engineer tried to design the lighting or because the requirements of the illuminating engineer were not taken into consideration in laying out the architectural scheme. Such unfortunate situations could be prevented if architects and illuminating engineers would come to a mutual understanding that they have a common purpose and that neither one can produce effective results without full co-operation from the beginning. Attempts have been made by the Illuminating Engineering Society through its reciprocal relations committee to bring about such co-operation, but in general these efforts have been futile. Sometimes where individuals have attempted the solution the architect has believed that the engineer was trying to tell him how he should design the structure; at other times the engineer has felt that the architect was specifying things beyond his sphere of knowledge. No doubt both sides have often been at fault in the past, but that should not prevent their putting petty jealousies aside and attacking the problem anew. Both are experts in their respective fields, and each should respect the other's knowledge. Co-operation can be expected only where the engineer looks to the architect for advice regarding the application of illumination fundamentals in an artistic way, and the architect must tell the engineer what effects he wishes to accomplish and then, if necessary, must so modify his design that illuminating equipment may be selected and laid out with the least possible hindrance.

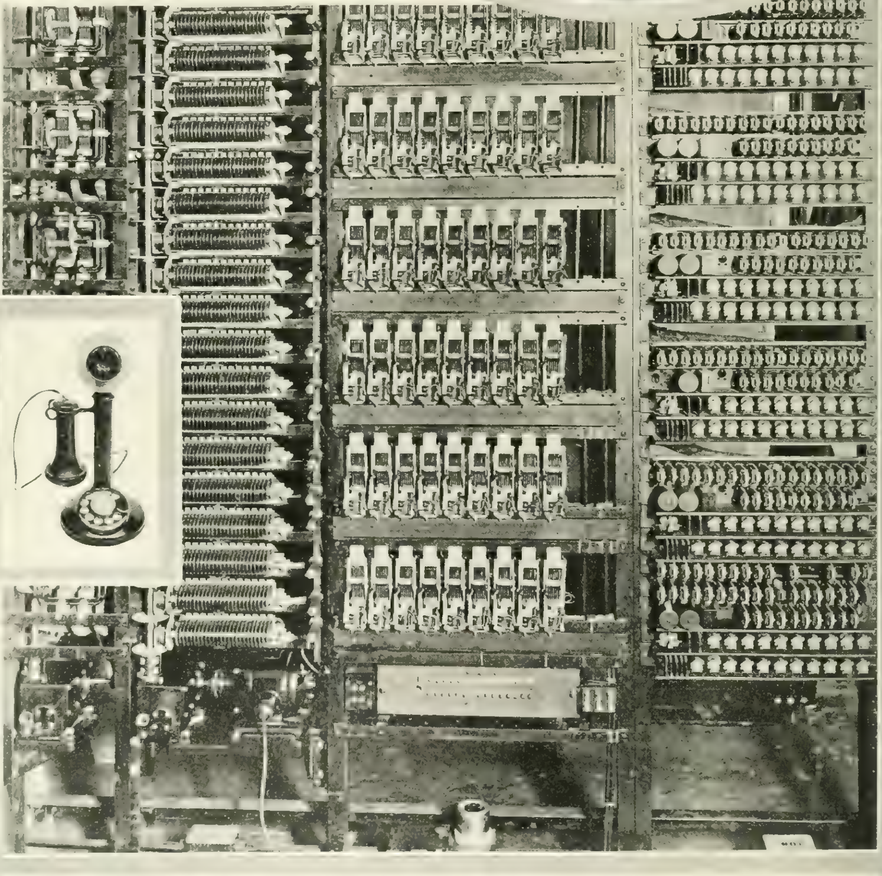
It is hoped that any further attempts of the Illuminating Engineering Society to bring about co-operation between architects and engineers will meet with more success. However, the results to be desired will be attained only if engineers prove to architects that the efforts are being made for mutual benefit.

Is Short-Circuiting and Grounding Practice Satisfactory?

THE common assumption that simply throwing a chain over the conductors of a circuit on which men are working to short-circuit and ground it for protective purposes is sufficient is rather seriously upset by the data presented elsewhere in this issue by Alfred Herz, giving the results of some tests made on the system of the Public Service Company of Northern Illinois. Short-circuiting and grounding has become an accepted standard protective measure, but in practice, on line work in particular, it has been commonly applied in the manner just mentioned. The tests in Illinois reveal conditions of resistance under varying degrees of tension that are rather startling and suggest the need of intensive study of the subject on the part of the safety and technical committees of the National Electric Light Association that are interested in operating and construction work. Resistance of an ohm or two up to infinity for chains depending only on their weight for good contact, when taken into consideration with unavoidable ground resistance, indicates rather disturbing possibilities in injuries to workmen on the high-tension lines on which they are used as a protective measure. The effect of electric current on the various types of chain tested points to the need of further investigation.

Transition from Manual to Machine Switching in Large Cities





TO HANDLE the congested and very rapid growth of traffic in the larger cities the Bell Telephone System has developed and is installing machine switching equipment which will take the place of manual switching now used. The transition will be gradual, one office at a time being changed over. During the transition special manual equipment like that shown in the oval is required to handle calls between manual and machine switching offices. The machine switching apparatus is power-driven and is not actuated directly by the electrical pulses sent out from the subscriber's dial. These pulses are used merely to set up the proper combination in the sender (shown above), which in turn controls the motion of the various power-driven selectors (not shown but which are mounted in a similar manner).

Factors Affecting Installation of Electric Motors for Hoisting

Methods of Determining Size of Motors Required—Various Types of Skip Hoists and Their Use—Advantages and Disadvantages of Alternating-Current and Direct-Current Drives for Skip Hoists

By GORDON FOX
Engineer with Freyn, Brassert & Company

ELECTRIC motor drive offers many advantages for hoist service and is applied in a variety of ways. Two common types of hoisting practice, namely, general-service and skip hoists, will be considered in this discussion.

For general-service hoists motors fall principally within the range from 5 hp. to 50 hp. Drum controllers are commonly used, except for constant-running squirrel-cage motors, where a starting compensator is employed. The duty required of a general-service hoist is usually of a rather indefinite nature. The torque and power demanded for hoisting the capacity load is the determining factor. The motor size may be obtained by the simple formula: Hp. $= WV/53{,}000e$, where $W =$ cacapacity, unbalanced load, pounds, $V =$ hoisting speed with rated load, feet per minute, and $e =$ efficiency of machine, usually 0.70 to 0.80.

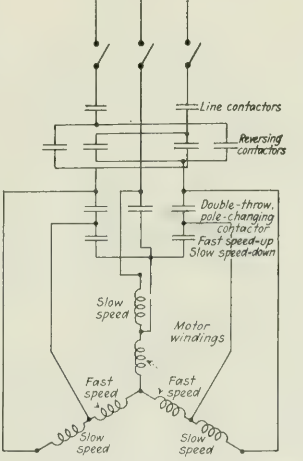
The prevailing load is ordinarily less than full load, and a variable-speed motor having a thirty-minute to sixty-minute rating equal to the horsepower as determined will meet all ordinary requirements. The sixty-minute rating should be used when the service is severe or constant.

The construction hoist is the most common and simplest type. It comprises a cylindrical drum upon which is wound a cable passing over guide sheaves and a head sheave to the load. The load is entirely unbalanced, so that its full weight must be overcome by torque exerted at the drum. General-service hoists of this character range in capacity up to 3 tons or 4 tons. The hoisting speeds used range from 75 ft. to 200 ft. per minute, according to the lift and the nature of the service.

DIRECT-CURRENT VERSUS ALTERNATING-CURRENT MOTORS

Both direct-current and alternating-current motors may be employed for general-service hoists. As alternating current is most often available, however, the direct-current motor must prove sufficient superiority to justify its use. In starting torque and pull-out torque the direct-current series motor fulfills the requirements excellently. This type of motor may be geared directly to the winding drum and dynamic braking may be employed for lowering. An electrically operated holding brake is applied at the motor. Many hoists of this type are equipped with a clutch between the motor and the drum. When lowering, the clutch is disengaged and a hand or foot band brake acts upon the drum shaft. A brake on the motor is not entirely necessary with the clutch type of hoist but the motor should have sufficient shunt-field winding to prevent serious overspeeding in case the clutch is disengaged with full power on the motor.

Squirrel-cage induction motors are used with a clutch for some small hoists. The motor is permitted to operate continuously. Lowering is controlled manually by a band brake on the drum. A high-resistance-rotor squirrel-cage induction motor can be used without a clutch for small hoists which do not have frequent service such as for car pullers, ice hoists, etc. The motor may be started by being thrown directly on the line, when it will draw about 350 per cent full-load current and exert 250 per cent full-load torque. This drive is popular in sizes up to 20 hp. For the larger alternating-current hoists wound-rotor motors are provided. These may start and stop with each operation to give better control. Lowering is generally accomplished by manual braking, the motor being disengaged through a clutch. If the load that is to be lowered is sufficiently heavy to drive the motor, regenerative braking may be employed or the motor may be plugged with high rotor resistance. Motors for this class of service are specially designed with high magnetization to produce high starting and pull-out torque. This, however, causes low power factor and rapid heating. Such motors are suited to intermittent duty only and will overheat if operated continuously, even without load.



MAIN CONNECTIONS FOR MULTISPEED INDUCTION-MOTOR DRIVE FOR SKIP HOISTS

THE SKIP HOIST

The skip hoist is widely used for handling ashes and for hoisting ore, stone and coke for blast-furnace charging. Sometimes skip hoists operate as unbalanced hoists and as such are very similar to the general-service hoists described. More frequently two skips are balanced against each other or a single skip is counterbalanced by a weight. Skip hoists for handling ashes range in capacity from 500 lb. to 5,000 lb. (226 kg. to 2,260 kg.). They may be either vertical or inclined slightly. The hoisting speed ranges from 50 ft. to 200 ft. (15 m. to 60 m.) per minute, depending upon capacity and height of lift, but it should be no greater than necessary. If the counterweight is attached to the drum, the weight of the skip may be fully counterbalanced and additional weight may be supplied to counterbalance half of the normal load hoisted. This arrangement minimizes the size of motor required. The equipment must be able, however, to lower a loaded skip or to hoist an empty skip if required.

The load of a balanced skip hoist may be determined with sufficient accuracy by the formula: Hp. $= PV/33{,}000e$, where P = net rope pull or force at winding drum; V = rope speed (feet per minute), and ϵ = efficiency. Efficiency may be taken as 0.75 for a gearless hoist and 0.65 for a geared hoist. The rope pull P depends on weight of skips and load and inclination of runway. The weight of the cable may be neglected. For an inclined skip the rope pull P may be determined as follows:

$$P = L \cos\theta + \frac{(L + 2C)\sin\theta \times 25}{2{,}000},$$

where L = weight of load (pounds), C = weight of skip (pounds) and θ = angle of incline from vertical.

The first element in the equation is the net rope pull due to gravity. The second element represents the rolling friction on the basis of 25 lb. drawbar pull per ton of load perpendicular to the track.

When a skip capsizes much of its weight is relieved from the rope. In starting it is then virtually necessary to lift the loaded bucket and skip without counterbalance. The motor must have sufficient torque for this. The rope pull for this condition is given below. This may be translated into torque at the motor as follows:

$$P = (L + C)\cos\theta \frac{(L + C)\sin\theta \times 25}{2{,}000}.$$

Direct-current motors are used most extensively in skip-hoist service. With the unbalanced or partially counterweighted skip a series motor may be used. For a balanced or counterweighted skip a shunt motor is necessary, although a compound-wound motor arranged so that the series field is short-circuited during the running period may be used. If the load overhauls a series or compound-wound motor, it will overspeed, whereas a shunt machine will exert torque either as a motor or as a generator with very little change in speed.

Small ash and coal skip hoists are usually arranged for automatic operation by unskilled labor. A "start" button causes the magnetic controller to start and accelerate the motor. When the dumping position is approached limit switches cause the motor to slow down and stop. Slow-down is accomplished by introducing the starting resistance in series with the motor and shunting the armature with one step of resistance. A time relay is provided to introduce a dumping interval, after which the skip is lowered, slowed down and stopped at the lower limit of travel. All operations except starting are performed by the limit switches. It is necessary that one or more brakes be provided on the motor shaft to hold the load at any point.

Where alternating current only is available, a reliable and comparatively high-speed installation can be made by using an induction motor which may be operated at half or full speed. The motor has single windings in primary and secondary. The six primary leads are taken to a pole-changing switch and the six secondary leads to a star-connected resistance. Such a motor is admirably suited for small skip hoists having a full speed of about 250 ft. (75 m.) per minute, giving a landing speed of 125 ft. (37.5 m.) per minute.

The prime requirements of a blast-furnace skip hoist are reliability and continuous operation. For this reason the motor and equipment must have a high safety factor, the layout should be simple, and careful provision should be made for rapid repairs and quick renewals. Blast-furnace skip hoists are mostly balanced hoists equipped with one or two drums and two skips which counterbalance each other. They operate on an incline of 20 deg. to 40 deg. from the vertical. The travel distance ranges from 120 ft. to 200 ft. (36 m. to 60 m.). The skips weigh 5 tons to 10 tons, and the loads run from 1½ tons of coke to 11 tons of ore. The hoisting speed is usually about 300 ft. (90 m.) per minute, although speeds up to 500 ft. (150 m.) are used.

Direct-current motors are used in nearly all cases for blast-furnace skips with either single-motor or two-motor drive. Recently a few hoists have been equipped with special two-speed alternating-current motors. Some foreign hoists are equipped with variable-voltage equipment. The single direct-current motor hoist is the prevailing type. The motor is usually compound-wound, having a no-load speed about 125 per cent of full-load, full-field speed. The size ranges from 100 hp to 300 hp. as required. The voltage is commonly 250. The motors may be direct-connected to the winding drums, but more commonly the motor drives through two gear reductions and a flexible coupling. The motor speed is usually about 250 r.p.m. to 450 r.p.m. A series-wound brake is applied to the motor pinion shaft and a shunt-wound brake is applied to the intermediate shaft. This arrangement makes possible a change of armatures without disturbing the brake or pinion. Either brake should be capable of holding the maximum load.

METHODS OF CONTROL

Magnetic control with current-limit acceleration is extensively used, but time-element acceleration is gaining popularity because with this system the accelerating time is independent of loading and not affected by an overhauling condition. A moderate rate of acceleration, about 1 ft. to 1½ ft. (0.3 m. to 0.5 m.) per second per second should be used. During acceleration the series field is effective. The last accelerating point short circuits the series field converting the motor to a shunt machine during the running interval. The hoisting speed is thus made largely independent of load, even in case of overhauling. When the skip approaches the knee in the track a limit switch functions, causing the series field to be introduced, putting the starting resistance in circuit and shunting the armature with resistance. This causes the skip to slow down. As the skip travels over the knee the armature-shunting resistance is reduced in one or more steps so that the skip speed is reduced to about 50 ft. (15 m.) per minute. When the skip dumps, the limit switch causes the motor to stop and the brakes to set. Two or three steps of slow-down resistance are desirable in order to limit the retarding current in slowing from full speed and in order to compensate for the load variation as the skip capsizes and decreases its rope pull. At the instant of dumping the load becomes overhauling. The limit switches may be driven by the winding drum or may be installed along the runway and actuated by the skip. The former arrangement is most used, its principal disadvantage being the necessity to adjust for cable variations.

As the load weights vary widely, the slow-down speeds tend to vary to some extent. Therefore controls have been developed to adjust the slow-down resistance in accordance with the motor speed. These are somewhat complex, and the simple method of reducing the armature-shunting resistance at two or three fixed points of travel is entirely satisfactory and to be preferred. Slack-cable switches are provided to stop the motor in case a skip fouls. A centrifugal governor stops the motor if the slow-down fails to function. An over-speed trip protects against any condition of power failure with an overhauling load which may cause the motor to generate power and hold open the brakes.

For a direct-current gearless skip hoist the motor must necessarily be a slow-speed machine, full speed being about 40 r.p.m. Therefore this type of equipment is relatively expensive, repairs involve large parts and changes are more difficult to make. An armature change can be made quickly in the case of the geared drive where the motor is coupled to a separate pinion and brake shaft and where the frame and brush rigging is horizontally split and arranged for rapid dismantling. On the other hand, the smooth, slow operation reduces the likelihood of motor failure to some extent. The equipment is very simple, has fewer parts and has also a lower kinetic energy. The control is similar to that used for the geared-type single-motor direct-current hoist.

DOUBLE-MOTOR EQUIPMENTS

The two-motor geared hoist offers the advantage of emergency operation with a single motor as each motor is rated at about 60 to 75 per cent of the total load. With two-motor drive series-parallel control may be employed, giving more accurate low-speed operation and decreasing resistance losses. The motors are compound-wound, with a light series field. The series fields are not cut out during full-speed operation as a drooping motor characteristic is necessary in order that the two motors may divide their loads properly. Difficulty is sometimes experienced in obtaining proper load division. Moreover, there is a possibility of considerable damage in case one motor develops a fault and bucks the other motor while running. Magnetic control is employed arranged for series-parallel acceleration and slow-down, and armature shunts are connected around each motor during slow-down. Drum control is employed for single-motor operation, circuits being quickly transferred from magnetic to drum control through use of a transfer switch. Two-motor drive offers a measure of advantage in that each motor is smaller and auxiliary drum control may be employed, whereas with single-motor hoists above 150 hp. rating the currents involved are rather heavy for drum control, and auxiliary control, if used, must be of the magnetic type. A two-motor equipment for a blast-furnace skip is somewhat more expensive than the single-motor equipment. The lower cost of spare parts and auxiliary control may compensate largely for the difference in first cost.

The single-motor hoist could be made to have higher efficiency at reduced speed and to give more accurate and uniform creeping speeds with control similar to elevator practice where adjustable-speed motors are commonly employed to give high running speeds with accurate creeping speeds, but this type of drive is a little higher in first cost, and tradition favors the single-speed motor or the two-motor design.

There has been some demand for an alternating-current skip-hoist drive. A few such equipments have been installed similar in general arrangement to the single-motor, geared direct-current hoist. The motor is of the induction type with wound rotor. It has two windings on the stator and two on the rotor, arranged for different numbers of poles to give two distinct running speeds. These speeds have a ratio of about six to one, being respectively 300 ft. (750 m.) and 50 ft. (15 m.) per minute. A magnetic control is provided for reversing and cutting over the primary windings and for adjusting the secondary resistance. The motor may start on either high-speed or low-speed winding, and acceleration is obtained by cutting out rotor resistance. Travel is at the higher speed, and slow-down is obtained by transfer to low-speed winding, causing a negative torque momentarily. Control is by limit switch and protective features are similar to those of a direct-current hoist.

ADVANTAGES AND DISADVANTAGES OF ALTERNATING-CURRENT AND DIRECT-CURRENT DRIVES

The advantages of an alternating-current skip hoist are as follows:

1. Alternating power used without conversion losses.
2. Low-speed operation can be maintained at a definite value regardless of load.
3. Change from full speed to low speed can be obtained with smooth retardation.
4. The efficiency at low speed is higher than that of a direct-current hoist, which absorbs considerable power in resistors.

The first-named advantage may be great, but, on the other hand, such equipment as ore bridges, unloaders and car dumpers is best adapted for direct-current drive. Where such equipment is used the skip hoist can obtain its direct current from the common source. The low speed of a direct-current motor can be controlled within the required degree of accuracy, although not as perfectly as the alternating-current motor. An entirely satisfactory change from full speed to low speed can be obtained with a direct-current motor provided proper control is installed. The efficiency of the direct-current skip-hoist motor at low speed is poor, but the alternating-current motor also has poor efficiency and poor power factor at low speed.

The disadvantages of the alternating-current motor for blast-furnace skip-hoist drive are as follows:

1. The motor is more difficult to repair. Defective coils cannot be cut out and isolated readily. The fact that the stator frame cannot be split horizontally and readily disassembled renders repairs on either stator or rotor relatively difficult and lengthy delays more probable.
2. The motor has a small air gap. This is a disadvantage as regards wear and also makes difficult quick assembly in case of repair.
3. The alternating-current brake is not the equal of the direct-current brake. A series brake is not feasible.
4. An alternating-current motor is heavier and more expensive than an equivalent direct-current motor.
5. Alternating-current control is heavier, more clumsy and more expensive than direct-current control.
6. The alternating-current motor takes a high starting current at low power factor.
7. The kinetic energy of the alternating-current motor is much higher.
8. The running speed is fixed. A direct-current hoist may be speeded up when desired.
9. The alternating-current skip-hoist motor is better adapted for 25-cycle than for 60-cycle circuit, to obtain the very low speeds required.
10. The voltage of the alternating-current motor should not exceed 440, for reliability, for safety and because of control considerations. Transformer conversion will therefore be necessary in most cases.

Determination of Water in Transformer Oil

New Method Which Does Not Involve the Usual Errors Encountered—Vapor Pressure Can Be Determined by Method

By J. E. Shrader
Research Laboratory,
Westinghouse Electric & Manufacturing Company

One of the usual methods of determining the amount of water in oil is to decompose the water chemically, collect and measure the volume of evolved gases, and then calculate the weight of water in a given sample. There are several objections to this method. In the first place the evolved gases are soluble in the oil so that the total quantities of gases are not readily measured. The oil contains quite large quantities of absorbed gases which are apt to be carried off with the liberated gases, thus giving greater values than should be obtained. Then there is always the uncertainty of the complete decomposition of the water since this takes place only when the water and the decomposing agent are brought intimately into contact. Other methods which depend upon the release of moisture under vacuum and operations which involve weighing quite small quantities are rather uncertain because of the difficulties of eliminating errors during the process of weighing. This is especially true where the amount of moisture to be determined is quite small.

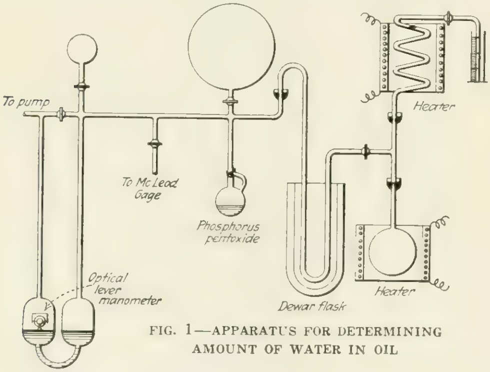


FIG. 1—APPARATUS FOR DETERMINING AMOUNT OF WATER IN OIL

A new method developed in the research laboratory of the Westinghouse Electric & Manufacturing Company, here described, avoids all the above-mentioned errors and is free of all others except those involved in observation and the error due to the assumption that vapor pressures which are well below the saturation point obey Boyle's law. This method consists in spraying the oil into a vacuum system and into a heated tube where under the influence of heat and vacuum the moisture is completely vaporized and separated from the sample. By condensing and isolating this vapor in a part of the vacuum system where it is allowed to re-expand in a known volume its pressure, together with that of the oil, is determined. By determining these pressures and by using Boyle's law the amount of water can then be determined.

The method employed and the apparatus used may be understood by referring to Fig. 1 and the following:

The whole system is thoroughly evacuated by a mercury diffusion pump. Liquid air or carbon dioxide snow is then placed in the Dewar flask and the sample of oil is introduced slowly from the graduated cylinder at the right by regulating the stopcock above. As the oil enters the spiral tube (raised to any desired temperature by the surrounding heater), the moisture and gases are liberated. The gases are continuously removed by the pump while the moisture is condensed by the liquid air or carbon dioxide in the trap. The treated oil is caught in the lower right-hand bulb, which is heated to the temperature of the spiral tube to prevent possible reabsorption of moisture.

After a sufficient amount of oil has been introduced the oil entrance stopcock is closed. After pumping for a short time to remove all gases from the system the condensed moisture is isolated by operating the stopcocks. With the phosphorous-pentoxide bulb cut off the liquid air or carbon dioxide is removed from the trap and the moisture and condensed oil vapor are allowed to expand. The pressure in this part of the system is determined by the optical lever manometer,* which measures vapor pressures of the order of 0.02 mm. Hg. After this pressure is determined the phosphorous-pentoxide bulb is opened and the moisture in the system is absorbed. The oil vapor is recondensed into the trap and the phosphorous-pentoxide bulb again cut off. The oil vapor is then allowed to re-expand and its partial pressure is determined. The difference between this partial pressure and the total pressure gives the pressure due to the water vapor alone. From the known volume and pressure of the water vapor its weight may be computed and expressed in percentage of the weight of the oil. When liquid air is used on the trap the carbon dioxide contained in the sample is also measured, but this has been found to be only about 2 per cent of the total moisture content. This carbon dioxide will be removed with the other dissolved gases if carbon-dioxide snow is used on the trap.

The auxiliary bulbs, having known volumes, are used when the moisture to be determined is of considerable amount and also to determine the volume of the rest of the system.

To determine how the temperature of the oil in a good vacuum affected the amount of water given off, several tests of "Lectroseal" oil were made at temperatures ranging from room temperature to 94 deg. C.

The results showed very slight variations of the amount of water released at different temperatures. It was noticed that the pressure of the oil vapor increases with the temperature, but only in the case of the highest temperature 94 deg. C., was there sufficient oil distilled over to produce saturation. The pressure in this case was 1.78 mm., which can be taken as the vapor pressure of the lighter constituents of this oil. While the results were true for "Lectroseal" oil, it is not true for all oils that water is readily given off at

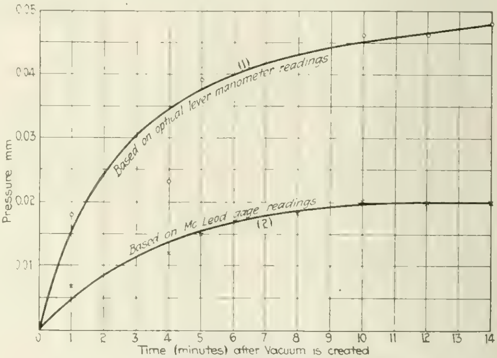


FIG. 2—VAPOR PRESSURE OF ONE OIL OBSERVED BY TWO METHODS

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*This manometer was described by Shrader at the Pittsburgh meeting of the American Physical Society, December, 1917, and by Shrader and Ryder, *Physical Review*, May, 1919.

the lower temperatures. For high-flash oil which has a higher viscosity a temperature of 120 deg to 130 deg. is necessary to release all the water vapor.

The vapor pressure of the oil after undergoing the foregoing treatment can also be determined by the apparatus here described. In determining vapor pressure the entire system is pumped thoroughly and afterward the increase of pressure with time in the closed system is noted. The pressure increases quite rapidly at the start and then more slowly until an equilibrium pressure is reached which is the vapor pressure of the oil. To show how this vapor pressure reaches equilibrium the curves in Fig. 2 are plotted from observations of pressure with time. The McLeod gage with which one of the curves was determined, of course, does not read true vapor pressures, but the curve is given to show that corresponding equilibrium was obtained. From the results obtained with "Lectroseal" oil it was observed that there is a slight lowering of the vapor pressure after heating to the higher temperature. This can be explained by the fact that more of the low boiling constituents have been removed.

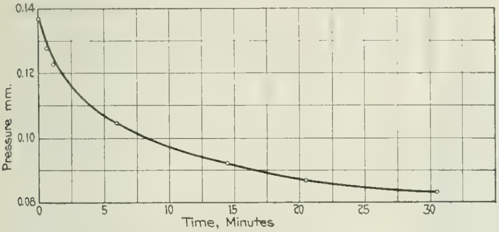

FIG. 3—ABSORPTION OF WATER BY PHOSPHOROUS PENTOXIDE

To measure the amount of dissolved gases in equilibrium under normal conditions this same experimental arrangement may be used. For this purpose, instead of continuing to pump while letting in the sample, the pump is shut off. The released air expands into a known volume, producing a given pressure, and its volume at 760 mm. can be calculated. The results obtained with "Lectroseal" oil showed that all absorbed gases are removed in vacuo even at room temperatures. Under the given conditions at 25 deg. C. the amount of absorbed gases in "Lectroseal" oil is 11 per cent by volume. In determining the amount of gases absorbed in oils considerable care has to be taken to avoid mechanical mixing of the air with the oil. In the case of the results here recorded the sample was siphoned carefully without splashing into a graduated cylinder holding sufficient oil for all the tests. This was then allowed to stand exposed to the air over night before testing. Previous samples taken somewhat carelessly differed from each other as much as 100 per cent owing to mechanically entrapped air.

Some question as to the absorbability of water and oil by phosphorous pentoxide might be raised. It was found by trial that moisture alone introduced into the vacuum system was removed in two or three minutes on exposure to the phosphorous pentoxide. When, however, the oil vapor was also present, so that the diffusion of the water molecules took place against the back pressure of the oil molecules, the action was less rapid. From all chemical data that could be found there was no absorption of the oil vapor, and from the curve the indications are that the oil vapor exerts a definite pressure.

Electric Light and Power in India*

British Government Power Survey Reports a Total Installed Rating of 215,509 Kw. and a Total Connected Load of 232,919 Kw.

RECOGNIZING that future industrial development of India depends primarily on the availability of cheap electric power, British India government engineers are making a very comprehensive survey of the present status of the electric light and power industry of that country and are working out a scheme for the acquisition of cheap power by developing the great natural water-power possibilities in the mountainous regions.

Among the industries which are possible of successful development in India if cheap power is available are the following: Electric smelting of indigenous iron ores and the production of steel and its alloys; electric welding, which is at present extensively employed; the production of aluminum from alumina, prepared from the local bauxite deposits; the manufacture of calcium carbide and its numerous derivatives; the direct fixation of atmospheric nitrogen into nitrates of commerce; the electrolytic production of chloride gas, and the preparation of phosphorus and of abrasives like carborundum.

TABLE I—PROBABLE WATER POWERS OF INDIA, SO FAR AS DETERMINED
(Continuous or twenty-four-hour horsepower.)

Province	Developed and Under Construction, Hp.	Known and Probable Sites, Hp.	Total, Hp.
Assam	.....	51,200	51,200
Bengal	600	203,600	204,200
Bihar and Orissa	...	12,800	12,800
Bombay	85,000	258,300	343,300
Burma	14,460	439,000	453,460
Central Provinces	....	153,000	153,000
Cochin		25,000	25,000
Kashmir	28,300	30,000	58,300
Madras	1,350	106,000	107,350
Mysore	32,000	....	32,000
Northwest Frontier Province	330	20,000	20,330
Patiala	285	....	285
Punjab	3,600	260,900	264,500
Sikkim	8,000	....	8,000
Travancore	530	....	530
United Provinces and Benares	5,400	32,200	37,600
Totals	179,855	1,592,000	1,771,855

TABLE II—PRIME MOVERS IN ELECTRIC GENERATING PLANTS OF INDIA

Type of Prime Mover	Public Light and Power Generating Plants, Kw.	Private Generating Plants	Electric Railway Generating Plants	Totals, Kw.
Steam	53,453	71,753	4,150	129,356
Internal combustion engine	2,392	5,064	572	8,028
Water power	74,625	3,500	......	78,125
Totals	130,470	80,317	4,722	215,509

In some of these industries the process is electrochemical, in others electrothermal, but in all cheap power and large-scale production are essential to success.

Apart from the ordinary town supply for electric lighting, heating, fans, and to electric tramways and railways for traction purposes, there are many other industries in which electric power would be welcomed if it could compete with other forms of power in cost. One striking instance of this lies in the area of the Duars, within easy reach of water power. The industrial load of this district is about 100,000 hp., much of which is in tea factories, energy being used to run steam engines, but mainly for drying purposes with hot air and fans. Both the motive power and the hot air can be obtained electrically, it being merely a question of comparative costs. Other large tea districts are similarly situated. In Bombay the cotton mills are mostly driven by electric motors, and similar markets for cheap power exist in jute mills, oil mills, the timber-working industry, sugar factories, paper-pulp mills and other industries.

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*An extract from "List of Electrical Undertakings in India," and "Report of Hydro Electric Survey of India," both issued by the Office of the Electrical Adviser to the Government of India

It has always been known that the Indian Empire has great natural water-power possibilities. This potential power has been developed in a few favorable localities to a limited extent, but prior to the war no serious interest had been taken in the subject owing to the limited industrial development of the country. In certain respects India differs from most countries whose natural resources in water power are now being investigated, for the rainfall is seasonal and during many months only occasional thunderstorms break the monotony of dry weather. The variations in rainfall in different parts of the country are enormous, and the departures from the monthly and annual "normals" in any given locality are also very great. As a result of these conditions many of the rivers and streams of India fall to a very low ebb or dry up altogether in their headwaters before the end of the dry season. Where these conditions are prevalent development by monsoon storage is the only method of getting continuous power, and this is not possible in most localities.

SIMLA MUNICIPAL HYDRO-ELECTRIC PLANT ON THE NAVTI RIVER, CHABA—HEAD 540 FT., INSTALLED RATING 1,250 KW.

TABLE III—BRAKE HORSEPOWER INVOLVED IN VARIOUS INDUSTRIES OF INDIA.

About 310,500 hp., or 27 per cent of the total, is electrical. The figures are only approximations and outside of the Province of Bengal are very incomplete.

Assam.. ..	22,550
Bengal, exclusive of Calcutta area	25,318
Calcutta area	176,200
Bihar, apart from collieries, etc	2,325
Bombay Presidency	32,872
Bombay City area	750,000
Burma, exclusive of rice mills, etc	17,750
Central Provinces	32,773
Madras	39,568
Northwest Frontier Province	....
Punjab (steam only)	15,734
United Provinces	38,548

The perpetual snows of the Himalayas are responsible for the hot-weather flow in most of the perennial rivers of northern India and may prove an asset of immense value for industrial power, just as they already are for irrigation. Even the comparatively low-lying snows will last well into the hot weather, feeding the springs and keeping up the volume of water. There is, however, very little of this "white coal" in other parts of India, and such perennial streams as exist are spring-fed.

The present water-power development in India and the probable potential water powers, so far as determined by the government investigation, are given in Table I. The water powers of the country have hardly been touched, and large additions to those developed may be expected in the near future.

Table IV gives detail figures on the electric light and power plants in India in 1917. There were 133 electric generating plants, of which 105 were private or isolated plants. The twenty-eight plants generating energy for public use, however, reported an installed rating of 130,470 kw. as against 80,317 kw. for the private plants. The total connected load of the public plants was also almost twice that of the private plants. Table II lists the prime movers installed in the three classes of electric generating plants. It is of special interest to note that in 1917 more than 57 per cent of the plants generating energy for public use were operated by water power.

Early in the power investigation inquiries were set on foot to ascertain the approximate power installed in various industries and localities in India. The total electrical energy generated was only 550,000,000 kw.-hr.

TABLE IV—ELECTRIC LIGHT AND POWER GENERATING PLANTS OF INDIA

	Light and Power Generating Plants, Public							Private Generating Plants				Installed Generator Rating of Electric Railway Stations, Kw.	Total Installed Generator Rating of All Plants, Kw.
Provinces	Number of Plants	Installed Generator Rating, Kw.	Total Connected Load, Kw.	Peak Load, Kw.	Number of Customers	Kilowatt Hours Generated	Kilowatt Hours Sold	Number of Plants Over 200 Kw.	Number of Plants Under 200 Kw.	Installed Generator Rating, Kw.	Total Connected Load, Kw.		
Madras..	2	8,000	6,677	2,070	2,305	7,634,400	5,693,800	7	14 (1912)	4,283	5,626	..	12,283
Bombay.	5	59,672	69,981	46,894	10,377	123,000,000	108,355,000	18	130 (1912)	11,315	11,270	.	70,987
Bengal	5	22,057	36,860	9,287	10,771	32,008,000	23,806,000	41	80 (1912)	33,514	36,000	4,150	59,721
United Provinces	7	5,305	4,174	2,556	3,913	5,768,000	5,014,000	4	47 (1911)	1,260	843	....	6,565
Punjab	4	2,375	3,959	1,409	3,280	4,596,000	3,712,000	2	16 (1912)	2,825	6,715	.....	5,200
Delhi	2	761	1,166	668	2,223	1,993,500	1,197,000	1	5 (1912)	200	175	.	961
Burma	2	5,850	6,244	2,541	4,217	7,866,000	6,075,000	8	60 (1912)	3,360	2,878	572	9,782
Central Provinces	1	250	470	96	174	209,000	182,000	4	28 (1912)	3,510	3,495	.....	3,760
Assam		.				.	...	1	17 (1912)	200	180	.....	200
Bihar and Orissa							....	19	..	19,850	15,206	.....	19,850
Native States		26,200	21,000	15,960		102,560,000	....	..	...	....	....	.....	26,200
Totals for India	28	130,470	150,531	81,481	37,260	285,634,900	154,034,800	105	397	80,317	82,388	4,722	215,509

Some Grounding Chains Are Inadequate

Galvanizing a Source of Trouble Due to Low Melting Point of Zinc—Tension on Chains Necessary to Obtain Results—Effect of Copper Plating

By **ALFRED HERZ**
Engineer of Electrical Tests, Public Service Company of Northern Illinois

IRRESPECTIVE of the most thorough tests of material and the use of the best engineering and operating skill, mistakes and accidents are apt to occur while high-tension lines are being worked upon if no precautions are taken. To prevent this the practice has been to short-circuit and ground the part of the line on which work is being done. The three main reasons for this form of protection are:

1. To give immediate indication of whether the section of line about to be worked on is actually disconnected from all sources of energy.
2. To prevent injury to men working on high-tension lines if such lines be accidentally connected metallically or inductively to a source of energy.
3. To clear the section of line under repair from voltages due to atmospheric and similar causes.

Aside from performing the above duties, a good shorting and grounding device should, if it is to be portable, be such as can be compressed into a small space; should be comparatively light if the transmission lines are located where vehicle access is difficult; should be easy to apply to the line, and should slide readily over the line at the time of its application or removal. The current-carrying capacity should be high and the junk value small to minimize stealing.

Up to this time it has seemed that any chain applied in any manner was deemed ample. The writer has felt that such haphazard methods are not in accord with modern practice in other lines and might not be at all adequate to handle the currents involved in modern transmission systems. To this end a series of tests were made, using some iron chains easily obtained in the market but not commonly used as short-circuiting chains, and some that were actually in use. For instance, in a certain case the common practice has been to use a galvanized chain, such as is used for hanging (raising and lowering) arc lamps, for a shorting and grounding chain. This was submitted to test with the result as indicated by curves. Chains as received from the manufacturer were submitted to the following tests:

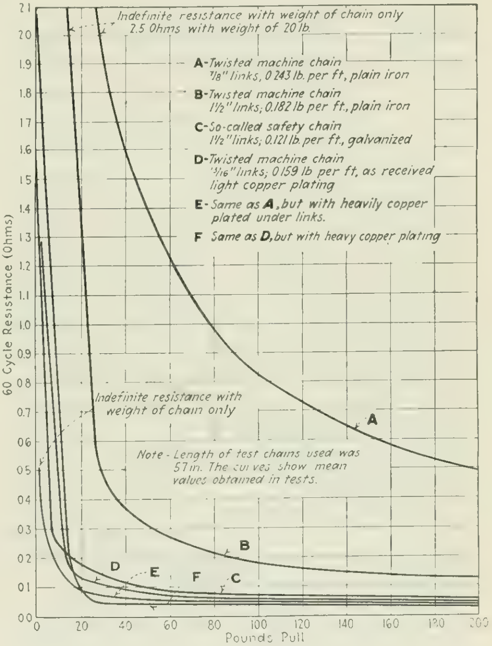
(a) Current-carrying capacity (fusing current).

(b) Resistance relative to tension on the chain.

(c) Effect of weather protection (plating, etc.) on the resistance and fusing current.

In carrying on these tests one surprising fact that became apparent immediately was that galvanizing the chain reduced the current-carrying capacity for heavy currents, the chain actually catching fire or causing a mild explosion when sufficient load was applied, even though this load was considerably below the melting point, or even bright-red heat of the iron, of which the chain is made.

This can be readily explained by the fact that the zinc coating (galvanizing) has a comparatively low ignition temperature, this in turn igniting the iron and bringing about the results mentioned. For instance, the test report says: "The chain separated in less than one minute when subjected to 250 amp. at 60 lb. (27 kg.) dead weight. It was further noted that the chain practically caught fire owing to the zinc coating rapidly oxidizing."



RELATION BETWEEN CHAIN RESISTANCE AND TENSION IN POUNDS

It will be noted that with chain "E," which is same as chain "A" but heavily copper-plated under links, the resistance curve bends more sharply and shows considerably lower resistance than in test of chain "A."

Irrespective of the material of which the chain is made, the tension on it affects its electrical resistance to a great extent.

I do not wish to convey the idea that the material itself has no relation to the resistance, but I do wish to emphasize that the material between which contact is made in the links and the pressure applied have a considerable bearing on the total resistance. For instance, a certain bright iron chain as received had, when submitted to a 100-lb. (45-kg.) pull, a resistance of 0.8 ohm for a certain length. This same chain heavily plated with copper, especially under the links, had one-sixteenth of this resistance with the same pull. When the bright iron chain was submitted to a 200-lb. (90-kg.) pull, it had ½-ohm resistance, which was reduced to one-tenth of this value after plating with copper.

The results obtained on these tests are set forth in the accompanying set of curves, showing the relation of resistance to pounds pull, and clearly demonstrate what I wish to repeat here: that when a chain is used for short-circuiting and grounding purposes it must be continuously submitted to tension while in use. This should be especially watched since the chain might stretch while heated. Noting any of the curves, it becomes apparent that although a short length of chain was used on these tests—about 6 ft. (1.8 m.)—the weight of the chain plus connections was not sufficient to bring the resistance within reason.

Take tests *A*, *B* and *E*. These show an indefinite resistance until the chain is submitted to some tension. These same chains, after being plated with copper, still have unreasonable resistance until a tension of about 30 lb. (13.6 kg.) is applied, after which the chain assumes the characteristic of a solid conductor and can be depended upon to furnish satisfactory means for carrying current. I believe the curves are extremely interesting and I do not recall seeing any other data of a similar nature.

The chains submitted to test were all iron chains and had varying physical characteristics. The curves show the resistance of chain "A" after being copper-plated and chain "D" after being heavily replated with copper.

As to the fusing current, the following tabulation will indicate the result obtained on 9 in. (22.8 cm.) of chain subjected to 60-lb. pull:

Chain "A" broke open in two minutes and twenty-nine seconds while carrying 300 amp.

Chain "B" opened in five minutes when carrying 240 amp.; opened in one minute and five seconds when carrying 300 amp.

Chain "C" separated in four minutes when carrying 180 amp.; separated in forty-eight seconds when carrying 300 amp. and caught fire; carried 1,400 amp. for one and two-tenths seconds; explosion resulted.

Chain "D" opened in thirty-nine seconds when carrying 290 amp. without any undue commotion; carried 1,750 amp. for four seconds; opened without any commotion.

COPPER-PLATED CHAIN SELECTED

From the foregoing it is clear a compromise must be made. This was done in our case by adopting the heavily copper-plated chain "D" as our standard, it being the chain which most nearly conformed to our ideals as to weight, small compass, current-carrying capacity, smooth riding quality, etc. We adopted a somewhat shorter length than usual for our work, since considerable mileage of our high-tension lines is overbuilt with ground wires. We therefore adopted 25 ft. (7.5 m.) as the standard length, and expect linemen to attach a good hand line on each end of the chain. Chain "D" is actually known to the trade as No. 3 twisted machine chain. For our work it is heavily plated with copper, especially under the links.

If for any reason longer lengths of chain are necessary, such as would be the case on lines not overbuilt with ground wires, several of these 25-ft. lengths can be attached to each other very readily by means of bare No. 6 or No. 8 copper wire.

Chains that are slack are worse than no protection at all, since men are liable to obtain a mistaken notion that they are being afforded protection against potential, which is not the case. In a recent conversation with a man who has traveled considerably and witnessed and done considerable high-tension work my assumption of the treachery of loose chains was verified. On the other hand, a recent case comes to my mind where the chain adopted and correctly applied has successfully withstood the brunt of being directly shorted on a system of high-tension lines within a comparatively short distance of a 10,000-kw. low-reactance transformer bank.

Baltimore System of Leaving Meters Alive

Practice of Not Disconnecting Vacated Residences Has Been Both a Service to the Public and a Source of Saving for the Company

BY R. F. BONSALL

Manager General Service Department Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

FOR some years in Baltimore we have been studying and applying recognized business methods in our commercial and operating relations with our customers. In every way possible we have cut red tape in the endeavor to promote a better feeling on the part of the public served. One of the most successful things accomplished has been to stop disconnecting vacated residences.

About seven years ago we decided there was no practical difference between selling merchandise and electricity, where the current and meter were on the premises. Since then we have not disconnected the service and removed the meter when a customer has notified us to "discontinue the service as we are vacating the premises." In deciding on such a policy, we appreciated that there would be a loss representing current registered on the meter while the premises were vacant. We believed, however, that this loss would be more than offset by a better feeling on the part of our customers, to say nothing of a better work distribution by operating departments and less record keeping.

The plan inaugurated, which has been in operation since 1915, consists of leaving the electric service alive in residences, apartments and small stores having an installation of less than 1 kw. By this I mean that once having established connection the service is available for the inspection of premises by prospective tenants and can be used by the new tenant, regardless of the fact that the previous tenant has moved away and ordered the service "discontinued."

When such an order is received we read the meter, which, of course, permits us to render the old customer a bill to the date on which he ordered the service discontinued and leave the service alive to the lamp or appliance, marking the meter sheet in the meter reader's route book as "premises vacant." The meter sheet remains in the route book, necessitating the meter reader seeing that particular meter or checking up the fact that the house is vacant each month on his regular rounds. This condition continues for a period of nine months, when if there is no application for the service the meter is removed on an order issued by the billing department. In our company the meter department is responsible only for the setting and removing of meters and the accuracy of registration on the premises.

Our business office is equipped with an application counter provided with a card file for each premises or apartment where service has been supplied, is supplied or is available. Upon application being made in person, the card file is referred to for data on the service condition or any other information which may have been placed thereon, such as "wiring unsafe," or "certificate withheld." If conditions are satisfactory, the customer's application is taken. Where request is made by mail or phone, the same reference is made to the card file. If conditions are all right, an order is issued to read the meter and at the same time obtain the customer's signature to the order, which then becomes the application. Such a proceeding refers to the class of premises previously mentioned and not to large stores or business places, and only to those locations where service is available. Where a service loop is necessary, orders are issued on the operating departments.

The application is given to one of a crew of men working directly from and under authority of the application department, and he is told to read the meter. His report that he has done so (he marks meter index and date on back of application form) is authority to the billing department to open or close the account at the index reported by the application department. There is no delay in connecting the service, as the new tenant finds it available when he moves in, and he is billed only for the energy used from that time.

HOW UNOCCUPIED PREMISES ARE CHECKED

Should the customer fail to notify us of his occupancy, it is discovered by the meter reader on the following meter-reading date, at which time he reads the meter and places the index on the meter sheet which has been left in the route book. This serves as a notice to the billing department that the premises are occupied. They in turn notify the application department to obtain the necessary application and credit data.

For the purpose of checking credit, applications taken at the counter or reported by the men on the street are sent to the credit department hourly and returned hourly. Cases held for investigation are so noted at the application counter, but 98 per cent of all applications taken are cleared completely within forty-eight hours. The operation of our system, with service always connected and available, makes it unnecessary to carry a large force in order to complete orders in the afternoon which are taken in the morning.

Orders for the termination of service are handled in the same way. They are given to the same crew of men who read the meters, and their reports are authority to the billing department to discontinue an account and mark on the meter reader's handbook that the premises are vacant. In cases of "termination" a tag is hung on the meter stating that service is available and asking that the company be notified that these premises have been occupied. "Telephone St. Paul 8000," we make our slogan. This tag is removed when the man calls to read the meter.

This plan, in addition to its effect on the public, we find of material advantage to the operating departments, inasmuch as they do not have to bother with change-of-name orders, which usually constitute a large percentage of the orders issued. It also means that the application department's crew does not have to be equipped with special automobiles in order to carry equipment quickly. It is furnished only with fuse blocks, a pair of pliers and sealing irons, and the men make better time by using street cars. They complete an average of thirty-five calls a day at a cost of about 18 cents each, as compared with the former practice of handling the same orders through the operating departments, with the necessary exchange of orders, carbon copies, and so on, at a cost of approximately 75 cents. This arrangement is also flexible and simple.

All the New Tenant Has To Do Is Call St. Paul 8000

How the Baltimore Customer Is Saved Annoyance

In Baltimore when home is vacated, gas meter is turned off and tagged. Electric service is always available.

In may other cities—both gas and electric service is discontinued. Meters are taken from home in some cities.

In Baltimore—a telephone call is all that is necessary to have gas service in new home. Electric service is always available.

In many other cities—it is necessary to make personal application before one secures gas or electric service.

In Baltimore—man reads gas and electric meters—turns on gas. Electric service is always available.

In many other cities—time is lost while application is going through various departments, resulting in delayed service.

In Baltimore—new tenant moves into new home, gas and electric service facilitates moving customers pleased with service.

In many other cities new tenant moves into dark house while application for service is held up through red tape.

In Baltimore—customers sometimes write or call at office to express appreciation of Company's handling of requests for service.

In many other cities—red tape results in dissatisfaction on the part of customers, waiting for illuminating service.

TAG HUNG ON METER WHEN PREMISES ARE VACATED

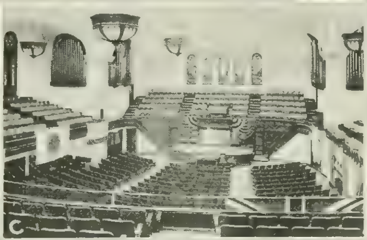
It is economical and profitable, and several of the other larger companies have adopted this plan, although many others have feared that the loss of unaccounted-for energy would be prohibitive. Here is the actual record of registered but not chargeable kilowatt-hours on the lines of the Consolidated Gas, Electric Light & Power Company in kilowatt-hours:

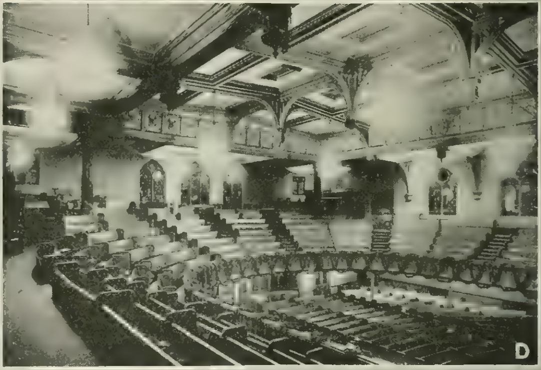
1915	1916	1917	1918	1919	1920	1921*
3,957	3,177	2,337	2,459	4,988	5,862	2,093

*For first nine months.

Figured at the cost of manufacturing energy per kilowatt-hour, the amount of loss is negligible as compared not only with the good will gained but also with the lower cost of operation, to say nothing of valuable flexibility. We have had no reason to regret the adoption of our present policy as applied to our 88,000 customers. The accompanying illustration reproduces a card which we have used to impress upon the public the many conveniences which the system brings to the new tenant in Baltimore. It extends a welcome to the new customer in a very practical and much-appreciated form. It also often aids the real estate man and owner to rent the house more quickly and puts the meter back at work.

Types of Church Illumination Which Have Been Found Effective





A—Direct lighting furnished by 150-watt bowl-frosted "Mazda C" lamps in dense opal-bowl reflectors, on 18-ft. x 14-ft. centers.

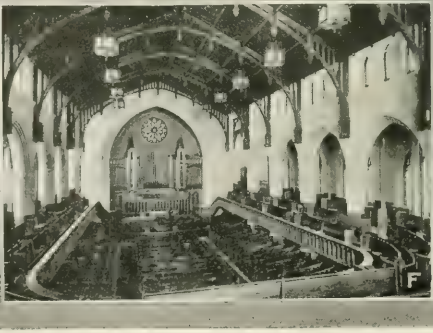
B—Stained glass window illuminated by floodlight.

C—General illumination is furnished by 500-watt "Mazda C" lamps in inverted mirrored-glass reflectors; at capitals in smaller angle units are 75-watt lamps. Concealed units illuminate baptismal pool.

D—The four large central bays are illuminated with 500-watt "Mazda C" lamps; while above the balcony are eight similar fixtures equipped with 200-watt units.

E—Deep-bowl mirrored-glass reflectors are recessed at crossings of arches and equipped with 200-watt and 300-watt units. Small inverted units at capitals and upper corbels afford indirect lighting.

F—Multiple-unit fixture containing four 150-watt "Mazda C" lamps in deep-bowl mirrored-glass reflectors on 15-ft. x 26-ft. centers hung 40 ft. above floor. Downward light diffuses through glass plate.



A Field for Greater Co-operation Between Architect and Engineer

Because of Varied Design the Lighting of Churches Cannot Be Standardized and More Than Usual Attention Must Be Directed to Artistic Effects—Conditions Encountered and Schemes Employed

By A. L. POWELL
Edison Lamp Works, Harrison, N. J.

LIGHTING of churches cannot be standardized, like the illumination of industrial plants, offices or stores, because places of worship vary widely in design and hence demand special attention to the artistic effects. For this reason in any discussion of the subject only the conditions likely to be encountered and schemes which have proved satisfactory in service can be outlined. The essential requirement is that there shall be early co-operation between the architect and the illuminating engineer. Best results cannot be obtained if the engineer does not have an opportunity to suggest modifications in design that will help the illumination effect.

In the church, in contrast to the theater or assembly hall, the lights are turned on the entire time that the congregation is present, so that particular attention must be paid to the arrangement of lighting units, concealing the lamps from view or equipping them with diffusing glassware. The lighting units should be in architectural conformity with the structure, yet the utility of the lighting must also have consideration. Every precaution should be taken to prevent eye strain, which leads to drowsiness and attendant discomfort, and enough light should be provided in all parts of the room to make reading easy. Experience has shown that, if there is no annoying glare or bad contrast, an intensity of from 0.75 foot-candle to 1.5 foot-candles is sufficient for reading at short intervals, as, for instance, during the singing of hymns or psalter responses. It is impracticable to specify the wattage necessary to obtain the desired illumination or give figures on the utilization constants for the different systems suggested owing to the wide variation in character of surroundings. The illustrations show some typical examples, and these, with the data presented in the bibliographical references, indicate the range of values which have been applied.

METHODS TO AVOID IN CHURCH LIGHTING

Huge chandeliers, unless very carefully designed, have no architectural significance, and as ordinarily employed they create severe glare. The tendency seems to be to hang these fixtures too low and use a large number of small lamps. With this arrangement it is almost impossible to avoid glare, and many a church otherwise pleasing is spoiled by such lighting. In a number of instances fixtures originally intended for gas jets or low-powered lamps have been modified to accommodate the brilliant high-efficiency modern lamp and are decidedly objectionable. Where such fixtures are employed special precautions must be taken to see that the light sources are of low brilliancy.

Studded lights around the capitals of the pillars, along the beams and on the corbels are also objectionable, for it is almost impossible to avoid the casting of annoying shadows. While this system sometimes brings out the architectural beauties of the building, it is difficult to maintain, and each burned-out lamp will make a break in the continuity and spoil the effect sought. The use of this system will occasionally produce freak effects. For instance, a row of small lamps around the capital of a pillar may give the appearance of an open space and leave the roof and its arches without visible means of support. The efficiency of this system is low and renewal cost high.

Bracket units at the front of the church and decorative lighting around the pulpit and organ are particularly objectionable, for any one giving attention to the speaker will be looking toward these bright spots. This is one of the most common causes of unsatisfactory church lighting.

FEASIBLE SCHEMES OF LIGHTING

Ritualistic Churches.—In many cases the ceiling of a ritualistic[1] church is too dark in color to warrant the use of an indirect system of lighting and the nave and transept must be lighted by direct overhead units. The following systems of lighting are applicable to the ritualistic church with dark surroundings. Buildings with light surroundings can be well lighted by the methods discussed below under "Evangelical Churches."

1. Direct-lighting fixtures consisting of clear gas-filled lamps and reflectors inclosed in some sort of ornamental house. This can be made up of art glass and wood or metal work in the form of a lantern to inclose one or more units (see opposite page). The multiple-unit fixture offers certain advantages in that the failure of one unit will not leave an entire section in shadow. Mirrored-glass reflectors are excellent here, but must be supplemented by a few low-wattage lamps inside of the fixture to illuminate the art glass. Translucent, prismatic or dense opal reflectors are also effective, and the transmitted light serves the purpose of the small lamps. Such fixtures as these can be relatively large

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[1] Churches fall in two distinct groups—the ritualistic and the evangelical. In the former the sanctuary or altar is the center of attraction and symbolically demands the higher intensity of illumination. In the evangelical church the speaker, pastor or minister is symbolically the representative of the divine power and demands the higher illumination. The very structure of the buildings devoted to these two groups still further separates their lighting requirements. The ritualistic church is generally of the Gothic type of architecture with the nave and transept forming a cross. A high peaked roof is also characteristic of this form of structure, and dark surroundings are likely to prevail. In the evangelical church the basilica type of structure is frequently followed. The ceiling is more likely to be light in color and also flatter. Even where the Gothic style of architecture is employed in these churches, it is usually modified and presents less of a lighting problem.

when suspended from the peak of the arch or smaller in size when dropped from the hammer beams.[2]

2. Bowl-frosted "Mazda" lamps in simple direct-lighting opalescent-glass reflectors can be suspended from the hammer beams and form a very inexpensive method of lighting. If possible, a Gothic type of decoration should be secured. This scheme, with a different arrangement, is pictured on page 180. As an alternative to open-type reflectors, simple types of inclosing globes of Gothic design can be used in the same position. Opalescent glass, of course, gives good diffusion, but the whiteness of the glass shows up in contrast with the background. It is desirable, therefore, to employ units with a spray of light brown or similar color. The slight absorption of the toning is offset by the improved appearance of the installation.[3]

3. Direct-lighting angle or symmetric reflectors, with clear "Mazda" lamps, can be placed behind the hammer beams, sending the light downward. These should be on the side toward the altar, not in the general view of the congregation, and if the proper type of reflector is chosen, they will not be annoying to the speaker.[4]

4. In the Gothic structure, with light surroundings, a combination of direct and totally indirect lighting is often applied with excellent results, as indicated on page 180. In this building the utilization of light from an indirect system would be of a very low order owing to the great height in comparison with the width. Direct-lighting reflectors are recessed at the crossing of the arches, and the indirect units eliminate severe contrasts in brightness.

Evangelical Churches.—Since the ceilings of many evangelical churches are light in color and nearly flat, there is considerable latitude in the choice of lighting equipment. In contrast with the pure Gothic structure, all three systems of illumination—direct, semi-indirect and totally indirect—have their uses. Frequently the architectural features of the building offer certain logical places for the attachment of lighting fixtures, at the crossing of the nave and transept, for example, or at symmetrical points along the main peak. Balance is usually desirable in the location of outlets.

Many forms of direct-lighting devices suggest themselves. They should generally be of the inclosed, rather than the open, type, as the likelihood of glare is then diminished. Decorated opalescent glass, parchment and painted mica are among the materials which can be effectively used for this purpose. A very wide latitude exists in the choice of equipment. The funds available for fixtures will govern this factor. As an example of extreme simplicity, inexpensive inclosing units with clear "Mazda C" lamps can be placed at the apex of the arches separating the side aisles from the main aisle in the modified Gothic structure. A sufficient spread of light will be obtained and lighting units will be well out of view.

Semi-indirect units symmetrically spaced are applicable to the church with a light-colored ceiling and are available in a wide variety of decorations which will harmonize with the architectural design. The character of illumination which can be obtained when this system[5] is employed is indicated on page 180.

Totally indirect illumination can be accomplished in a number of ways. Hanging ceiling fixtures with clear "Mazda C" lamps in mirrored-glass reflectors concealed by an appropriate decorated housing are inexpensive and relatively simple to install. Smaller lamps in mirrored-glass individual or trough reflectors can be placed in a cornice, or groups of such units may be placed in recesses at the tops of the columns or capitals.[6] Wall boxes with suitably designed mirrored-glass reflectors have also been employed for this method of lighting. Occasionally recessed windows offer logical locations for such equipment. A novel method of indirect illumination is used in one church where deep recessed boxes are used at the front of the balcony, these boxes being so shaped as to confine the light to the ceiling and avoid "spill" light on the walls.[7]

Many churches are provided with an art-glass ceiling to admit natural light. Excellent artificial illumination can be accomplished by properly placing direct-lighting reflectors and clear "Mazda C" lamps above the skylight. Where the skylight is limited in area it is often necessary to supplement illumination received from this by overhead units placed between it and the side walls. A combination of semi-indirect or totally indirect illumination and the diffused direct light through the sky window proves effective.

For balconies the general overhead lighting of the auditorium will usually take care of the balcony itself. Lighting beneath the balcony can be accomplished by the use of the wall-type indirect lighting box previously mentioned, close ceiling hemispheres or flat plates attached to the lower side of the balcony. The glass should be of an opalescent character giving good diffusion with minimum absorption.

In order that the minister or speaker shall be illuminated to a higher degree than the body of the church, it is desirable to have some means of projecting light on the pulpit. The suspension-type spot lamp with a concentrated-filament "Mazda" unit is compact and can be hidden from view. One of these units placed above the speaker will produce the desired result. It should be focused so that a rather spread (not sharply defined) spot is obtained.

On account of the desirability of concentrating the attention on the elaborate ritual in the sanctuary, this must be the most brightly lighted portion of the church, and yet no lights should be visible, for the congregation faces in that direction. In the Gothic structure there is usually an excellent opportunity for placing the units behind the chancel arch. Angle-steel or mirrored-glass angle reflectors simplify the problem remarkably.

The sanctuary should have plenty of light to bring out its decorative value, and yet the altar should not be uniformly bright, for shadow effects are then lost and the elaborately carved portions appear flat and dull, with consequent absence of detail. It is usually better to light the altar from the sides, simulating the daylight values, rather than from the top, to avoid any deep shadows without entirely eliminating them.

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[2] "Relighting an Old Church," by W. J. Wheeler, *Lighting Journal*, January, 1917; "A Rather Novel Method of Church Illumination," by J. L. Stair, *Lighting Journal*, January, 1914; "Lighting a Cathedral at Albany, N. Y.," by J. W. Mackie, *Lighting Journal*, April, 1916.

[3] "Church Lighting," by A. L. Powell, *General Electric Review*, February, 1914; "Improved Lighting of a Well-Known Church," by A. L. Powell, ELECTRICAL WORLD, Nov. 14, 1914.

[4] "A Problem in Church Lighting," by A. H. Ford, *Lighting Journal*, July, 1913; "A Semi-Concealed Church Lighting Installation," ELECTRICAL WORLD, Dec. 30, 1909.

[5] "A Pleasing Church Installation," by A. L. Powell, *Lighting Journal*, February, 1914; "Lighting of a Church Basement," by R. Simpson, *Lighting Journal*, September, 1913.

[6] "Lighting Installation for a Church Auditorium," by H. O. Stewart, *Electrical Review*, July 5, 1919; "A Unique Method of Lighting a Church of Unusual Architecture," by J. C. Stehley, *Lighting Journal*, June, 1913; "Modern Illumination in Churches," *Lighting Journal*, January, 1913; "Concealed Lighting That Emphasizes the Architectural Features of a Cathedral Interior," by J. L. Stair, ELECTRICAL WORLD, July 8, 1916; "Lighting a Church of the Basilica Type," *Electrical Review*, Sept. 30, 1916; "Lighting the Church of St. John the Divine, New York," by W. H. Spencer, *Illuminating Engineer*, May, 1911; "Effective Illumination Scheme of Holy Trinity Church, New York," ELECTRICAL WORLD, March 2, 1912, and *Illuminating Engineer*, March, 1912; "Indirect Lighting in Auditoriums," by H. B. Wheeler, *Transactions I. E. S.*, Vol. 7, page 163; "Examples of Church Lighting Installed by a Central Station," by W. R. Moulton, *Lighting Journal*, June, 1915.

[7] "Illumination of St. George's Episcopal Church, Newburgh, N. Y.," by A. L. Powell and R. B. Thompson, ELECTRICAL WORLD, Feb. 26, 1916.

The lamps should be so arranged that the choir stalls are well illuminated, and it is often desirable to have the units on several switches, to meet the demands of the different portions of the services.[8]

In the synagogue the scroll kept in a cabinet at the rear of the altar should be illuminated by a few low-wattage lamps placed to furnish uniform illumination. A switch turning these on automatically as doors are opened is a desirable accessory. An outlet above the altar for a low-wattage lamp for the "Light Everlasting" and convenience outlets for the imitation candlesticks on the altar are also necessary features.

Choir Loft Presents Problem

In the evangelical church the choir loft occasionally presents a problem. Often it is at the front of the church. The light from the main auditorium units is low in intensity and comes from the wrong direction. A practice often followed is to place a few brackets on the organ and shield the lamps with some sort of diffusing shade.

These units are continually in the vision of the congregation and are extremely annoying. One solution is to place the lamps in recessed boxes in the overhanging portion of the organ and diffuse the light through glass plates. If the organ structure will not permit of this, recourse has been made to bowl-shaped steel reflectors painted on the outside to harmonize with the organ finish and used on brackets. While these are not especially decorative, a strong light is provided on the books of the choir, and as the reflectors are opaque, the eyes of the congregation are protected. Reading lamps on music racks, as in the orchestra pit of a theater, are also applicable and possess many advantages.

A local lamp is, of course, provided for the organist, and in many instances it is advisable to have a low-candlepower lamp below the keyboard to illuminate the pedals. All these lamps should be separated from the main circuits and readily controllable during rehearsals.

Make Stained-Glass Windows Attractive by Night and Day

Most churches have at least one elaborate stained art-glass memorial window, which can be made a thing of beauty at night as well as day. For this purpose weatherproof-type, enameled-steel angle reflectors with clear lamps have proved of use. In most cases it is necessary to make a point-by-point illumination calculation to determine the type of unit and its location for the even distribution of light, and this can often be supplemented by some slight experimentation to determine the final result.

As a general rule, the window should be evenly illuminated, and it is bad practice to have the light source visible through the glass. Sometimes, however, there is a point in the design which logically demands a higher intensity of light, as, for example, the sky in a landscape scene, and this feature must have attention, as evidenced by Fig. 7, where the Saviour is the most brilliant spot.

For large windows a very effective method is to project from a distance a beam of light having sufficient spread to cover the entire window area with a uniform intensity. There are available weatherproof floodlighting projectors which are especially applicable to this class of work. They can be mounted on a post or other convenient location, from 25 ft. to 300 ft. (7.5 m. to 90 m.) from the window, the beam being trained on the window and its spread varied as necessary. The 500-watt unit is sufficient to cover 20-ft. (6 m.) windows with the unit mounted, 100 ft. (30 m.) away.[9]

Suggestions Regarding Wiring

In many respects the demands of the church are similar to those of the theater, and it is advisable to have a conveniently located central control. Dimmers are an especially desirable feature, both on the main and chancel circuits. During the sermon the dimming of lights produces an excellent effect.

An experiment with colored lighting is now being carried on in St. Mark's Church in the Bowery, New York City.[10] Direct-lighting lantern-type fixtures are used to produce red, amber, blue and green-toned illumination. During the prayer one combination is employed, during the sermon another, at the offertory still another, and so on. The psychological effect is taken into consideration at each point, blue and green for meditation, red and amber for stimulation and so on. There are undoubtedly wonderful possibilities in this, and the future will see great developments. Such manipulation of the light requires a number of circuits with the necessary switching and dimming controls.

Standard convenience outlets at certain points about the building are a necessity. In some churches entertainments are given requiring the use of a stereopticon. A stage pocket at the rear of the auditorium with sufficient capacity for the lantern is a feature worthy of attention. On various occasions decorative lighting is called into play, as, for example, at Christmas time when a tree might be illuminated by small lamps. A receptacle on the rostrum or stage is necessary for such occasions.[11] Many clergymen use notes, and a reading lamp giving a strong localized light is often necessary.

A feature often overlooked in designing a lighting system is the fact that reflectors and lamps become covered with dust, which very materially reduces the light output. In many cases complaints of poor illumination are due to this cause alone. In the church, with its high ceiling, fixtures are very likely to be most inaccessible, and the sexton hesitates to risk his safety for the sake of cleaning the lamps. If one wishes the installation to give continuous satisfaction, he should keep the question, "will it be easy to clean reflectors and replace burned-out lamps?" constantly in mind. Equipment should be installed so that it is directly accessible or lowering devices should be provided. Automatic cutout hangers are of assistance here, and suitable windlasses for massive fixtures are a necessity.

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[8] "Chancel Lighting," by R. B. Ely, *Lighting Journal*, January, 1913; "Electricity Versus Wax in Religious Work," by Roscoe Scott, *Electrical Review*, Feb. 3, 1912.

[9] "Light the Church Windows," by J. R. Colville and D. S. Myers, *Electrical Merchandising*, November, 1921, and *Electrical Review*, Dec. 10, 1921; "Lighting Opportunities in Stained Glass Windows," by Roscoe Scott, *Electrical Review*, June 9, 1917; "Church-Window Floodlighting," by A. O. Davis, *Lighting Journal*, October, 1916.

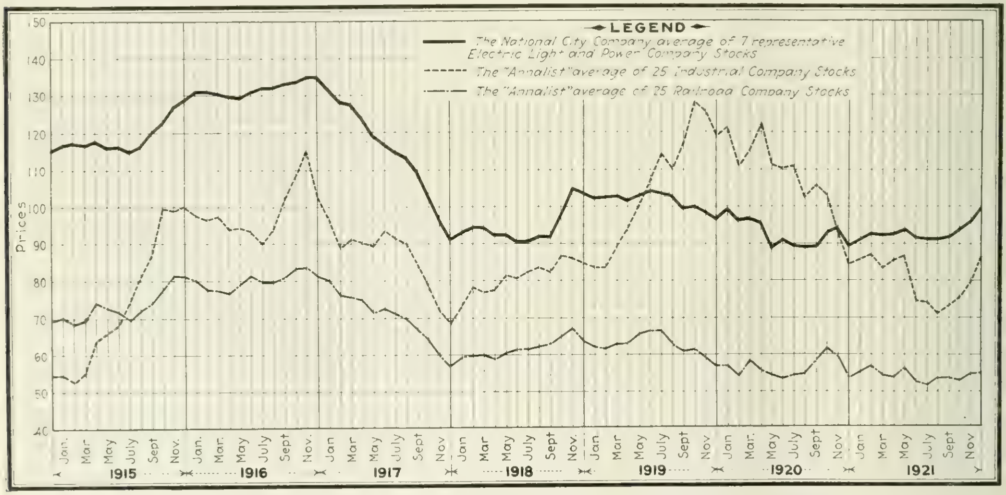
[10] "Illumination Features of St. Mark's," *Electrical Review*, Dec. 17, 1921.

[11] "Special Lighting Effects for Christmas Entertainments," by A. L. Powell, *Electrical Merchandising*, November, 1919.

Light and Power Stocks Take Upward Turn

Marked Stability Has Been Shown by These Securities in Comparison with the Fluctuations of Industrials and Rails

PERHAPS one of the most encouraging outcomes of the period of depression which gripped all industry during the first three-quarters of 1921 has been the enviable position attained in the financial world by the stocks of electric light and power companies. Careful investors are seeking securities the value of which will not be materially affected by existing industrial conditions, and it would appear that the stocks of electric light and power companies are meeting these rigid requirements. Our industrial and financial structure is so interwoven that absolute immunity from outside effects is impossible, but when an industry like that devoted to electric light and power supply becomes part and parcel of the national life its earnings, both gross and net, fluctuate little from year to year.



SEVEN-YEAR FLUCTUATION OF LIGHT AND POWER STOCKS ONE-THIRD THAT OF INDUSTRIALS

Moreover, the electric light and power industry is a growing industry, as is instanced by the acquirement of 1,001,700 new residential lighting customers during 1921 and an increase in the total gross revenue of $51,200,000 over that of 1920, which was itself a record year, while during the same period the total operating expenses decreased by $8,853,000. The investing public is beginning to sense these dividend-paying qualities exhibited by electric light and power companies' stocks. Through the courtesy of the National City Company, the ELECTRICAL WORLD is able to continue through December its chart* showing the average prices of the common stocks of seven representative light and power companies, twenty-five industrial stocks and an equal number of railroad stocks.

So far as is possible, the electric light and power stocks represented in the curves are of companies having a purely electric light and power business. With one exception, companies combining more than one utility have not been included in the tabulation. In order that the curves may be comparable the values plotted have been obtained by averaging the high and low.

There has been a marked tendency toward stability in the market price of electric light and power stocks during the past year as against a very appreciable fluctuation in the case of stocks of industrial corporations and rails. The accompanying tabulation of price of stocks brings out very clearly this comparative stability. The fluctuations in the prices of bonds of companies in the industries represented, while much less pronounced, would show approximately the same relative proportions as do the junior securities.

It will be observed that the total fluctuation of the electric light and power stocks based on the percentage of the range to the low during the past seven years has been but one-third that of the industrials, and considerably less than that of the seasoned rails. This relation holds substantially true not only over a long period but for the past year of reactionary market tendencies as well. The stability of the electric light and power stocks is a reflection not only of their relative immunity from temperamental labor markets (statistics show that the labor item amounts to but 18 per cent of the gross revenues of the electric light and power companies as compared with 52 per cent in the case of the railways), but, as indicated above, from the rise and fall of the cycle of business prosperity as well.

	1915 to 1921 Inclusive				Year 1921			
Stocks	High	Low	Range	Per Cent of Low	High	Low	Range	Per Cent of Low
Industrials..	127.96	52.57	75.39	143.3	86.47	71.49	14.98	20.9
Rails	83 60	52.31	31.29	59.9	56.80	51.50	7.30	14.2
Electric light and power....	134 81	88.71	46.10	52.0	99.55	90.18	9.37	10 4

The fact that the prices of electric light and power stocks increased during the later part of 1921 was due in large part to the principle that since the earnings of utilities companies warrant virtually a fixed return on their stock, these stocks will follow inversely the market price of money.

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*See ELECTRICAL WORLD, July 23 and Oct 8, 1921.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Time Switch Compensates for Varying Time of Dusk

To the Editors of the ELECTRICAL WORLD:

Permit us, as factory representatives of the time switch mentioned in the article on "Achievements in Electrical Equipment" in your issue for Jan. 7 (page 17), to draw your attention to two statements which, if left uncorrected, will give your readers an erroneous impression. The small motor used in this switch is of the universal type, series-wound, and can be operated on 110/125-volt or 220/150-volt alternating current or direct current. The automatic adjustment is to compensate for the changing length of the nights, not months. It is accomplished with the patent "astronomic" dial, which closes and opens the circuit in accordance with the varying time of dusk and dawn throughout the year, thus eliminating adjustment by hand.

We appreciate the recognition you have given this time switch in your valuable article, but in justice to the product in question, and particularly on account of the identifying illustration accompanying said article, we should appreciate a correction, if possible.

R. W. Cramer Company, R. W. CRAMER.
New York City.

Carrier Current for Interstation Communication

To the Editors of the ELECTRICAL WORLD:

On page 1,189 of the ELECTRICAL WORLD issued Dec. 10, 1921, I note an article entitled "Carrier Current for Interstation Communication Demonstrated." In this article it is stated that effective communication between generating station and distribution centers by the carrier-current system over power lines was demonstrated for the first time by the General Electric Company.

I beg to call your attention to an article in the ELECTRICAL WORLD of July 17, 1920, page 141, which article was an account of a demonstration of carrier-current communication over power wires of 22,000 volts between Atlantic City and Ocean City, N. J. This demonstration was very successful. In May, 1921, we obtained results by means of the same system in talking over a transmission line operated at 132,000 volts between Canton, Ohio, and Wheeling, W. Va., a distance of about 55 miles. The circuit at that time was delivering 25,000 kw. of energy. In this system the carrier-current frequency was obtained by means of oscillator tubes, and a connection to the high-tension line was made by means of current transformers. The experiment was repeated with the connection to the line made on the low-tension side of the power transformer by means of current transformers. In other words, we succeeded in talking through the power transformers. With the large amount of energy transmitted at the time of talking, there was virtually no 60-cycle noise in evidence.

I am merely calling to your attention the misstatement of the fact contained in your specific assertion that carrier-current communication over power wires was first demonstrated on Dec. 7, 1921, while we had successfully demonstrated it in June, 1920.

M. L. SINDEBAND.

American Gas & Electric Company,
New York.

[Mr. Sindeband is quite correct in his statement, but the American Gas & Electric Company's demonstration, as the published statement shows, was before officials of that organization. In that sense it was not a public demonstration. The significance of the recent statement in the ELECTRICAL WORLD was that the General Electric Company had developed its equipment to the point where it was willing to demonstrate it before a representative group of the electric light and power industry.—EDITORS.]

Electrical Ore-Locating Device Developed in Arizona

To the Editors of the ELECTRICAL WORLD:

We have had a great many inquiries relative to the ore-locating device developed by the Arizona Bureau of Mines, and the thought occurred to us that perhaps a number of your readers would be interested to learn of the present status of the work. I wish to say that we have been conducting experiments with it for over a year and now feel convinced that it is practicable. Our work has been almost entirely confined, however, to copper ores, but we are satisfied that it will operate equally well on pyritic gold ores. We expect to continue our experiments for several months more and hope to have an opportunity to ascertain whether the device can or cannot be used to locate deposits of other metals.

No description of the process or apparatus will be issued until it is known that our application for patent has been received and filed in the Patent Office at Washington. Neither will any attempt be made to use the apparatus commercially until more information concerning its possibilities and limitations has been secured. It is possible that one or more companies will be formed next summer to use the process commercially. The university will never use the process for the benefit of individuals and may make no attempt to benefit financially in any way from the invention. It will, however, probably retain sufficient control over the device to prevent its ever being used by incompetent or dishonest people.

The process is not applicable, so far as is now known, to the location of oxidized ores, nor can it at present be used where there are numerous metallic connections between the surface and underground sulphide-ore bodies.

The apparatus used is comparatively expensive and delicate, and a high degree of technical skill is necessary to utilize it satisfactorily. For these reasons it is presumed that mining companies will employ men trained in the use of the method rather than attempt to use it themselves. The expense of the work may then easily run up into thousands of dollars, but under suitable conditions may readily result in the saving of vast sums of money and the more complete development of our mineral resources.

G. M. BUTLER,
University of Arizona, Dean and Director.
Tucson, Ariz.

Transmission of Radio Signals Beyond the Earth's Atmosphere

To the Editors of the ELECTRICAL WORLD:

I have read the letter of Charles Rettie published in your issue of Jan. 14 with great interest, particularly because of the suggestion that it may be impossible to transmit radio signals beyond the atmosphere of the earth because of the electrical conductivity of an upper layer. It does not appear to me that the mere fact of conductivity precludes the possibility of the passage of electrical disturbances through or beyond this layer. In the first place, this layer is probably not uniform and therefore its conductivity may vary from place to place. In addition to this, it seems quite possible that local regions of high electric intensity as between the earth's surface and the upper conducting layer taking place over very short intervals of time may well cause oscillations of charges in the non-uniform conducting region of the upper layers. In this way it would appear quite possible to obtain potential gradients beyond the region of high conductivity.

There is one natural phenomenon which suggests that it may be possible to penetrate the upper conducting layer, namely, the magnetic storms on the surface of the earth. It is supposed that these storms have their origin in phenomena on the sun. It is well known, for example, that a period of great sun-spot activity is usually accompanied by magnetic storms on the surface of the earth. It is suggested that the sun emits streams of negative electrons and that the absorption of these electrons in the upper layers of the atmosphere causes not only variations in conductivity, but also the emission of electromagnetic waves which penetrate into the earth's atmosphere, causing such phenomena as magnetic storms, the aurora borealis, and possibly other types of meteorological disturbances.

It appears to me therefore a somewhat extreme claim that owing to the conductivity of the upper layers it is impossible for electromagnetic disturbances to pass through them. J. B. WHITEHEAD.

Johns Hopkins University,
Baltimore, Md.

Changes Necessary in Pole Specifications

To the Editors of the ELECTRICAL WORLD:

As pointed out by you on page 1310 of the Dec. 31, 1921, issue of the ELECTRICAL WORLD, several agencies are at work at present proposing changes in pole specifications in an attempt to unify the present specifications and to make similar specifications for all kinds of timber. In my opinion there are two important reasons for this state of affairs. One is our knowledge that there is a noticeable decrease in the supply of timber that meets with the present specifications. This naturally means that poles bought under these specifications are increasing in price, with the evident result that the buyer is trying to determine the cause of this increase. The producer also realizes that he soon will be unable to furnish poles bought under present specifications, and his hope is to make better use of the timber that nature is growing.

The second important reason is the more general realization that what is wanted in poles is a given strength at the most reasonable price. This realization is in part due to the rise of price of poles and in part to an advance in engineering knowledge. The actual stresses on poles in operation are better understood than they were. The necessity for specifications resulting in the purchase of poles of uniform strength is becoming more apparent. The fundamental principle that the weak section of a pole should be taken at the ground line is better understood. The fact that decay lowers the weak section from some point above the ground on a new pole to the ground line on a pole that has been in service some time has become well known. The effect of the top diameter in the matter of strength is understood, and it is appreciated now that all that is necessary, except in case of special guying, is a section at the top large enough for framing. The conclusion can therefore be drawn that better knowledge of stresses on poles and the desire for economy are going to result in better use being made of our timber. There is little question that specifications will be drawn in the near future that will be satisfactory both from the conservation standpoint and the structural standpoint.

Detroit Edison Company, P. O. REYNEAU,
Detroit, Mich. Assistant Electrical Engineer.

Saving from Increased Feeder Capacity

To the Editors of the ELECTRICAL WORLD:

Often in direct-current installations where a mixed load of motors—say mining machines, locomotives and pumps—is operated from the same feeder line, it is desirable to demonstrate the saving in watts which will result from increased feeder capacity. Such a load, of course, registers a certain value in amperes on the switchboard at the power house or substation. By Ohm's law, since we know the resistance of the present feeder in ohms and the current it carries in amperes, we can determine the drop in volts and from it the operating voltage at the point of load. The input watts of the machinery in question will then be the product of this voltage times the amperes. To ascertain the saving from putting additional copper into car lines, we must first determine the decreased current values which will flow due to the lessened resistance.

If we use the formula $I^2R - EI = -W$, in which $R =$ resistance in ohms of feed line with added capacity, $E =$ voltage at generator, and $W =$ input watts of load derived from former values for volts and amperes at point of load, then $E \times$ (old value of I) $- E \times$ (new value of I) $=$ saving in watts brought about by increasing feeder capacity.

This, of course, will not be entirely accurate since increased motor efficiencies will give slightly reduced outputs. Thus, in order to get the same output from our motors as formerly, our new value of I will be slightly greater than it appears from the equation and our saving in watts slightly less. However, the results obtained are sufficiently accurate for most practical purposes.

In applying a single motor at the end of a transmission line, or in calculating saving from increasing the size of the transmission line in such an installation, if the formula is written as follows quite accurate indications of expected results will be obtained: $I^2(R + R_1) - EI = -W$, in which $W =$ load in watts of motor (hp. $\times$ 746), $R =$ line resistance, $R_1 =$ resistance of armature circuit of motor, and $E =$ generator voltage.

The writer has found both applications of this equation quite useful. E. D. KNIGHT,
Chief Electrician.

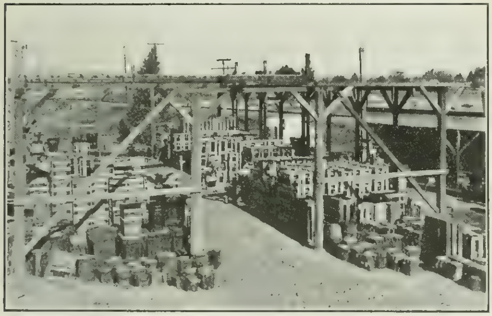
Cabin Creek Consolidated Coal Company,
Kayford, W. Va.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Distribution Transformers Stored Outdoors

A CONSIDERABLE saving in the cost of warehousing and handling a large order of distribution transformers was effected by the San Joaquin Light & Power Corporation of Fresno, Cal., through the storage of these transformers in a yard, as shown in the accompanying photograph. A hand-operated crane was erected overhead on a wooden structure at a very low price, and the transformers were hauled into the storage yard on trucks, unloaded and stacked by the use of the crane. In a similar way when removing transformers they were placed on a truck with the greatest ease. In the San Joaquin Valley the climate is comparatively dry, and as the transformers did not remain outdoors very long no great risk was run of damaging them by moisture.



SHOWING EIGHT THOUSAND TRANSFORMERS STORED OUTDOORS

San Joaquin Light & Power Corp., E. P. SMITH.
Fresno, Cal.

Single Conductors in Iron Pipe Found Objectionable

SOME time ago the writer had occasion to investigate certain damage upon outgoing feeders from a substation. The damage was caused through a severe lightning storm striking the aërial lines. The feeders were single-conductor, lead-covered and paper-insulated, and ran up the wall of the station in iron pipes connecting with the overhead lines on the roof. These feeders running in the iron pipes were connected with an automatic voltage regulator in the station, and for lightning protection a set of choke coils was connected in the overhead lines together with an electrolytic aluminum lightning arrester. The lightning upon striking the lines passed the choke coils and broke down the insulation on all the cables entering the pipes. According to my observations, this was caused by the inductance of the pipes piling up a high induced voltage on the end of the cables.

When a single conductor in an iron pipe carries an alternating current the amount of flux interlinking the conductor throughout the pipe length is greatly increased on account of the high permeability of the iron, and as the conductor is carrying an alternating current the rapid reversal of the flux produces hysteresis and eddy-current losses which are dissipated in the iron as heat. The temperature may become so high as greatly to increase the fire hazard. For this reason it is not safe practice to run single alternating-current conductors through iron pipes. The inductance set up by having the cable surrounded by iron produces a steep wave front or high-frequency surge and increases the likelihood of insulation failure especially where the cables enter the conduits. R. H. N. LOCKYER.
Trail, B. C.

Erector's Instructions for Installing Engine-Type Generators

PLANT engineers who have not had experience in erecting engine-type generators may find some value in the following directions, which are intended to cover the problems usually arising in installing such equipment. The instructions apply to moderate size engine-driven machines of either alternating-current or direct-current design in which the rotor has been forced on the shaft at the factory. It is assumed that the engine bed has been set and that no crane is available.

Run a line through the center of the bearings and with a straight edge laid across the generator foundation measure from the bottom of the straight edge to the line to see if sufficient space is available for the generator. Next, measure from the center of the armature core to one crank disk and drop a light plumb line down into the generator pit from the line through the bearings to check the position of the foundation bolts. Measure in all directions, this plumb line to hang at a point corresponding to center of armature core as measured from the disk.

After placing cap plates on foundation bolts with a wedge under each corner, put the bottom half of field frame over pit, skids and all. To remove skids, rig a gin pole or A-frame for lifting frame. Lift one end, cut skids and remove the lifted end. Replace skids by substantial blocking so weight rests on cap plate. Do the same at other end. Then by raising one end and putting in lower blocking let that end down 2 in. or 3 in. Repeat on other end and continue till all blocking is cut and bottom half rests on cap plates. An A-frame like a big sawhorse with a chain block over each plate will handle this job quickly and well. If the chain hoists and A-frame are strong enough to trust, the bottom half can be lifted clear of skids, the skids removed and the piece lowered onto plates without blocking; but it is always wise to keep enough blocking under the feet so that if anything breaks, the piece cannot fall more than 2 in. or 3 in. Having landed the bottom half on the cap plates, move it over so that the foot bolts can be inserted. Then start the bolts in the threads and shift the frame so that the bolts stand centrally in the holes, finally screwing down tight with no shims under the feet.

With the slush cleaned off the bearing portions of the armature shaft block up the ends high enough for the crank disk to clear the engine bed. By careful blocking and lifting shift the rotor over until the shaft rests in the bearings and lower it. With the assistance of the engine man check the shaft to see that it is level. Then wedge up under the cap plates until the bottom half clears the armature.

The top half of the field frame should then be placed over the bottom half, lowered and the frame bolts inserted and drawn tight. The field frame and cap plates can then be shifted as one piece until the poles line up with the core all the way around. This can be best done by putting three wedges under each cap plate, locating a wedge at the middle of each end and at the middle of one long side. By driving in or pulling out these wedges the whole piece can be lifted or lowered a little, and by driving in the wedge at one end of each cap plate and pulling out the other end the frame can be rocked on the middle wedge so that it will stand plumb and the poles will line up with core all the way around.

At the same time see that the air gap on each side is equal and that the air gap at top is about 1/16 in. (1.5 mm.) greater than at bottom. Lay a long straight edge across pit on the cap plates and place a level on it to be sure that the cap plates are approximately the same height. The purpose is to fit everything to the armature and shaft.

Carefully, and without disturbing the adjustments, drive a wedge under each corner of each cap plate, close to the foundation bolt. Drive just enough to set firmly and draw down tight on the bolts. Take out all the wedges except those at the corners, except in the case of very long plates or very heavy machine, when the middle wedge on the long side should be left in. Check all adjustments once more and "grout in" the cap plates.

Grouting is usually part of the foundation man's job and should be done as follows: Build a dam around each cap plate, as high as the top surface. Make the dam of mud, bricks, boards or any convenient material. Mix Portland cement and water to form a thin paste, like thick paint. Pour into grouting holes in plates until spaces under plates are full. Allow it to set two days, remove dams, and trim off excess cement around outside. The wedges can be left in place if they are not unsightly. Engine men usually take out their wedges, but they have reasons which do not apply to generator work.

After grout has set, if it is a split-frame alternator, remove the foot bolts, clean off the cap plates, side-shift the stator and put in joint coils and bridges, and connect the winding. Then shift the stator back to place. Raise the lifting screws and put in sheet-iron shims under each foot to make the air gap correct at top and bottom. It is advisable to leave it a little less, not more than 0.006 in. (0.4 mm.) less on top than bottom. The unbalanced magnetic pull thus created relieves the bearings of some of the armature weight. If too much out of center, a direct-current armature without balancing windings will have unbalanced currents and brushes may spark. The reason for setting a frame so that it is just comfortably clear of the armature when all shims are out is to allow all shims to be removed and still have clearance enough to side-shift the frame. It is difficult to shift a frame with shims under the feet, and it is difficult and bad practice to shift a frame while standing on the lifting screws. After the grout has set and shims are in make sure that the foundation nuts and foot bolts are tight. Then put on small fittings such as brush rig, shields and terminals.

If the machine has a pit plate, set it on the floor or over the pit with a wedge under each corner. Along each edge place two pieces of strap iron, about as thick as the amount of shims under each frame foot. On top of these pieces of strap iron lay three or four sheet-iron shims (full size) of pit plate. Then drive in wedges with a heavy hammer until the pit plate and its shims sit firm under the pad on the bottom of frame, and grout the pit plate.

Go over every bolt and nut to see that they are tight, clean up machine and adjust and sand the brushes ready to start up. If it will be some time before the machine is started provide a covering to keep it clean and dry. Apply grease or vaseline to all bright iron or steel parts so they will not rust. If the machine is left without starting it, leave it with brushes raised and the field circuit open at the machine so the engine man can run and tune up his engine without running up voltage on the machine.

James Dixon.

Reliance Electric & Engineering Company,
Cleveland, Ohio.

Unit Costs for Estimating Line Extensions

To reduce the cost of estimating pole-line extensions the accompanying table has been computed. The various items have been separated so that the cost of labor and material may be readily obtained for any portion of an extension on either existing poles or new poles, and the same classifications permit the separations of an estimate into the respective accounts to which the work is chargeable.

COST IN DOLLARS FOR EXTENSIONS TO DISTRIBUTION

Description	Spans										Average per span for more than five spans.	
	1		2		3		4		5			
Poles and fixtures:	Material	Labor	Material	Labor	Material	Labor	Material	Labor	Material	Labor	Material	Labor
30 ft	27.63	13.18	49.67	19.26	69.62	25.34	89.75	31.40	109.71	37.50	20.95	6.79
35 ft	31.28	13.36	56.77	19.62	80.42	25.88	104.25	32.12	127.41	38.40	24.60	6.97
40 ft	34.30	13.96	62.97	20.80	89.62	27.70	116.45	34.50	142.91	41.40	27.62	7.57
45 ft	42.64	14.70	79.65	22.30	114.62	29.90	149.95	37.50	184.51	45.10	35.96	8.31
50 ft	49.02	16.29	92.41	25.50	134.12	34.65	174.85	43.80	216.41	53.00	42.34	9.90
55 ft	57.81	16.92	110.00	26.74	160.15	36.56	210.49	46.25	260.46	56.20	51.13	10.53
60 ft	64.82	19.93	124.01	32.76	181.18	45.59	238.53	58.50	295.51	71.30	58.14	13.54
Six pin arms	9.80	5.80	13.97	7.30	16.12	8.80	18.45	10.30	20.41	11.80	3.12	1.90
Wire, secondary:												
Two No. 6	5.35	6.10	10.13	8.60	14.72	11.10	19.40	13.60	24.22	16.10	4.78	2.86
Three No. 6	7.85	7.35	15.00	11.10	22.23	14.85	29.38	18.60	36.23	22.35	7.22	4.11
Two No. 4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
One No. 6	9.85	7.35	19.10	11.10	28.43	14.85	37.58	18.60	46.93	22.35	9.32	4.11
Three No. 4	10.95	7.35	21.20	11.10	31.43	14.85	41.68	18.60	51.93	22.35	10.32	4.11
Three No. 2	17.75	8.60	34.30	13.60	51.05	18.60	67.48	23.60	84.00	28.60	16.76	5.36
Three No. 2/0	34.05	9.20	67.10	14.80	99.65	20.40	132.98	25.60	165.83	31.10	33.05	5.86
Wire, primary:												
Two No. 6	6.09	6.10	11.36	8.60	16.48	11.10	21.60	13.60	26.92	16.10	5.29	2.86
Four No. 6	12.18	8.60	22.72	13.60	32.96	18.60	43.20	23.60	53.84	28.60	10.58	5.36
Four No. 4	16.08	8.60	30.72	13.60	45.26	18.60	60.00	23.60	74.64	28.60	14.74	5.36
Four No. 2	26.90	9.85	50.14	15.10	73.08	22.35	96.52	28.60	119.36	34.85	23.47	6.61
Four No. 2/0	49.20	11.10	93.64	18.60	138.08	26.10	183.52	33.60	227.96	41.10	45.27	7.86

These figures are based on copper at 15½ cents, poles at 1921 average price, spans of 125 ft., supervision 7 per cent, injuries to labor 6.6 per cent, and line material, costs of Dec. 1, 1921.

The table is computed for triple-braid weatherproof copper wire at 15½ cents per pound, butt-treated Western cedar, N.E.L.A. class B poles, line hardware and cross-arms at market price, and for average spans of 125 ft. To the actual cost of material and labor have been added 7 per cent for engineering and supervision and an additional 6.6 per cent to the labor cost for injuries and accidents.

D. C. Hopper,
Distribution Engineer.

Northern Ohio Traction & Light Company,
Akron, Ohio.

Experience with Carbon-Tetrachloride Fire Extinguishers

However great the efforts made to prevent fire in power houses may be, a breakdown of insulation may occur, and for this reason an operator must always be prepared to combat flames. He must know the location of each piece of fire-fighting equipment, the method of its use and its limitations. The stations of the Consumers' Power Companies are supplied with one or more of three classes of fire-fighting apparatus, the carbon-tetrachloride and soda-acid extinguishers and the regular fire hose.

The carbon-tetrachloride extinguisher is the "first line of defense." This type of extinguisher is furnished in 1-quart and 1½-quart sizes under different trade names. Carbon-tetrachloride liquid, under various designations, is used as the fire-extinguishing agent. This evaporates rapidly, especially in the presence of heat, and forms over and around the fire a "blanket" of non-conducting gas that will not support combustion, smothering the flames very quickly. The liquid gas is an excellent insulator, having several times the dielectric strength of air. In addition to this valuable property it does not injure any fabric or other substance with which it comes in contact. A further valuable characteristic is that it will not freeze. The non-conducting properties of this liquid and the gas formed from it make it safe to use around apparatus and conductors energized at any voltage, if the extinguisher is not permitted to touch or approach the energized conductor.

In extinguishing an arc the stream of carbon-tetrachloride should be directed at the point where the arc originates. In any fire the stream should be directed at the base of the fire. If oil is burning in a transformer case or other partly closed receptacle, the stream should be directed *across* the surface of the oil, rather than down into it. In the latter case the heavy liquid will settle at once to the bottom of the oil tank, without doing any good. The carbon-tetrachloride extinguisher is the only kind with which this company is equipped that is safe to use on energized conductors. No other extinguisher should be used until not only the broken-down unit but all other energized apparatus in its vicinity has been taken off the line and made dead, and in the case of the high-tension circuits grounded.

While carbon-tetrachloride will extinguish an arc, it will not prevent it from forming again, if the arcing points are so close together that the voltage will jump the gap. If this occurs, and if it be impossible for any reason to get the apparatus off the line, the arc may be held down by repeatedly spraying the arcing points with the liquid, thus keeping it covered with a gas blanket.

It must be remembered that any breakdown of insulation that is serious enough to start a fire calls afterward for a careful examination at least, and in most cases for repairs, before the unit affected can be depended upon for safe and reliable service. Therefore, if any apparatus takes fire and it is possible to take it off the line, it should be made dead at once, as the fire can be handled much better in the dead machine and it will be necessary anyhow to have it dead before examination and repairs can be made.

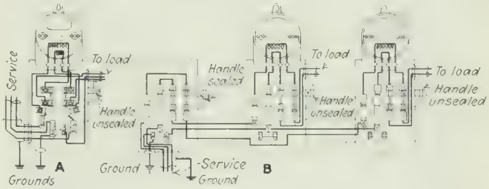
The tetrachloride extinguishers should be filled as soon as possible after use, so as to be ready for any further trouble that may develop and so that the refilling will not be forgotten. Enough liquid should be kept on hand to meet any reasonable need, and new supplies should be ordered before the old supply is exhausted.

In some stations carbon-tetrachloride extinguishers of large capacity are installed for fighting generator and other fires in places difficult of access. In these extinguishers pressure is maintained by means of an air compressor or hand pump. Frequent inspection must be made of these extinguishers to make sure they are maintained at or very near the required pressure so that they may be ready for instant use. When used, immediate steps should be taken to have them refilled to full capacity. In case they are partly discharged, the normal air pressure should be restored at once and the tank refilled as soon as possible.

Consumers' Power Company, H. J. Burton.
Jackson, Mich.

Safe Method of Mounting Supply Cut-outs and Meter Cabinets

The specifications for mounting meter cut-out boxes and cabinets recently issued by the Edison Electric Illuminating Company of Boston are good examples of standard safe practice. These specifications are now written to comply with the new code requiring the customer's service pipe to extend to and enter the cut-out cabinet. Up to 100 amp. the company requires the service cabinet to be of a special improved design, permitting the mounting of a watt-hour meter in combination with the cabinet, adapter end walls permitting the use of any of the standard types of meters. In sizes above 100 amp. the combination of the meter with the service cut-out cabinet is not required, the standard National Electrical Code fuses and switches mounted in a sealable metal cabinet being acceptable. Where the meter is not combined with the service cut-out, a separate cabinet with meter cut-out is required for each meter called for in the installation.



WIRING DIAGRAMS FOR SAFETY CABINETS FOR SERVICE CUT-OUTS AND METERS

A—Combination safety cut-out cabinet and meter for single-phase. B—Safety cut-out cabinet and combination meter and safety switch cabinets for two or more meter installations.

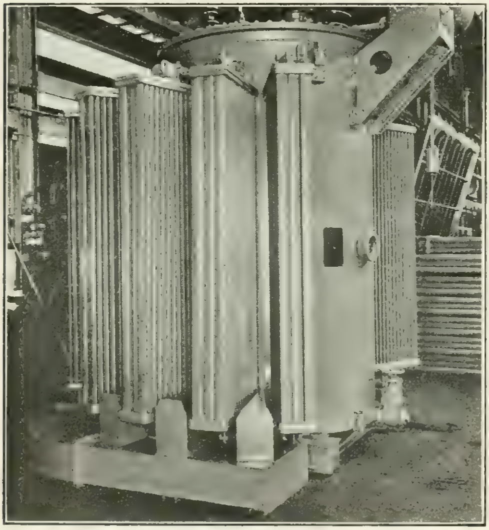
Five approved types of cut-outs and cabinets are available to contractors in the Boston Edison territory (Johns-Manville, Trumbull, Metropolitan, Square D and Westinghouse), these equipments being practically interchangeable as to size and fittings. They are adapted to either direct-current or alternating-current (single-phase) service, 115-volt, two-wire, or 230-volt, three-wire connection, thus minimizing the stock to be carried and the changes required in case of additional installation at a later date. In all sizes provision is made for carrying the neutral wire into or through the cabinet without fuse or switch, but with a "disconnecting link" to conform to the National Electrical Code. A solder lug is provided at the neutral terminal for the connecting of the ground wire to be brought into the cabinet through knock-outs in the bottom. To save time in making connections to meters integral with cut-out cabinets, the proper short lengths of cut and end-stripped wire are provided in each case. Standard connections are shown in the accompanying diagram.

This company has recently established a regulation placing upon the wiring contractor the responsibility for this construction and has given up the practice of furnishing switches and cabinets at its own expense. The company has for some time been one of the few that assumed this portion of the service investment.

Boston, Mass. Field Editor Electrical World.

Forced Ventilation of Transformers Increases Capacity 25 per Cent

With abnormally high air temperatures, such as exist in certain sections of southern California, it may be necessary to reduce the load on a self-cooled transformer below the transformer rating or to provide some means of artificial cooling to keep the winding temperature within safe limits. The latter method has been adopted by the Southern California Edison Company for the 5,000-kva., 66,000/16,500-volt oil-immersed, self-cooled transformers shown in the illustration. The transformers as built by the Westinghouse Electric & Manufacturing Company were provided with air ducts surrounding the base, with openings between the radiators to direct the flow of air, which is furnished by a motor-driven blower. A hot-spot temperature indicator in the winding guides the operator properly in controlling the auxiliary system.



AIR IS BLOWN FROM THE SHEET-IRON DUCTS TO COOL THE RADIATORS

This auxiliary method of forced cooling has proved to be so effective that 25 per cent greater load can be carried with a given temperature rise in the transformer windings than is possible with natural air circulation.

Field Editor Electrical World.

San Francisco, Cal.

Testing Transformers in Service for Insulation Breakdown

For testing the condition of the insulation of transformers a high-potential test is probably the most reliable. Such a test may be made on a transformer installed in place provided it is disconnected from all lines.

If a transformer is to be tested on account of having been overloaded or overheated, or insulation breaking down on account of excess moisture in the coils, it has been found best to megger between windings and between windings and core before applying a high-potential voltage. If the transformer shows a low megger reading, it should be dried out or repaired as the case might be, then meggered again, and, if no trouble is indicated, tested by applying a high voltage the value of which is indicated in the accompanying table. The time of application for each test should be one minute.

VOLTAGES FOR HIGH-POTENTIAL TESTS ON TRANSFORMERS

High-Voltage Winding to Low-Voltage Winding and Core:

Highest Operating Voltage	Test Voltage
Below 550	4,000
550 to 4,500 (inclusive)	10,000
Above 4,500	Twice the highest operating voltage plus 1,000 volts

Low-Voltage Winding to Core:

Highest Operating Voltage	Test Voltage
1,500 and below	4,000
Above 1,500 to 4,500	10,000
Above 4,500	Twice the highest operating voltage of the low-voltage winding plus 1,000 volts

(Voltage should be applied for one minute)

The method of testing transformers with high potential has been developed to such an extent that a test transformer with a high range of voltage, of a portable type which can be easily moved from place to place, is now manufactured. It is a current opinion that no better method has been developed than the megger for indicating trouble, but as an indicator only. The megger will show a high resistance at times that a potential test will break. The high-potential method, however, can be recommended as a satisfactory way of making a test of transformer insulation.

This information was presented in the report of the committee on overhead and underground systems before the Southwestern Electrical and Gas Association.

Chicago, Ill. Field Editor Electrical World.

Unconventional but Effective

When an emergency arises that requires equipment which cannot be obtained from a manufacturer for several days or weeks, the unconventional thing must sometimes be done, namely, to adapt existing equipment to the needs. In the case in mind an unanticipated load of indefinite duration was thrown on some oil switches which were threatening to overheat so badly that trouble was expected. In the absence of other relief some galvanized tanks several inches larger than the switch tanks were quickly constructed and tapped at the bottom and top of opposite sides for cold water inlet and outlet respectively. The tanks were supported so that they would inclose the switch tanks and water turned on. The makeshift performed its function satisfactorily until larger oil switches arrived about two months later.

Ancon, Canal Zone. Manuel Rodriguez.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Financial, Engineering and Commercial Aspects of Interconnection

By Samuel C. Moore

General Manager New England Power Company, Worcester, Mass.

THE economic advisability of interconnection is no longer a debatable point, but if the best possible results are to be obtained, the engineering and financial aspects must have careful study. Each specific case of interconnection must be considered on its own merits. Broadly speaking, however, contractual relations should be flexible. This is essential so that a working arrangement can be developed along the most economical lines.

While it is desirable to make such interconnections on a basis both physical and financial that will permit of the most economic operation, it is equally true that "half a loaf is better than no bread," and inadequate interconnections will invariably demonstrate the wisdom of a more adequate arrangement and lead to it.

The tying together of large systems has raised many problems which have been only partly solved. Possibly the oil-switch problem is one of the most pressing. The service demanded of high-tension oil switches becomes more exacting as additional capacity is placed behind them. A proper system of relaying is an ever-present problem, and here probably more than in any other phase of interconnection eternal vigilance in studying the records of the relay performances and a proper knowledge in interpreting and correcting the faulty operation are necessary. A close follow-up on the relay situation will be amply repaid by the improvement and dependability of service.

The problem of maintaining satisfactory voltage is also one of considerable moment, and in order to keep ahead of this problem a continuous study and forecast of load conditions are imperative.

The problem of maintaining standard frequency when systems are tied together has presented some difficulties which are gradually disappearing. In order to insure a harmonious working together of interconnected systems, personal acquaintance between system operators is desirable. With this object in view the New England System Operators' Association has been formed. This association brings the men together in friendly intercourse, and as is invariably the case when men get to know each other a great deal of the friction which would otherwise take place is eliminated.

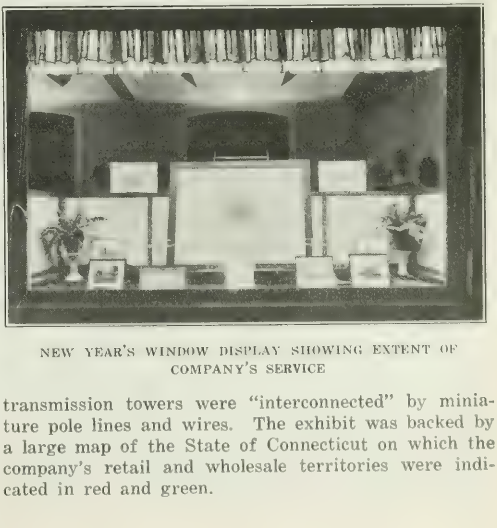
Condition of load and efficiency in handling it change so rapidly that constant study and analysis are necessary in reviewing results obtained from each intersystem connection. The excessive demands for power during the period of the war firmly established in the minds of every one connected with the industry the usefulness of interconnection. This was again made apparent during the protracted drought of last fall, and had the railroad strike materialized, threatening a fuel shortage in interior points, it would have aided in keeping industry and homes supplied with energy. In the great sleet storm of Nov. 27 and 28 last the numerous interconnections between systems not only facilitated handling service on lines which were still intact but aided in the restoration of service on lines that were in trouble.

The capacity of interconnections between the New England Power Company system and the systems of the Narragansett Electric Lighting Company, Blackstone Valley Gas & Electric Company, Fall River Electric Light Company, Edison Electric Illuminating Company of Boston, Worcester Electric Light Company, Eastern Connecticut Power Company, Turners Falls Power Company and several other smaller systems exceeds 150,000 kw. To operate these interconnections successfully experienced load dispatchers and extraordinary vigilance in the careful use of water power are essential.

In the final analysis economic interconnections are co-operative undertakings, and through their skillful co-ordination they benefit the public at large by the improved use they establish of facilities representing invested funds devoted to the supply of energy. Interconnection is a means whereby the waste of natural resources and labor can be reduced, and there can be no question of its continued value and further extension in the year 1922.

Hartford Company's Facilities for Service Make New Year Window Display

THE Hartford (Conn.) Electric Light Company staged this interesting window display on New Year's Day by way of greeting to the local public. Photographs of the company's generating plants and transmission towers were "interconnected" by miniature pole lines and wires. The exhibit was backed by a large map of the State of Connecticut on which the company's retail and wholesale territories were indicated in red and green.



NEW YEAR'S WINDOW DISPLAY SHOWING EXTENT OF COMPANY'S SERVICE

Store-Door Demonstration of Electric Signs

THE fall and winter months are the best time to go after the small electric sign business, and this illustration shows how an electric sign company is stimulating the sale and rental of signs in Chicago. The sign is securely mounted on the body of a runabout, and by means of a long cord it can be illuminated by plugging into a socket on the customer's premises. This method of actual store-door demonstration has helped materially in closing sales right on the spot.

AN EFFECTIVE ELECTRIC SIGN DEMONSTRATOR

Increasing interest in the use of electric signs has been shown in Chicago this fall, with the result that the central-station company's income has also increased. This class of business is particularly desirable as the average income per kilowatt of station capacity is somewhat in excess of $100, which is about twice the average income per kilowatt of the entire station load.

"Get Together" Meetings Gain Public Support for Utility

MEETINGS where the city officials and leading business men get together with the manager and employees of the local utility for a general discussion of the company's problems have been held by the Kentucky Utilities Company. "We have held a number of these meetings and found them very helpful," says L. B. Herrington, vice-president of the company at Louisville.

"Personal touch, friendly relations and wide acquaintance," he says, "go a long way in Kentucky to establish confidence and bring about correct understandings in business dealings. We therefore have local meetings and district meetings and gather together our local and district managers, department heads, company officials, superintendents, cashiers, meter readers and stock salesmen. We invite the municipal authorities, bankers, newspaper men and important citizens to our meetings and endeavor not only to sell the personnel of our organization to them but to interest them in our business problems and plans.

"Our organization is made up principally of Kentuckians and as far as possible recruits are drawn from the communities which we serve. We cannot afford to lose the co-operation of the local people. Our street-lighting and water-pumping contracts come up from year to year. We are drawing new capital from the sale of stock to our customers, and we are dependent upon the confidence and good will of our people. We must give them good service, tell them how hard we have to work to do it, let them know that we are as human as they are, that we are honest people in an honest business, convince them that the money we use in our business is the same kind that they earn and use in their business, take them in with us if they will come, and keep the thought away from them that there is some far-off, cold combination of capital seeking to take advantage of them.

"There is no commission in Kentucky, and our rates are fixed by the city councils. During the war we appealed to thirty different city councils for relief in the way of increased rates, curtailment of service and limiting capital expenditures for extensions and improvements. Assistance of some substantial character was secured in twenty out of the thirty cities. We have found that it helps to hold such meetings and to keep our case constantly before the public by newspaper and other advertisements."

What Other Companies Are Doing

Albany, Ore.—Plans are being formulated by the Oregon Electrical Contractors' Association for opening a home electrical in this city at an early date.

Newark, N. J.—The electric iron campaign which the Public Service Electric Company conducted last fall in co-operation with the local contractor-dealers proved so successful that the company is planning to hold similar campaigns throughout the year 1922. In addition steps have already been taken to establish in the Newark papers a co-operative electrical page and the company hopes to have this under way by the latter part of January.

Enid, Okla.—The Enid division of the Oklahoma Gas & Electric Company has organized a club called the Enid Division Thrift Club. All the employees are members and the object is to save a certain amount each week, if it is nothing more than 50 cents. The company's preferred stock is bought every month and constitutes the assets. The club will close its books at the end of each year, and the members will be paid in the preferred stock of the company or cash, whichever they prefer.

Ohio.—The Northwestern Ohio Railway & Power Company of Toledo has closed a ten-year contract with the village of Elmore, Ohio, for supplying its municipal system with electric service. The village owns its own distribution and street lighting systems and furnishes all service used within the municipality. It is planned to electrify the municipal pumping plant and drive the present pumps with electric motors, this, in the past, having been done with gas engines. The contract was secured in accordance with the regular rates filed with the Public Utilities Commission of Ohio and will be subject to any changes which may be made in such rates during the term of the contract.

Augusta, Me.—The Central Maine Power Company has added about 4,600 hp. in connected load to its lines since Jan. 1, 1921. Activities on line extensions are being continued throughout the winter with unabated energy. A 5.5-mile extension is under way in the Poland district and one of 10.7 miles has been started in the Thomaston-Tenants Harbor district. The company looks forward to 1922 with enthusiasm, the diversified industries of the territory showing much improvement during the past few months. George S. Williams is general superintendent.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Correcting Magnetic Side Pull in Rotating Electric Machines.—A. M. DUDLEY.—Unless the rotating member of a machine is accurately centered and rigidly held, there is a tendency for the two members to approach one another and strike, with resulting damage to the machine. By proper connection of the windings, either on the stator or the rotor, it is possible to secure symmetry of the magnetic field and minimize any tendency toward this unbalanced side pull, with its resulting mechanical vibration, noise and likelihood of damage. Numerous diagrams are given to illustrate this method. —*Electric Journal*, January, 1922.

Refilling Commutators.—A. HERVEY.—A study of the insulation failure in commutators and a discussion of the assembly and baking of commutators.—*Power*, Jan. 10, 1922.

Generation, Transmission and Distribution

System of Locating Faults in Underground Cable.—LUIGO SELMO.—The system described involves the use of two voltmeters, one in series with the capacity formed by the conductor and sheath and the other measuring the voltage applied across this condenser. Examples are given by the author of its application.—*L'Elettrotecnica*, Dec. 5, 1921.

Power Generation in Steel Plants.—D. M. PETTY.—Consideration of the operating conditions in steel plants, outlining means of increasing load factor and reducing the cost of power. Methods for utilizing waste gases are included. Power contracts which cover only the purchasing of power should be changed to cover interchange of power between steel plants and the power company, it is suggested.—*Paper read before the Philadelphia Section, A. I. and S. E. E.*

Electrical Characteristics of Transmission Circuits.—XVII.—WILLIAM NESBIT.—Continuation of a series of articles dealing with high-voltage transmission. In this article a typical 220-kv. problem is solved.—*Electrical Journal*, January, 1922.

Effects of Sulphur in Fuel Oil.—ALLEN F. BREWER.—The presence of sulphur in fuel oil is detrimental, but its deteriorating effect can be largely avoided by adopting proper precautions which are discussed in the article. —*Power*, Jan. 10, 1922.

Behavior of Insulators Under the Effect of High-Frequency Voltages. — FRITZ GRÜNEWALD. — High-frequency disturbances of high-voltage overhead lines are among the chief causes of insulator failures. There are two methods used for tests in the laboratory—the simple resonating circuit, resulting in a voltage shock test on the insulator, and the method of the coupled resonating circuit with the aid of a Tesla transformer. These two methods do not give the same results on the same insulator. The author claims that only the second test method, with the Tesla transformer, satisfies all requirements of a reliable insulator test and that it is at the same time simpler and less dangerous to the operator. A great number of test data are given to substantiate this claim. The testing method for insulators, as published by Creighton in the *Proceedings* of the A.I.E.E., May, 1915, is essentially the method indorsed by the writer.—*Elektrotechnische Zeitschrift*, Dec. 1, 1921.

Lamps and Lighting

Code of Lighting.—The report of the committee on lighting legislation of the I. E. S. on the code of lighting for factories, mills and other industries has been issued to make available authoritative information for legislative bodies, factory boards, public service commissions and others interested in enactments, rules and regulations for better lighting. The text has been divided into three parts to facilitate reference. Part 1 contains rules arranged in convenient form for legal enactment or government regulations. Part 2 contains a discussion of the rules of Part 1; that is, it gives the legal requirements which must be met where a code is in force and also suggestions and general information as to desirable practice in factory lighting. Part 3 takes up the advantages of proper and adequate illumination, both natural and artificial, and discusses such lighting particularly from the standpoint of economics. The rules set forth in Part 1 cover (1) the illumination required in all kinds of business, (2) the diffusion and distribution of light and avoidance of glare, and (3) exit and emergency lighting. Part 2 gives various tables covering, for instance, approximate foot-candles in good lighting practice. Classification of light sources from the standpoint of glare is made, and some of the causes of glare are discussed, among which are (a) brightness of source, (b) total volume of light (that is, the light source may be too powerful for comfort), (c) location in the field of view, (d) contrast with background, and (e) time of exposure. Some of the advantages of good illumination are (a) reduction of accidents, (b) greater accuracy in workmanship, resulting in improved quality of goods, (c) increased production for the same labor cost, (d) less eye strain, (e) greater contentment of the workmen, (f) more order and neatness in the plant, and (g) the greater ease of supervision.—*Transactions I. E. S.*, Nov. 20, 1921.

Traction

Two New Types of Safety Cars for Chicago.—CHARLES GORDON.—This article discusses the design and construction of single-truck and double-truck one-man safety cars that are arranged for double-end operation with separate entrance and exit passageways and a gate barrier in the exit. Diagrams, photographs and tables of general dimensions are given for both single-truck and double-truck types.—*Electric Railway Journal*, Jan. 14, 1922.

Third-Rail Is Favored by Northwestern Pacific.—Experience with third-rail support, methods of making road crossing and feeder connections, protection of the third-rail, maintenance cost, bonding and effects of high water are discussed.—*Railway Electrical Engineer*, December, 1921.

Selecting Designs for Electric Locomotives.—A. W. Gibbs.—Abstract of a paper presented before the Franklin Institute giving results of a comparative trial of steam and electric locomotives made to get information for the design of locomotives for the Pennsylvania Terminal in New York City. Relative advantages and disadvantages of the quill and connecting-rod types are both considered. Methods of determining lateral impact are considered, and results of several tests are given.—*Railway Electrical Engineer*, December, 1921.

Installations, Systems and Appliances

Electric Telpher Installation at Plymouth Gas Works.—H. Blyth.—An interesting article on the handling of coke in the Plymouth gas works by means of a telpher or crane. A description is given of the electrical layout and overhead-suspension crane track. — *Electrician (London)*, Dec. 30, 1921.

Reconstruction of French Winding Equipment.—John F. Perry.—Reference is made to the difference between hoisting and lowering speed, a device for allowing this variation in speed, the duty cycles of hoisting equipment, operating costs and energy consumption for a specific installation. Three pages are devoted to a calculation sheet for electric winders, showing the factors which must be taken into consideration in selecting the equipment as well as the method of making the calculations.—*Beama*, December, 1921.

New Control of Lowering Speed on Three-Phase Cranes.—C. Ritz.—Instead of one three-phase lifting motor, two half-size motors, rigidly connected together, are used. Lifting is done with both motors in parallel, as if they were a single unit. In lowering a load, however, the two motors are energized in the opposite torque sense. On the first "down" step an equal amount of resistance is connected across both rotors, so calculated as to develop the full starting torque, which is about 50 per cent of the normal running torque. The motors will, therefore, balance each other without any motion if there is no load hanging on the hook. With a load the motor connected in the downward sense will start up and will reach a speed where the momentum of the load plus the torque of the downward motor is equal to the torque of the motor connected in the upward sense. Very small and accurate lowering speed may thus be obtained, which is virtually independent of the load. The two motors may be built very compactly as a twin motor in one casing. Characteristic operating curves of such a lifting motor are given.—*Siemens Zeitschrift*, December, 1921.

Electrophysics and Magnetism

An Investigation of Fatigue of Metals.—H. F. Moore and J. B. Kommer.—A work of 185 pages, including forty-six illustrations, based on tests of materials well scattered over the field of ferrous metals, in which two or more distinct heat treatments for each metal are considered. A series of tests was conducted under reversed bending stress, using various stresses, until an endurance of 100,000,000 reversals was reached. In addition, corresponding static tests in tension, compression and shear were made, as well as hardness and impact tests. Magnetic analysis was employed for examining the homogeneity of the material tested and a study of various accelerated tests for resistance to repeated stress was made. The main purpose of the first stage of the investigation was to determine whether or not there exists, for ferrous metals, any clearly defined relation between static properties and ability to resist reversed sets.—*Bulletin No. 124, Engineering Experiment Station, University of Illinois.*

Telegraphy, Telephony and Signals

Operation of the Modulator Tube in Radio Telephone Sets.—E. S. Purington.—The most satisfactory method of modulating the output current of an electron-tube generating circuit is by variation of the operating plate voltage. A study is made of: (1) Operation of the modulator tube as an aperiodic power amplifier; (2) the actual load impedance of a tube acting as an amplifier; (3) imperfections of the audio choke coil due to its reactance; (4) the audio impedance of parts of the generating circuit, and (5) the presence of electromagnetic energy in the radiator unit. The signal strength under conditions of no distortion, using a receiving set with square law of reception, is proportional to the difference between the peak radio power and the minimum radio power in the transmitter radiator unit.—*Scientific Paper of the Bureau of Standards, No. 423.*

Wave-Length Relations for Progressive Antenna Generation.—A. Press.—It is shown (1) to what extent non-reflected progressive waves can be expected along wires fed from a source of sustained oscillations, (2) how progressive waves can be set up in the ether, and (3) how the antenna wave-length factor depends on the radiating efficiency of such antenna systems.—*Electrician (London)*, Dec. 9, 1921.

Miscellaneous

Recent Developments in Switzerland. — Stanley Parker Smith.—A comparison between locomotives produced by the Ateliers de Construction Oerlikon and the Baden Works of the Brown, Boveri Company, with a statement of the advance in design. The hydro-electric power station at Eglisau is described. It is rated at 42,000 hp. and has a head of 35 ft. (10.5 m.). The Ritom station at Piotta and the Amsteg station are also noticed. The Furka Railway, with the 14-mile (25.6-km.) Simplon tunnel, and the Loetschberg Railway are described.—*Electrician (London)*, Dec. 23, 1921.

Hydro-Electric Report on St. Lawrence River.—The Ontario Hydro-Electric Commission's report to the International Joint Commission. It is suggested that three alternative schemes for power development may be carried out, and the cost of each is given. An interesting study of the physical conditions is presented. The outstanding physical characteristic of the river from a water-power standpoint is the dependability and uniformity of its flow. The average discharge of the St. Lawrence during the sixty-year period of observation was about 247,000 cu.ft. per second. The total twenty-four-hour power which can be developed is in round numbers 4,000,000 hp., of which about 300,000 hp. is already developed. The capital cost per horsepower for the three schemes is approximately $95. With complete navigation improvements, this would be raised to the neighborhood of $125 per horsepower, and the same figure holds for 14-ft. navigation with the exception of one scheme which will cost $232 per horsepower with 14-ft. navigation.—*Canadian Engineer*, Nov. 24, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Electric Utilities Repay 60 per Cent of War-Time Government Loans

OUTSTANDING loans to public utilities, as shown by the annual report of the War Finance Corporation, totaled $19,783,212.81 on Nov. 30, 1921. Advances outstanding on Nov. 30, 1920, totaled $21,132,995.52. Repayments during the year were $1,349,782.71. Under its war powers the corporation advanced $39,797,400 to public utilities. Of that amount $20,014,187.19 has been repaid. Of the foregoing amount the electric light and power companies borrowed $7,852,000. They have repaid $4,779,250.06, leaving outstanding on Nov. 30 last $3,072,749.84.

Move to Place California Municipalities Under Regulation

UNDER the terms of an initiative measure which has been filed with the Secretary of State of California and which will appear on the general ballot in the November elections, municipally owned utilities are to be declared public utilities, and another similar measure will compel these utilities to pay taxes as do the privately owned utilities in the state. The act declaring municipally owned utilities to be public utilities would place these departments of municipal government under the control of the California Railroad Commission.

The initiative petition to place on the same ballot the so-called water and power act, which would provide for the expenditure of $500,000,000 by a board of five men appointed by the Governor for the development of water and power for general distribution by the state, has also been filed.

Hoover Foresees Coal Crisis

THAT the country might have advance notice of the possibility of a coal strike, Secretary Hoover gave a statement to the press on Jan. 19 to the effect that the stage is all set for an industrial disturbance of first magnitude. Those who heard Mr. Hoover make this statement did not get the impression that the government has abandoned hope of influencing a settlement without resort to industrial warfare, but he made it very clear that no progress toward that end has been made as yet and that the line of approach has not even been indicated.

Operators continue to hold a pronounced opinion that no strike will be called. Coal specialists in the government service express the opinion that neither the operators nor the leaders in the union have any exact estimate as to the temper of the rank and file of mine workers. The anthracite workers are expected to give great momentum to the sentiment for a strike. They are well fortified with funds. It is recognized that most of the factors operating against a bituminous strike are not present in the anthracite situation. The operators in the non-union fields have assured Secretary Hoover that they will be able to attain an output of 6,000,000 tons a week in case the mines in union fields are tied up.

Abolition of Franchise Tax in New York Is Urged

THE joint legislative committee on taxation of the New York Legislature has recommended a drastic revision of the tax laws relating to public utilities and indorsed a constitutional amendment making possible abolition of the special franchise tax. Regarding public utility taxation the report says in part:

> The present system of taxing these corporations in the state is a chaos of intricacy and complexity. The staff of the committee has reduced these complicated taxes to a basis which makes possible a comparison with the taxes paid by other business interests. The grossest inequalities come to light. Many of the companies, particularly some of the electric railway companies which are bound by a fixed low rate of fare, have been literally taxed into bankruptcy.
>
> Not all the public utilities are so unfavorably situated, because some have been more successful in their efforts to shift their burdens to the consumer through increased rates. Every class of public utility, however, pays heavier taxes than either manufacturing or financial institutions.
>
> It is evident that the state has been using the public utilities to a considerable extent as tax collectors, imposing upon them obligations which in many cases are justified only upon the assumption that the extra burden can be passed on in higher charges to certain particular sections of the consuming public.
>
> Completely satisfactory adjustment cannot be made until the constitution is changed so as to make practical the abolition of the so-called special franchise tax.
>
> As an immediate means of improvement, the committee recommends that the entire series of complicated state taxes on public utilities be at once abandoned, with the exception of the special franchise tax, which cannot be immediately abandoned for the reason stated above; and that in substitution therefor a "gross net" tax be established, against which special franchise taxes, pending the passage of the constitutional amendment may be used as an offset. It is contemplated that the real estate of public utility corporations, closely defined, shall continue to be taxed locally.

St. Lawrence Report Reaches Committees of the House

THAT part of the St. Lawrence report which is concerned with bond issues has been referred to the committee on ways and means of the House of Representatives. The remainder of the report will remain under the jurisdiction of the committee on interstate and foreign commerce, despite the vigorous efforts made on the floor of the House by Representative Dempsey of New York and others to have the report of the committee turned over to the committee on rivers and harbors.

California Companies Issue New Securities Totaling $13,000,000

TWO new security issues have been placed on the market by California electric utilities. The Pacific Gas & Electric Company of San Francisco is offering through the National City Company of New York $10,000,000 of twenty-year 6 per cent bonds at 99½, to yield 6.05 per cent. The proceeds of the issue will be used toward the retirement of a like face amount of 7 per cent notes, secured by $16,000,000 general and refunding mortgage 5 per cent bonds, which upon release will be pledged under the first and refunding mortgage.

The San Joaquin Light & Power Corporation has issued $3,000,000 in 7 per cent cumulative prior preferred stock with the par value of $100 a share. This stock is offered at 98½, at which price it will net the investor more than 7.10 per cent. It is tax-exempt in California. Dividends are payable quarterly.

Economic and Human Relations Discussed by President of A. S. M. E.

SPEAKING before the Chicago Section of the American Society of Mechanical Engineers on Jan. 20, President Dexter S. Kimball pointed out three fields which were essentially dependent upon engineers for the development of well-being individually, industrially and nationally. These fields were production, economical distribution and human relations. The first had been so studied and developed that little anxiety remains. Concerning the economic preparation of the engineer, President Kimball was not pessimistic, but he realized that little attention had been given by engineers to the broader aspects of economics and he thought that it was their duty to become familiar with this subject. Finally, he suggested that every engineer do what he could toward bringing about a proper viewpoint on human relations in the industries by taking part in civic affairs and working with his national and local societies.

Closing of Last Link in Oregon-Arizona Transmission Line

ONE completely interconnected transmission system extending from the Columbia River at a point 60 or 70 miles east of Portland, thence to Portland, through Oregon, and through California into Arizona, will result from the final linking up by the California-Oregon Power Company of its transmission line from its present northern point at Prospect, Ore., to Springfield, near Eugene, Ore. The total length of the interconnected transmission system will exceed 1,200 miles.

The last section of line to be built will be 115 miles long and will be operated at 66,000 volts, which later will be increased to 110,000 volts. Over this line the California-Oregon Power Company will supply power to the Mountain States Power Company at Eugene for a period of thirty years. The line will undoubtedly result in an increased development of the rich and fertile Willamette Valley.

The transmission systems entering into the interconnection are the Southern Sierras Power Company, from Yuma, Ariz., to San Bernardino, Cal.; the Southern California Edison Company, from San Bernardino to a point near Bakersfield; the San Joaquin Light & Power Corporation, from Bakersfield to a point north of Merced; the Pacific Gas & Electric Company, from this point to a point above Redding, Cal.; the Oregon Power Company, from Redding, Cal., to Springfield, Ore.; the Mountain States Power Company, from Springfield to Salem; the Portland Railway, Light & Power Company, from Salem to Portland; the Northwestern Electric Company, from Portland to White Salmon River; the Pacific Power & Light Company, from White Salmon River to The Dalles and Tygh Valley. The Sherman Electric Company connects with the lines of the latter company at Dufur and extends to the towns of Wasco and Moro, in Sherman County, Ore.

Industrial Heating Courses to Start Feb. 6

INDUSTRIAL electric heating courses for central station power engineers will begin Feb. 6 at the Mansfield (Ohio) factory of the Westinghouse Electric & Manufacturing Company and at the Schenectady (N. Y.) and Pittsfield (Mass.) works of the General Electric Company along the lines recently reviewed in the ELECTRICAL WORLD. On account of the pressure of work during and immediately after the holiday season upon the commercial departments of central-station companies it was found desirable to postpone the active instruction planned in these courses until the above date. A total of about twenty-eight registrants for the two courses above mentioned had been received up to Monday noon of this week, representing companies as far south as Alabama and including a good number from New England and the Middle East. During this interim the courses have been studied with the object of endeavoring to condense them into a fortnight limit.

Chamber of Commerce Members Split Even on American Valuation

THE Chamber of Commerce of the United States has announced the result of the referendum vote of its membership of 1,400 chambers of commerce and trade organizations on the subject of the tariff. Eight separate questions were submitted in the referendum, a two-thirds vote of the membership committing the national chamber to the policy established.

The referendum declared for:

1. Legislation which would provide for adjustment of tariff rates by administrative authorities in the event of changes of economic factors. For, 1,588; against, 304.

2. Creation of a tariff adjustment board to administer adjustable rates. For, 1,379; against, 481.

3. Reasonable protection of American industries subject to destructive competition. For, 1,840; against, 27.

4. The principle of maintenance and encouragement of our export trade so far as consistent with the protection of American industries. For, 1,793; against, 59.

5. Tariff legislation to be framed and administered with a view to meeting discriminations by other countries; anti-dumping legislation of May, 1921, to be maintained in principle. For, 1,846; against, 37.

On the subject of American valuation the vote was nearly even for and against, as also was the vote as to whether tariff legislation should be postponed. The national chamber is, therefore, not committed on either.

Los Angeles Bond Sale Declared Illegal

THE sale by the Los Angeles City Council on Aug. 2, 1921, of $13,500,000 of power bonds to finance the purchase of the distribution system of the Southern California Edison Company within the city limits has been declared illegal by the California Supreme Court. The bonds were issued to carry 4½ per cent interest, but owing to the large discount at which they were sold the Supreme Court held that the interest exceeded 5 per cent and that therefore the transaction must be set aside. The bonds were hurriedly sold by the City Council at a discount of $1,535,000.

Three years ago the city of Los Angeles entered into an operating agreement with the Southern California Edison Company whereby the latter was to operate its own distributing system in the city of Los Angeles as an agent for the city, with the understanding that on March 1, 1922, the city of Los Angeles was to purchase and take over this system. The price was determined at $11,000,000 plus additions and betterments made after the date of the agreement. Thus far these additions and betterments have equaled approximately $1,250,000.

Detroit and New York Utility Companies Show Gains

ANNUAL reports of the Consolidated Gas Company of New York, which controls the New York Edison Company and the United Electric Light & Power Company, and of the Detroit Edison Company were issued this week. While the gas properties of the Consolidated Gas Company continue to show a loss in both output and income, electrical properties show a healthy growth.

The aggregate capital expenditures of the Consolidated and its affiliated gas and electric companies for 1921, it is stated, were $42,396,100.98, of which $33,624,175.06 was for electric property and $8,771,925.92 for gas property. It is estimated that in 1922 it will be necessary to expend for additions and extensions to the gas and electric manufacturing and distributing systems approximately $34,181,634.31.

The combined sales of gas of the various companies during the year were 36,282,751,000 cu.ft., a decrease below the previous year of 4.78 per cent.

The sales of electrical energy during the year, including that sold to the Third Avenue Railroad Company, the Brooklyn Rapid Transit Company and the New York, New Haven & Hartford Railroad Company, amounted to 1,186,346,264 kw.-hr., an increase over the preceding year of 17.25 per cent.

At a cost of $10,559,030.01 for repairs and $1,454,296.13 for renewals, or a total cost of $12,013,326.14, all of these gas and electric properties, it is stated, have been maintained in excellent repair.

The Detroit Edison Company in its annual report for 1921 shows net earnings, after deducting $3,433,665 for interest on the funded and unfunded debt, of $2,850,170. This is an increase of 37.6 per cent over the net of $2,070,936 reported for 1920, despite a decrease in output due to curtailment of industrial load. Gross revenue was shown at $23,382,898, an increase of 6.3 per cent over the $21,990,351 gross of the previous year. The company's expenses decreased 2 per cent to $17,099,062.

In his remarks to the stockholders President Alex Dow said in part:

"The operating ratio has fallen to 66.9 per cent. The ratio for 1916, which we considered to be a normal year before the war, was 54.5 per cent; in 1917 it was 63.8 per cent, in 1918 67.2 per cent, in 1919 68.9 per cent, and in 1920 77.6 per cent. The actual unit costs have also been reduced. Our largest single economy has been in the reduction in the amount of coal burned per unit of electricity produced."

Lockwood Investigation of Incandescent Lamps Concluded

AFTER hearing testimony from officers of the General Electric Company relative to the production of electric incandescent lamps, the Lockwoo legislative committee concluded for the present its inquiry on lamps. Those who appeared before the committee were Douglas Dewar and Arthur L. Brockway, accountants; A. S. Terry, supervisor of incandescent lamps of the General Electric Company; A. W. Burchard, vice-president of that company; F. S. Terry, manager of the National Lamp Works of the General Electric Company, and W. R. Burrows, manager of the Edison Lamp Works of the company.

Representing accountants for the General Electric Company, Douglas Dewar stated that the total stock issue of the General Electric Company, as of Dec. 31, 1920, was $139,026,900. Upon being asked how much of that amount represented stock that was issued for stock dividends, Mr. Dewar said there was nothing in his accounts of the last three years, during which time he has made examinations personally for the company, to show what proportion was stock dividends.

Mr. Untermyer then asked: "In addition to the stock dividends and the cash dividend, how much has the company carried to surplus?" "Well, the surplus account of Dec. 31 was $70,000,000," replied Dewar, to which Mr. Untermyer retorted: "Seventy million dollars was after writing off $115,000,000 to reserve of plant." "I do not know where you get the $115,000,000 from," Dewar answered.

Mr. Untermyer then pointed out that the figure had been obtained from the report of the directors. It was then testified by Dewar that 50 per cent of expenditures for 1920 included depreciation rates of the total capital up to that date, plus amortization of war facilities, to which Mr. Dewar added that the amount was depreciation of capital investment. The witness could not state from memory what the company's expenditures for war construction were during the years 1917 and 1918.

PROFITS IN INCANDESCENT LAMP BUSINESS

Arthur A. Brockway, a certified public accountant, who audited the books of the company at Schenectady last year, testified that the General Electric Company had carried its overhead expenses on several items of manufacture to its lamp manufacturing account. The total cost of upkeep of the experimenting plant conducted by the company in Cleveland was written off to the account of incandescent lamp manufacture, Mr. Untermyer said.

That profits, amounting to 150 per cent, in the sale of incandescent lamps were made by the company was charged by Mr. Untermyer during the examination of Mr. Brockway.

Mr. Brockway testified that the 40-watt bulbs sold in retail stores for 40 cents cost the company 14.939 cents, and the 60-watt bulbs sold for 45 cents and cost

16 cents at the factory. It was also developed that the agents got 70 per cent commission on sales and that the cost of distribution and other charges had been added to the company's accounts.

A. S. Terry, who supervises the manufacture of incandescent lamps for the company, was questioned by Mr. Untermyer concerning the amounts charged licensees of the company for the use of patents controlled by the General Electric Company. Terry admitted that the General Electric charged royalties on values in excess of the selling value of the lamps. In many instances, he testified, royalties on the basis of $1.50 per lamp were charged to manufacturers who sold their particular lamps for 80 cents.

INCANDESCENT LAMP PATENT SITUATION

Anson W. Burchard, one of the vice-presidents of the General Electric Company, was questioned as to certain financial matters. Mr. Burchard's testimony was similar to that of the company's accountant, Dewar. The vice-president stated that the company's export business was approximately 10 to 15 per cent of the total and that its capital stock was substantially $173,000,000, but when asked as to how much of the capital stock represented stock dividend he was unable to reply. He was further questioned as to patents that the company controlled and as to its plants throughout the country, and said that the company and its licensees control 95 per cent of the lamp output.

Mr. Burchard testified with reference to German and Austrian patents acquired, particularly those of Just and Hanneman and Kusel. He also told of arrangements with Siemens & Halske pursuant to which United States patents taken out on their inventions in a certain field became the property of the General Electric Company. Two of these relating to incandescent lamps had to do with the tantalum lamp and the other with a method of supporting the filament used in the tantalum lamp. The German patents of W. K. Voelker, Van Volten, Kremenitski, Hardman, Blau, Gottschalk, Hurwitz, Bergman, Reigenstrif, Shaupay, Schaller, Schumann, Schroeder, Weintraub and Frech were cited. Reference was also made to the Hoskins patent covering the resistance wire used in electric flatirons, ranges, heaters, etc., and the licenses issued by the General Electric Company to appliance manufacturers using this high-resistance wire. It was brought out that under the Hoskins license there is a schedule of selling prices to be observed by the licensee. An attempt was made to show that the General Electric Company controls the price to the jobber and the ultimate consumer. It was also brought out that the heating appliance business of the General Electric Company under the Hoskins patents has never been profitable. Mr. Untermyer then traced the ownership of the Sibley-Pitman Company to the General Electric Company and the method by which incandescent lamps of the General Electric Company are sold through General Electric jobbing houses.

Before placing William R. Burrows of Newark, manager of the Edison Lamp Works, on the stand, Mr. Untermyer placed in evidence a statement furnished by the General Electric Company upon request of the committee, covering certain salient features of the company's financial data between the years 1909 and 1920, inclusive. The statement covers expenditures on plant year by year, the amount written off, the percentage of the write-off to the expenditures year by year, the book value of the plant at the end of each year, and the sales bill and percentage off sales value to the sales bill.

Reading from this statement, Mr. Untermyer pointed out that year from year from 1901 there have been write-offs every year of the expenditures made on construction to the plant. Beginning in 1901, 65 per cent was written off the year's expenditures; in 1902 66 per cent was written off; 1903, 57 per cent; 1904, 64 per cent; 1905, 79 per cent of the total construction expenditures; 1906, 73 per cent; 1909, 85 per cent; 1915, 133 per cent, and so on.

"The lowest write-off in any of the years was the 50 per cent of the $31,000,000 spent in 1920," Mr. Untermyer said. "That was written off—no, there were two years, in which one was 45 per cent and the other 56 per cent and then a year in which there was 49 per cent written off, so that the plant in that way has been written down to $66,536,000 at the present time."

In questioning Mr. Burrows, Mr. Untermyer brought out that the General Electric lamp business is divided into two parts, fifty-fifty. The Edison Lamp Works makes about half of the lamps and the National Lamp Works of the General Electric makes the other half.

"How many lamps did you make in 1920?" Mr. Untermyer queried.

"We made 67,000,000 large lamps and I think about 40,000,000 miniature lamps, a total of a little over 100,000,000, in the Edison division," was the reply of the witness.

Mr. Burrows then stated that he thought the National division made about the same amount, making a total of about 200,000,000, and that the Westinghouse was responsible for about 50,000,000, a grand total of approximately 275,000,000 lamps for the year 1920.

"I mean to say," the witness continued, "that the licensees and the so-called infringing companies made about 25,000,000, or a little more, and of this amount the independent companies make about 3 per cent or 4 per cent—I should say perhaps 7,000,000 or 8,000,000—and the rest are made by the General Electric and its licensees," Mr. Burrows explained.

It was then brought out that there were about twenty licensees of the General Electric, representing aproximately between $3,000,000 and $4,000,000 of the actual total business, which may be $6,000,000 when based upon the list price of the General Electric.

F. S. Terry testified that Association Island in Lake Ontario off New York is owned by the General Electric Company and that its maintenance is charged to the lamp account.

Alabama Power Completes Final Unit on Coosa River

THE completion is announced of the sixth and final generating unit of the Alabama Power Company's Coosa River development. This unit, installed at Lock 12, adds 19,500 hp. to the capacity of the plant, which it brings to 110,000 hp. for the six units. The new unit has been placed in operation and will, President Thomas W. Martin is quoted as saying, make it possible to meet the demands of normal business, although the water flow will not permit continuous operation of all six units throughout the year. Additional demands approximating 40,000 hp. are expected in 1922. The company has now completed connection of its lines through Georgia and South Carolina, creating an interchange of power between five Southern states.

Interconnection to Be Made Compulsory in Switzerland

ABNORMALLY low water in Swiss streams has resulted in federal legislation regulating the distribution of hydro-electric power. The law as finally passed by the federal assembly makes interconnection between stations compulsory when the general advantages to be obtained warrant. When the supply of power is inadequate it is to be furnished preferentially for uses contributing most to the public good. Export of power under certain conditions is prohibited. The administration of the law is placed in the hands of the secretary-general of the Swiss Central Electric Union in order to obviate the building up of a government personnel to administer the law. The Swiss press has been attacking what it terms an overabundance of government officials.

In this connection the Swiss Federal Council has authorized a study of the question as to whether or not it is possible for Switzerland, which during the summer is able to export electric power, to import coal-produced electricity during the winter. Negotiations are in progress to that end with French companies.

Semi-Popular Demonstration of Recent Communication Achievements

DR. F. B. JEWETT, vice-president and chief engineer of the Western Electric Company, gave a most entertaining and instructive lecture on Tuesday evening of last week, explaining and demonstrating the functioning of apparatus which has made possible the loud-speaking telephone, carrier-current communication, radio broadcasting and other marked achievements in the communication field. The demonstration was made before nearly a thousand members and guests of the New York Telephone Society at the Engineering Societies Building, New York. During the entire lecture the speaker made use of the loud-speaking telephone to enable him to address his audience without raising his voice above an ordinary conversational tone.

None of the achievements pointed out Dr. Jewett has been the result of any single development, but all are due to the combination of several, notably the wave filter and the audion in the rôle of amplifier, modulator, oscillator, rectifier, etc. The hybrid coil, an older development, has played no small part in the achievements.

Simultaneous telephone and telegraph communication by means of carrier current were demonstrated over a wire circuit and through the ether. The effect which each piece of apparatus had on the original voice vibrations or telegraph signal was demonstrated by plugging the loud-speaking telephone into the circuits at various points.

Chicago Case to Determine if Past Losses Can Be Ignored

WHETHER a commission in its ruling can ignore the fact that losses have been incurred owing to its own slowness in fixing higher rates during a period of rising operating costs and establish a rate at a later date that will not compensate for these losses will be the issue raised in court proceedings by the People's Gas Light & Coke Company of Chicago, according to a recent announcement by Samuel Insull, its president. The Illinois Commerce Commission last week established a reduced rate for gas in the city of Chicago, and Mr. Insull in announcing that the company would put the lower rate in effect on Feb. 1, 1922, indicated that the adequacy of the rate would be tested in court and that the above question would be clearly presented. The case is expected to attract a great deal of attentions.

International Conference on the French Superpower Transmission Systems

AT THE international conference on the French superpower transmission lines held in Paris on Nov. 21-26, 1921, a report of which has just been received, there were present forty-seven representatives of the United States, France, England, Belgium, Denmark, Spain, Holland, Italy, Japan, Norway, Sweden and Switzerland. The object was to obtain the opinions of these representatives in regard to the newly planned high-voltage transmission lines of France, tying into one extensive network the coal and water resources of that nation. The meeting was divided into three sections to consider (1) production and transformation of the available energy, (2) design of the overhead lines, and (3) exploitation of the resources. The following main points were discussed and partly agreed upon.

Under the first section two conductors per slot in alternators at a voltage of 6,000 was recommended. A high reactance and a voltage drop of 25 to 45 per cent for high-speed turbo-generators up to 43,700 kva. and 21 to 29 per cent for low-speed generators up to 7,000 kva. were considered permissible and the use of quick-acting automatic voltage regulators was held to be advisable. No definite agreement was reached as to the proper test voltage of transformers for more than 100 kv. The voltage drop of transformers, it was felt, should be between 8 and 10 per cent. It was suggested to omit voltage taps on these transformers and to ground solidly the neutral point of star-connected banks. Overload relays, it was argued, should be selected with greatest care and attention. No agreement was reached as to whether oil circuit breakers should be equipped with two or more breaks per phase. Substations up to 70 kv., it was felt, should be housed in; above that voltage the outdoor type was favored. The installation of a synchronous condenser at the different distribution centers was considered preferable to one at the end of the line. The necessity of a centrally located load dispatcher was realized.

In the section devoted to overhead lines it was felt that on lines of very high voltage—*i.e.*, 220 kv.—the use of bimetallic conductors of steel-aluminum is preferable to pure copper lines. While most countries prefer the steel-tower construction, the representatives of Scandinavia reported good success with reinforced-concrete poles. The design of steel poles, it was thought, will largely depend upon the legislative requirements for spans and crossings of public highways and property. As such vast trunk lines are of international importance, it was agreed that there should be identical laws in the separate countries governing their layout. It was brought out that in many cases too strict requirements are hampering the developments. As regarded many suggestions for crossings, use of double insulators was felt to be sufficient. A long discussion was held on the voltage distribution along chain insulators, a very detailed report on this subject being presented by Dr. C. O. Mailloux, the American representative. Porcelain was recommended for the insulators, but tests are still under way on promising samples of basalt insulators.

Several representatives in the third section related their experiences in the exploitation of large power transmission systems. The discussion of the most suitable overvoltage protection for lines of the highest voltage culminated in a general agreement to abandon old-fashioned protective apparatus, such, for example, as horn gaps, especially when in connection with electrolytic arresters. The use of a grounding cable, laid out above the power lines, was unanimously accepted. While the grounding of the neutral point was not recommended for medium voltages, it was held to have many advantages for very high tensions. However, new and more effective means have to be found in this case to protect against telephonic disturbances. Radio communication between the individual stations, such as is in use to some extent already, was held to have much in its favor.

City of Seattle's Light and Power Bonds to Bring 5.70 Per Cent

AN OFFERING of $250,000 of 6 per cent and $50,000 of 5 per cent municipal light and power bonds of the city of Seattle was advertised last week at a price to bring the following annual yield: 1927 to 1931, about 5.70 per cent; 1932 to 1937, about 5.65 per cent; 1938 to 1941, about 5.60 per cent. Principal and interest are payable from the gross revenues of the city's electric system.

New Proposition Made to Power Commission on High Dam Project

A PROPOSAL whereby a license would be issued to the Northern States Power Company which would give the Municipal Electric Company the right to take over the High Dam (Minnesota) development within five years was submitted to the Federal Power Commission at its meeting on Jan. 24, and as a result final action was not taken on the High Dam applications. The Northern States Power Company has agreed to accept such a license, under which it would turn the development over to the Municipal Electric Company on being reimbursed for the actual cost of its outlay. The Municipal Electric Company had not signified its acceptance at the time of this writing.

The commission at its session on Jan. 24 granted nine licenses and six preliminary permits. Among the licenses granted were those for the important projects of the San Joaquin Light & Power Corporation on the San Joaquin River in Fresno County, Cal., and the El Dorado Power Company on the south fork of the American River in El Dorado and adjoining counties in California.

The San Joaquin corporation's project covers a construction work with 45,000 installed horsepower. The power is being used for public utility purposes. A fifty-year license was granted.

The project of the El Dorado Power Company has an estimated capacity of 40,000 hp. The applicant proposes to enlarge four existing reservoirs and to build two additional ones. In addition, a diversion dam is to be built, a power house constructed and a transmission line run to connect with the existing system of the Western States Gas & Electric Company. The license authorized carries a restriction that the storage in Echo Lake reservoir is not to be increased.

The other licenses granted are as follows: Alaska Endicott Mining & Milling Company, 350 hp., Juneau, Alaska; Central Arizona Light & Power Company, transmission line; George Inlet Packing Company, 40 hp., Revillagigedo Island, Alaska; J. H. Cann, 60 hp., Chichagof Island, Alaska; Blue Mountain Irrigation Company, 40 hp. and transmission line, La Salle National Forest, Utah; Fresh Water Bay Lumber Company, 35 hp., Chichagof Island, Alaska; Darwin Silver Company, transmission line, Los Angeles to Inyo County mines.

The preliminary permits granted covered the following projects: W. R. Banks, 300 hp., Osage River, Camden County, Mo.; Morris J. Leehey, 12,000 hp., Beaver Falls Creek, Alaska; Alaska Development & Mineral Company, 14,400 hp., Tyee Creek, Alaska; Myser & Drach, 12,000 hp., Frying Pan Creek, Col.; Hirst Chichagof Mining Company, 400 hp., Chichagof Island, Alaska; city of Boise, 12,000 hp., Payette River, Idaho.

Electrical Men Attend Lieb Lecture for Italian Benefit

ELECTRICAL men of New York City were largely represented at a benefit lecture given by John W. Lieb, vice-president of the New York Edison Company, at Carnegie Hall on Jan. 20, for the Italian free milk and relief fund. The subject was "Leonardo da Vinci, the Master Mind of the Italian Renaissance." Mr. Lieb has been greatly interested in the strengthening of the bond between this country and the Italian people and has given much time and effort to this end. He spent several years of his early life in Italy, where he assisted in the installation of the first hydro-electric development in that country. While in Italy he became a student of the great Italian master, not alone as a painter, but as an eminent engineer of his time.

Mr. Lieb's lecture has been given before several bodies of electrical men and technical societies. It is illustrated with reproductions from the many data sheets left by Da Vinci depicting studies in mechanical and engineering as well as artistic subjects. Mr. Lieb has been decorated by the Italian government.

Indiana Hydro-Electric Company Makes Contract for Norway (Ind.) Power

THE Indiana Hydro-Electric Company has asked the Public Service Commission of that state for authority to close three contracts for the disposition of electric power it intends to produce from a power plant it will build at Norway, on the Tippecanoe River, near Monticello. The Middle West Utilities Company is to take all the energy until 1951 and is to pay for it a sum equal to the hydro-electric company's operating expenses, interest on bonds, dividends on stocks and other expenses and charges. The Interstate Public Service Company is to take two-thirds of the output, and the Central Illinois Public Service Company is to take the remainder. They are to pay 1¼ cents a kilowatt-hour for prime energy and ¾ cent a kilowatt-hour for secondary energy.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Worcester Company Will Make Rebates Because of Interruption to Street Lighting by Storm.—The Worcester (Mass.) Electric Light Company will make rebates to the towns of Shrewsbury, Paxton and Leicester on account of the interruption to its street-lighting service caused by the great sleet storm of the early winter.

Securities of Ohio Central-Station Companies Exceeded $70,000,000 Last Year.—Despite industrial depression, the Public Utilities Commission of Ohio last year authorized the issue of public utility securities to the amount of $177,148,339. Of this amount the securities of electric light and power companies formed nearly 40 per cent, reaching $70,130,600.

Electrical Development and German Reparations.—The proposal that Germany should be allowed to discharge part of her reparation indebtedness to Great Britain by supplying German equipment and sending German workmen to build the new plants called for by the great scheme of electrical development and consolidation which has been sanctioned by Parliament and is now in its early stages has met with the unanimous condemnation of the British electrical associations, both technical and commercial, as well as of the electrical workmen's unions. These bodies contend that the course they condemn would increase non-employment, cheapen service, diminish national prestige, discourage embryo electrical engineers and, in short, ruin the British electrical industry.

An Unusual Development of Hydro-Electricity in a Remote District.—A new reservoir for the city of Bradford, England, is, according to the London *Electrician*, about to be built in the remote fastnesses of the Yorkshire moors, and all the motive power for the machinery of building is to be derived from a hydro-electric plant whose wheels will be turned by water conveyed in a pipe line from an existing reservoir. In addition, this plant will provide lighting and make possible a motion-picture show in the village which will be erected for the workmen near the reservoir site. Nor will the development be merely temporary. The colony that will remain around the reservoirs will be far from an industrial area and the district is poorly served by rail. It is hoped therefore that the hydro-electric plant will solve the fuel problem of the village and give it permanently the most modern heating, cooking and lighting facilities.

Winnipeg Hydro-Electric System Plans Ahead.—A survey, to extend over two or three years, for a new water-power development is being made by the Winnipeg (Manitoba) Hydro-Electric System at Slave Falls, 4½ miles above the city's present plant at Point du Bois. The plan is to operate both plants together, the combined rating to reach 170,000 hp.

Hope Again Contends with Darkness.—Street lights in the town of Hope, Ind., have again been turned off, and the citizens face the prospect of having to grope their way around in the dark as they did for several months last year during a quarrel between the town board and the Pulse & Porter Lighting Company. The trouble this time is with the town treasury. The old town board, which went out of office the first of the year, failed to fix a tax levy that would raise money sufficient for lighting. The new board has been forced to order the lights turned off. An issue of bonds to enable the town to meet the situation is considered.

Polytechnic Institute Is Giving Lectures on Industrial Topics.—The Polytechnic Institute of Brooklyn, N. Y., is giving a course of lectures on local and national problems in their relation to the industries of the Greater New York district, designed "to bring to the attention of the leading executives and business men af Greater New York the best thought and latest information regarding some of the broad topics that are at present receiving the consideration of the business world." Such men as former Secretary of Commerce W. C. Redfield, Prof. W. Z. Ripley of Harvard University and George McAneny, chairman of the New York Transit Commission, are among the lecturers.

End of Quarter-Century Municipal Fight in Sight.—A fight between Goshen, Ind., and the Hawks Electric Company over rates for electric light and power which started two years ago and which has often been before the Indiana Public Service Commission is about to be compromised. A preliminary conference between members of the Council, members of the Board of Public Works, the superintendent of the municipal water, light and power plant and representatives of the Hawks company has been held, and it is thought that a compromise schedule will be agreed on and pending litigation dismissed. For twenty-five years the city and the Hawks company have been competitors. Estimates of the cost of the fight to the city vary from $5,000 to $15,000, and users of electrical energy are now paying higher rates than ever before, notwithstanding that during the last two years this competition hass been unusually bitter. The Hawks company succeeded in annulling a ten-year contract to provide Goshen with energy at a low rate after the agreement had been in effect about a year. The city made the contract on the theory that it could buy energy of the Hawks company cheaper than it could generate it at the municipal plant.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Providence Engineering Society.—The sixth annual banquet of this society will be held on Tuesday, Jan. 31, at 6:15 p.m., in the Narragansett Hotel. Floyd W. Parsons will speak on "The Engineer in Public Service," and Capt. Daniel A. Mackay on "Public Service in the Canadian Northwest."

Section Meetings of the A. I. E. E.—Among the February section meetings of the Institute will be these: Providence, Feb. 3, "Radio Telephony," by W. R. G. Baker, radio-engineering department of the General Electric Company; Vancouver, B. C., Feb. 3, "Development of the British Columbia Electric Railway Company's Hydro-Electric System," by J. I. Newell; Los Angeles, Feb. 13, "The Human Voice and Its Electrical Transmission," by John Mills, engineer with the Western Electric Company.

Public Relations Topic of Forthcoming New England Meeting.—Addresses upon public relations will comprise the program of a luncheon-meeting of the New England Division, N. E. L. A., to be held at the New Bedford Hotel, New Bedford, Mass., Jan. 31, at 12:30 p.m. President C. L. Edgar is to occupy the chair, and the speakers scheduled are: E. L. Milliken, Woonsocket, R. I.; "Employee Relations with the Public"; W. P. Schwabe, Thompsonville, Conn., "Public Speaking"; T. C. Fales, Boston, "Relations with Bankers"; Miss O. A. Bursiel, Boston, "Woman's Public Information," and J. B. Groce, Boston, "The New England Bureau of Public Utility Information."

Coming Meetings of Electrical and Other Technical Societies

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

A. I. E. E. Section Meetings—Vancouver, Feb. 3; Providence, Feb. 3; Los Angeles, Feb. 13.

A. I. and S. E. E. Section Meetings—Philadelphia, Feb. 1; Cleveland, Feb. 13; Birmingham, Feb. 25.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A. Springfield, Ill., Feb. 15.

American Physical Society — New York, Feb. 25.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association — Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Fixing Rates for Dual Utility Where There Are No Data to Govern Allocation.—In the absence of information which would have permitted it to allocate the investment and the operating expenses of a combined electric and water company, the Missouri Public Service Commission allowed for depreciation and return 11 per cent upon the combined values, holding that in such circumstances "it may suffice to fix rates which will produce a reasonable return on the combined plants, with the proviso that the rates for either plant shall be reasonable by comparison with rates at other localities of about the same size and similarly situated."

Line Losses Due to Faulty Construction Should Not Be Reflected in Rates. -The North Dakota Board of Railroad Commissioners in fixing rates for the Sheyenne Valley Light & Power Company found that there was an unusually heavy loss—approximately 50 per cent—in transmission, due partly to transformer loss and partly to faulty construction of transmission lines, on which steel conductors are used. The commission was of the opinion that to compel the consumers to bear the expenses of the heavy line losses would be unfair and impose an undue burden upon them, although to rebuild the entire system would involve an increase in rates to provide additional revenue for return on investment.

Waste Caused by Competition.—In sustaining an action to prevent the entry of a competing electric utility into the city of Idaho Springs, the Public Utilities Commission of Colorado made these observations on the fallacy of competition being the life of trade where public utilities are concerned: "This sentiment carried out to a logical conclusion invariably resulted in rate cutting, the destruction and wiping out of weaker concerns by vast aggregations of wealth, until the country is now strewn with derelicts representing hundreds of millions of wasted wealth and untold human effort and endeavor. In very many instances cut-throat competition in the end resulted in a combination of warring interests and an enormous increase in rates that were not justified and were detrimental to the welfare of the general public. To protect the public from such pernicious influences the legislatures of all our states have resorted to remedial legislation and vested courts and communities with regulatory powers to prevent the abuses spoken of."

Letting Consumers Pay for Meters, with Refund in Installments.—A small Wisconsin utility which because of lack of funds had difficulty in supplying its customers with meters had been connecting them without meters at a flat rate of $1.50 a month. The Wisconsin Railroad Commission condemned the practice as inconsistent with the costs of service and likely to result in a long delay in meter installation. It ordered instead that the customers pay for the meters, the company to refund the costs in installments of 50 per cent of the monthly bills.

Lighting Ranked Above Power Service.—The use of electrical energy for lighting purposes is in the opinion of the Idaho Public Utilities Commission a higher use than that for commercial purposes, and the lighting customers must be served first in case there is not sufficient electrical energy for both lighting and power customers. However, it is the duty of a public utility to furnish service to all its patrons, and where it cannot do this either from its own system or otherwise, a competing company should be permitted to enter the territory and fill the needs.

Differentials in Rural Service.—In establishing rates for rural service for the Monroe Electric Company the Wisconsin Railroad Commission said: "The applicant has asked that differentials be made in the rural charges in order to apply to consumers who have been taken on under the company's different plans. We do not believe, however, that such a plan is advisable. The utility has failed to adopt a uniform policy in the past in making its extensions, and we believe that the rural charges as outlined, in addition to eliminating the confusion incident to schedules bearing different charges, will also adequately provide for the financial needs of all rural extensions now being operated."

Extending Transmission Lines and Fair Return.—The Illinois Commerce Commission, dealing with the question of fair return on extensions made by the Southern Illinois Light & Power Company, which serves fifty towns in southern Illinois, held that it is not necessary for each individual extension by itself to be made to pay a fair return, but rather that the entire business of a public utility is to be considered. "In the instant case," said the commission, "service to the village of Bingham would constitute a very small percentage of the total service rendered by the Southern Illinois Light & Power Company. The fact that a small annual loss would be experienced in rendering this service would make very little difference in the return to this company upon the value of the whole property. In the opinion of the commission the consideration of the convenience of the public to be served by this extension entirely outweighs all other considerations which have been offered in evidence."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Measure of Damage Caused by Grant of Right-of-Way.—The Supreme Court of Wisconsin in establishing a measure of the damage caused by the grant of a telephone right-of-way (Riddle vs. Lodi Telephone Company) declared it to be the difference between the value of the premises as they were without the telephone line and the value of the premises after the line was erected, not considering the accessibility of the line to plaintiff's home. (185 N. W. 182.)*

Injury Caused to Workman by Horseplay of Fellow Laborers Does Not Arise Out of Employment.—The Supreme Court of California has found, in Great Western Power Company vs. Industrial Accident Commission, that an injury to a workman caused by two other workmen falling upon him while they were engaged in playful scuffling did not arise out of his employment and thus did not render his employer liable for damages, no claim being made that such wrestling was habitual or that the employer had knowledge of it. (201 Pac. 931.)

Principle of Comparative Negligence and Apportionment of Damages.—No error was found by the Georgia Court of Appeals, in Burdasaw vs. Augusta-Aiken Railway & Electric Corporation, in this charge of the lower court to the jury: "If you find from the evidence in this case that both parties are at fault, and that the plaintiff by the exercise of ordinary care could not have avoided the consequences to herself of the defendant's negligence, she may nevertheless recover, but her damages shall be diminished by you in proportion to the amount of default attributable to her." (109 S. E. 530.)

New York's Transit Commission Not an Unconstitutional Body.—In a unanimous decision the Court of Appeals of New York State has held that the Transit Commission act passed by the Legislature of 1921 was constitutional and that the Board of Estimate and Apportionment of New York City must hand over to the Transit Commission the sums it had asked for. The Board of Estimate declined to honor these requisitions, and the Transit Commission applied to the Appellate Division, First Department, for an order requiring the board to make such an appropriation. Again the board refused, and took the case to the Court of Appeals. It is understood that the case will go to the Unied States Supreme Court.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Charles R. Wanneman has been appointed chief engineer of the New York Public Service Commission. In 1910 he was made inspector of the old Second District commission in the division of transportation. In 1914 he became chief of division of steam railroads, and in 1918 his duties were extended to include those of the engineer of grade crossings. Later he had charge of steam railroads, electric railroads and grade-crossing eliminations in the state outside of Greater New York. His new position as chief engineer places him in charge of engineering and inspection work, for the commission, of all steam railroads, street railroads, grade crossings, electric light companies, gas companies, telephone and telegraph companies throughout the state. Previous to his appointment on the old commission Mr. Wanneman was acting chief examiner of the State Civil Service Commission and assistant engineer for the State Engineer and Surveyor. Prior to that he had been for some time in the employ of the Pennsylvania Railroad. He is a graduate of Cornell University and resides in Albany.

C. R. WANNEMAN

Charles W. Price, who has just retired as editor of the *Electrical Review* after nearly forty years in the editorial chair, was the guest of honor at a luncheon given by a number of his friends in the electrical industry on Jan. 18 in New York at the Lotos Club, of which Mr. Price has also long been secretary. Appreciative tributes to Mr. Price's veteran service to the electrical industry were paid in brief addresses by E. W. Rockafellow, Western Electric Company; Gen. J. J. Carty, American Telephone & Telegraph Company; O. H. Caldwell, representing James H. McGraw, president McGraw-Hill Company; F. S. Terry, General Electric Company; A. Wilson-Lawrenson, National Carbide & Carbon Company; W. L. Goodwin, Society for Electrical Development, and others. Messages of regret were also received from Henry L. Doherty, Chester S. Lord and M. H. Aylesworth, who were absent from the city. As already noted in these columns, the *Electrical Review*, over which Mr. Price so long presided, has been purchased by the McGraw-Hill Company, which will continue to publish it in Chicago, but as a monthly magazine for practical maintenance men, under the title *Electrical Review and Industrial Engineer*.

F. M. Feiker, vice-president of the McGraw-Hill Company, who for the past eight months has been assisting Secretary Hoover in the reorganization of the Department of Commerce, has resigned. Mr. Feiker has not, however, completely severed his relations with the Secretary or the department. He has been appointed a special agent of the Bureau of Foreign and Domestic Commerce, to continue in a consulting capacity the work he has been doing. Last May Mr. Feiker received leave of absence from the McGraw-Hill Company to join the Department of Commerce as a special administrative assistant of Secretary Hoover. He was selected because of his very wide knowledge of and experience and acquaintance in the American industrial field.

Under the direction of Mr. Feiker and Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, the industrial and business contacts of that bureau have been enlarged, business relations with trade association committees have been established and the so-called commodity divisions of the bureau created. Mr. Feiker has drawn some fifty or sixty experts from the business world to the Department of Commerce to be of direct and specific service to American business. During Mr. Feiker's stay with the department, *Commerce Reports*, the government's official foreign trade paper, has been changed from a daily to a weekly publication and its style and appearance have been completely altered to meet more nearly the needs of business. The *Survey of Current Business*, a new publication destined to be of much assistance to American business men, was brought into existence. Mr. Feiker's services extended to the Bureau of Standards, the Bureau of the Census and other parts of the department. He served as editorial adviser on the department's board of editors.

L. J. Moore, formerly electrical engineer, has recently been appointed executive engineer of the San Joaquin Light & Power Corporation, Fresno, Cal. Mr. Moore has had a quite varied experience in electrical engineering and is well known on the Pacific Coast through his activities in the technical societies. He was born April 27, 1885, in Iowa, and was graduated from the Iowa State College in electrical engineering in June, 1908. Immediately therafter he was employed by the Telluride Power Company in Utah, following which he became instructor for the Telluride Institute. In 1911 he entered the employ of the San Joaquin Light & Power Corporation, holding various positions as inspector, construction foreman, maintenance foreman, chief dispatcher, technical assistant to the general superintendent, and finally, in 1918, was promoted to the position of electrical engineer. In that position he had charge of the design of transmission lines, substations and generating stations, including both steam and hydro-electric stations, among the latter being included two automatic generating stations. Mr. Moore is an associate member of the American Institute of Electrical Engineers and is chairman of the apparatus committee of the Pacific Coast Electrical Association. His present position as executive engineer is virtually that of technical assistant to the general manager of the corporation.

L. J. MOORE

Victor Bagley, for the past two years line superintendent Central Maine Power Company, Augusta, Me., has resigned to take up a line of work outside the electrical field. Mr. Bagley began electrical work thirty years ago as a lineman with the Bath & Brunswick Light & Power Company and later became district superintendent from which post he was advanced to the supervision of the entire Central Maine system.

G. W. Atkinson has resigned as electrical engineer of the United States Armory, Springfield, Mass., and has been appointed superintendent of power and maintenance of the Gilbert & Barker Manufacturing Company, Springfield. Mr. Atkinson was born at Morocco, Ind., in 1883, and received the degrees of B.S. and E.E. from Purdue University in 1908 and 1911. In April, 1909, he entered the office of the Supervising Architect, Treasury Department, Washington, D. C., as electrical and mechanical engineer, dealing with the design, construction and operation of all mechanical equipment entering into federal buildings and including a large number of power plants. In this post Mr. Atkinson performed a large amount of inspection work in three-fourths of the states of the Union. From June, 1917, to Jan. 1, 1922, he was electrical and consulting engineer at the Springfield Armory. Here he had charge of design, construction and operation of all steam and hydro-electric power plants, the complete electrification of all shops, signal systems, buildings, road work, factory facilities, etc. This work in general included advancing the type of equipment from that of the Civil and Spanish wars to modern standards, and this was done virtually without shutdowns. Mr. Atkinson is an associate member of the American Institute of Electrical Engineers and a director of the Engineering Society of Western Massachusetts.

G. W. ATKINSON

E. T. Martin, formerly associated with the miniature-lamp sales department of the National Lamp Works, General Electric Company, has been appointed assistant to the manager of the Federal Miniature Lamp Division, New York City.

William E. Skinner, formerly with the electrical department of the Chicago, North Shore & Milwaukee Railroad, has formed the Associated Engineers, Inc., with offices at Milwaukee, Wis. He is vice-president of the company and will have the active management. Mr. Skinner is a member of the A. I. E. E., the A. A. E. and the Society of American Military Engineers. He holds a reserve commission in the United States Army.

F. W. Price, for a number of years Southern district manager of the Apex Electric Distributing Company, has been appointed Eastern district manager in charge of the territory of metropolitan New York, eastern Pennsylvania, New Jersey, Maryland, West Virginia and Virginia.

Roy M. Brown, formerly assistant sales manager in charge of advertising for the Apex Electrical Manufacturing Company, Cleveland, has been appointed vice-president and general manager of Andrews, Brown & Cole, Inc., successors to the Morton Company, Cleveland.

Daniel G. Head, for several years field representative in the New England territory for the Federal Miniature Lamp Division of the General Electric Company, has become sales manager for the Culver-Stearns Manufacturing Company, Worcester, Mass., manufacturer of automotive electric lighting accessories. Mr. Head has had a number of years of experience in the field of automotive electric lighting.

Herbert Metz, who has been connected with the farm electric equipment department of the Western Electric Company for a number of years, has been appointed power and light sales manager, with headquarters at the company's general offices in New York. Mr. Metz was graduated from Pennsylvania State College in 1914 and became connected with the company shortly afterward, taking the commercial student course at the company's Hawthorne plant near Chicago. In 1915 he took a position in the advertising department in New York. Later he spent a year in the Rocky Mountain territory doing sales promotion work. For the last two years he has been in charge of farm electric light plant advertising in the New York office and has been closely connected with the extensive farm-lighting plant campaigns of the company.

Albert J. Young, Jr., formerly manager of New York district sales for the Sprague Electric Company, has been made manager of the conduit and supply division of the company. Mr. Young has been with the Sprague company during his whole business career, starting in its employ as a clerk in the cost department in 1903. Three years later charge of the cost department was given to him. In 1907 he was transferred to the sales department as inside salesman, and a little more than a year afterward received the appointment of sales agent in the metropolitan district. This position he held until 1920, when he was made manager of sales for the New York district.

A. J. YOUNG, JR.

T. H. Hays has been appointed manager of the Indianapolis office of the Westinghouse Electric & Manufacturing Company.

H. W. Cross, for several years turbine engineer for the General Electric Company in its Chicago office, has been made the head of the Boston office of the C. H. Wheeler Manufacturing Company.

Obituary

Charles P. Praitsching, who for a number of years covered the New England States and part of New York State for the sales department of Shapiro & Aronstein, Inc., manufacturers of lighting fixtures, died on Dec. 15, 1921.

Frank N. Jewett, who had been associated with the Wagner Electric Manufacturing Company for the past twelve years, died at his home in St. Louis on Jan. 4. Mr. Jewett had been in failing health for the last two years. He was a member of the Electric League, the St. Louis Electrical Board of Trade and the A.I.E.E.

Charles F. Schneider, general factory superintendent of the Robbins & Myers Company, Springfield, Ohio, died from an attack of acute indigestion suffered at the plant of the company on Jan. 12. Mr. Schneider was appointed general factory superintendent only recently. He entered the employ of the company in 1897 as foreman of winding, and wound and assembled with his own hands the first power motor ever built by the company. He gradually worked his way up from this position to that of superintendent of Plant No. 1, holding this place for a number of years until his recent promotion to the position of superintendent of all plants. Previous to his employment by the Robbins & Myers Company Mr. Schneider had several years' experience in central-station work.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

St. Louis Jobber Sees More Business, Less Liquidation in 1922

THE volume of jobbing business in 1922 will probably be somewhat larger than it was in 1921, according to H. N. Goodell, St. Louis district manager of the Western Electric Company, interviewed recently by a representative of the ELECTRICAL WORLD and, on account of fewer price drops should be more profitable. Electrical materials, as shown in the accompanying chart, said Mr. Goodell, did not increase in price proportionately with other materials and with the reductions which have been made are well in line for 1922 business. The volume of business this year has been between 30 per cent and 40 per cent less than that of last year.

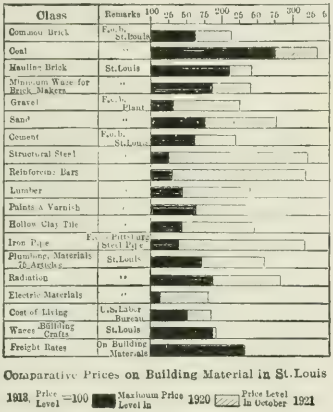

CHART SHOWING THAT ELECTRICAL MATERIALS DID NOT INCREASE PROPORTIONATELY WITH OTHER PRODUCTS

"Certainly no boom is expected in 1922 business," Mr. Goodell continued, "and any further increases will come quite gradually. Better crops and better values for farm products will be of considerable general help and should directly aid the sale of farm-lighting outfits. Liquidation of costs of building materials and labor is necessary, and this is slowly being obtained. The new construction work next year will be principally of institutions and residences as most of the industrial concerns are now overbuilt and will be until the industrial situation is substantially improved. The central-station companies are expected to continue their expansion, and in the resultant business the jobbers will naturally find their share. An optimistic view of 1922 business is entirely warranted."

Steel-Pole Market More Active Since First of Year

INQUIRIES for and sales of steel poles and transmission towers have improved considerably since the first of January, according to a survey of conditions in that field. Sales are better than during the entire last quarter of 1921. The month of December was naturally very slow, business being held over for various reasons until the new year. One of the important reasons for delaying orders until then was the fact that on Jan. 1 the war tax on freight bills was eliminated. This came to a large figure on a carload of steel poles.

There are many inquiries for steel poles and towers, and investigation discloses that these queries are the forerunners of much proposed spring construction. There are quite a number of combination railway and lighting pole jobs awaiting favorable action by property owners in various cities. The street-railway companies are buying only such poles as are necessary, on account of their generally poor financial condition. On the other hand, central-station companies and those municipalities owning their own lighting poles are in much better financial condition. One solution of the problem put forward by an interested manufacturer is to have the lighting company collect sufficient funds to provide steel poles for lighting and charge a proportion of their cost to the street railways for use as span supports. One company reports some export inquiries, but foreign exchange conditions militate against export sales.

Current prices are said to be on a level with those prevailing in June, 1916. There was a general drop in prices during the last quarter of 1921. The market at the present moment is firm, and it is doubtful whether there will be any further downward movement for some time to come. Deliveries are good, ranging from thirty to sixty days on tubular steel poles and from one to three weeks on steel towers.

The outlook, manufacturers agree, is for better business all through 1922 than during 1921. The increase is expected to be very gradual but permanent.

Insulators Quiet, with Improvement Looked for in Spring

THE insulator market in the last two months has become uniformly quiet, but manufacturers are a unit in looking for a good demand to develop early in the spring. That there is a large volume of line construction needed and proposed for spring is known. One manufacturer states that a number of large inquiries are now developing into negotiations. Last spring many central-station companies would have gone ahead with extensions and new lines if it had not been for the tight money market and the high price of materials. Since that time there has been a general price liquidation in this line and money can be obtained much more cheaply. For these reasons producers of insulators are expressing confidence that early spring will see a revival of sales.

Current sales are reported as somewhat spotty. Some manufacturers state that they have been small but steady all during the past year and that neither December nor the first part of January showed any improvement over the previous twelve months; other manufacturers are experiencing a demand running from 60 per cent to 80 per cent of the 1920 demand. With some companies there was a flurry of sales early in the fall, and for a short time production was just about able to keep ahead of orders. This was momentary, and at the present there are practically no producers working full time.

Deliveries are about normal. Some plants have attempted to carry certain popular sizes and as a general rule can make prompt shipments. Goods which must be manufactured after receipt of order can be immediately put in process, and normal delivery is from three to six weeks, depending on the class of material. Glass insulators can be shipped in 3 to 4 days in ordinary quantities. Prices of both the high-tension porcelain and the glass insulators were dropped about 10 per cent early in January by several large manufacturers. A few companies have guaranteed them for the first quarter. The decrease was the third in a year, and it is estimated that the cost of this product is 25 per cent below the high level reached in 1920. There is no expectation among the manufacturers of any further liquidation in the near future.

Brazilian Electrical Market Quiet

THE market for electrical goods in Brazil is quiet at the present time, according to advices received from an official of an American electrical manufacturing company who is stationed there. This situation is due in part to the exchange problem and in part to liquidation of prices in this country. The Brazilian public feels, said this official, that as long as the exchange value of the milreis is only about half as much as normal, investment in American electrical goods will not bring a proper return. However, the country is moderately prosperous, and the exchange condition would not prove such a deterrent to buying if Brazil was convinced that liquidation of prices here had come to an end. The American public has reached this frame of mind, and it is only a matter of time before it will be communicated to the South American republic.

The future of Brazil electrically, he continued, is very bright. The population of the country is slightly in excess of 25,000,000. Of this number about 7,000,000 may be considered as a prospective market for electrical goods. The country is one of almost unlimited water power and as is well-known has other great natural resources, the development of which will demand the use of this water power. There are many large electrical projects under consideration, but virtually all of them are being held up temporarily on account of financial considerations. Thus the market for large electrical equipment has been virtually dormant for some time. There has, however, been a good market for wiring supplies, appliances, lamps and other small electrical products.

The most serious competition encountered by American firms in Brazil, he remarked, is of German origin. People in Brazil have no particular animosity toward Germany and so lower prices give the German manufacturer a temporary advantage. However, this cannot last long, he said, for Germany is conducting a gigantic bankruptcy sale and cannot continue it indefinitely. Contrary to general expectations, deliveries of German-made goods, including even locomotives, heavy machinery and fabricated material, were good for some time after they re-entered the Brazilian market. At the present they are lengthening, and, it is thought, will continue to increase. There has been no marked importation of the new German incandescent lamp into Brazil.

December Electrical Exports Bring 1921 Total to $95,814,885

EXPORTS for December, 1921, amounted to $5,177,276 and showed an increase over the preceding month of nearly $1,000,000. This figure does not compare with the total for December, 1920, which saw American electrical manufacturers selling $13,812,180 worth of their product to foreign customers. In spite of the decline in exports which began in March, 1921, the total for 1920 was only $6,175,119 in excess of 1921 exports, as shown in the accompanying table. Leading authorities estimate that electrical materials have shown an average drop of 15 per cent from 1920 prices so that while the value of all electrical goods exported has dropped about 7½, the volume has actually increased over 1920. With this in mind as well as the 20 per cent increase registered by December, 1921, as compared with the previous month, electrical exporters are justified in taking an optimistic view of the future.

In eight of the items listed 1921 showed an increase over 1920. These include dynamos and generators, insulated wire and cable, carbon-filament lamps, meters and measuring instruments, motors, telegraph and telephone apparatus. Motor exports showed the largest total, amounting to $15,444,564, about $2,000,000 ahead of the previous year. Transformers had the largest percentage of gain, their value, $7,988,440, being 66.5 per cent ahead of last year. The greatest decrease in volume was shown by batteries, which dropped from $6,633,542 to $3,831,738, or almost 50 per cent. Other large drops were noted on carbons, interior wiring supplies, metal filament lamps and heating and cooking apparatus.

As compared with the previous month, December showed increases in batteries, dynamos and generators, heating and cooking apparatus, metal-filament lamps, meters, motors, switches, telegraph and telephone apparatus and miscellaneous items. Decreases were shown by fans, carbons, insulated wire and cable, interior wiring supplies, transformers and several other items. The largest increase was on motors, amounting to almost $500,000, or 100 per cent.

	December 1920	December 1921	1920 Total	1921 Total
Batteries	$649,769	$176,580	$6,633,542	$3,831,738
Carbons	123,793	29,430	1,477,831	433,869
Dynamos and generators	1,487,282	620,831	7,796,305	7,942,473
Fans	257,432	29,165	1,364,742	1,270,253
Heating and cooking apparatus	206,548	73,818	1,801,127	1,637,450
Insulating wire and cable	1,301,307	362,899	8,208,539	8,573,820
Interior wiring supplies	442,129	82,184	3,386,068	1,848,793
Arc lamps	2,610	938	25,098	13,795
Carbon-filament lamps	19,622	3,070	114,542	125,045
Metal-filament lamps	463,487	145,537	4,051,835	3,148,635
Magnetos, spark plugs, etc.	314,185	34,607	3,601,419	1,313,614
Meters and measuring instruments	332,314	121,811	2,676,548	2,726,448
Motors	1,702,846	950,285	13,421,550	15,444,564
Rheostats and controllers	81,569	33,649	707,719	1,044,393
Switches and accessories	568,343	105,907	4,438,709	4,033,299
Telegraph apparatus	101,605	54,165	713,798	1,010,891
Telephones	544,068	319,768	3,898,987	4,797,923
Transformers	696,057	258,602	4,803,158	7,988,440
All others	4,517,214	1,774,030	32,868,433	28,628,982
Total	$13,812,180	$5,177,276	$101,990,004	$95,814,885

In not a single item is there found an increase over the same period in 1920. The figures in the accompanying table were obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Metal Market Situation

THE week opened with both consumers and producers of copper indifferent, an attitude that is apt to last for some time. Consumers have practically covered their needs for the next sixty days, while the large producing companies made large enough sales in the last quarter of 1921 to carry them through a quarter of dullness. Some of the smaller producing interests are showing a disposition to sell at concessions. Probably in the hope of assuring themselves outlets when new supplies come from the companies about to resume operations. These small producers are offering electrolytic for shipment even into the second quarter for as low as 13¾ cents delivered, while the general market is at 13⅞ cents to 14 cents per pound.

Export demand is light. For several days there has been little buying of American electrolytic, and the tone of the market continues consistently weak. On Monday, Jan. 23, there were no exports from the port of New York at all. The week before the outgo was 3,185 tons, more than half of which went to Germany. Total exports for 1921 were 278,145 tons, the largest since 1918. These exports, however, included some manufactured shapes and contents of copper sulphate.

Tin prices have been weak during the past few days. The London market declined £3.17.6 to £4 per ton, and as a result the price of tin in New York is ¾ cents per pound lower.

NEW YORK METAL MARKET PRICES

	Jan. 17 1922	Jan. 24, 1922
Copper:	£ s. d.	£ s. d
London, standard spot	65 2 6	64 17 6
	Cents per Pound	Cents per Pound
Prime Lake	13.75–13.87½	13.75
Electrolytic	13.62½	13.50–13.62½
Casting	13.00	13 00
Wire, base	15.00–15.25	15.00–15.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.45	4.45
Nickel, ingot	41 00	41.00
Sheet zinc, f.o.b. smelter	8 50	8.00
Zinc, spot	5.07½	5.00
Tin, straits	32 12½	31.37½
Aluminum, 98 to 99 per cent	19 10	19.10

OLD METALS

Heavy copper and wire	11.25–11.50	11.00–11.25
Brass, heavy	5.25 –5.37½	5.00– 5.25
Brass, light	4.50 –4.87½	4.50– 4.75
Lead, heavy	4.00 –4.12½	4.00– 4.12½
Zinc, old scrap	2.50 –2.62½	2.25– 2.37½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

MANUFACTURERS and distributers the country over report business steady but light. Colder weather in some portions of the country has interfered with building, and wiring supply demand has fallen off somewhat, while stocks remain good. Nevertheless as soon as building is resumed it will be found, according to many jobbers, that stocks of wiring materials are none too large. Appliance sales continue to be spotty. Those which require the smallest initial investment are meeting with less sales resistance.

Indications still point to good business. In Boston construction steadily forges ahead of 1921 figures and contractor-dealers find no dearth of work. Three steam-turbine installations in New England were closed during the week. Chicago notes a good call for safety switches. Inventories there are over and the industry in the Middle West is going after business again. Atlanta jobbers are stocking fans in about the same quantities as last year. A good demand for engine-generator sets by small industrial concerns and municipalities has been noted in St. Louis.

Several price changes have been reported during the week. Glass insulators are down 5 to 7½ per cent in Chicago. Rigid iron conduit is down 5 per cent in Atlanta. High-tension insulators have dropped 10 per cent in the Pacific Northwest.

NEW YORK

Quiet seemed to pervade the electrical trade last week. Little change in conditions was noted, and jobbers report that the demand for wiring material is only moderate. Stocks have been pretty well reduced, and jobbers are ordering from manufacturers in quantities just sufficient to keep somewhat ahead of the demand. In general, wiring supplies are moving slowly and most contractors are buying for immediate requirements only. Price competition is pretty keen on some items, and in some quarters it is not uncommon to make concessions in this respect to obtain the business. Quotations, however, remain about the same as reported last week.

With the exception of air heaters, flatirons and vacuum cleaners, the appliance business is sluggish. Recent cold weather and the drop in prices have materially stimulated the demand for heaters. One item on which the jobbers and manufacturers have been unable to meet the demand is the small radio receiving set which retails between $25 and $30. It is stated that one manufacturer at present has unfilled orders for 200,000 of these sets.

With the announcement of the reduction in price of fans the jobbers are now making contracts with dealers for this year's requirements. The new list prices on 12-in. and 16-in. fans average about 12 per cent reduction as compared with 1921. Jobbers, generally have a small carry-over from last year.

Rigid Conduit.—Stocks are moderate but easily ample to meet the present demand. Quotations remain about as reported last week, most jobbers' prices already virtually conforming to the new card issued by the manufacturers. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44.90 to $46; ¾-in., $57.70 to $59, and 1-in., $82.85 to $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $48.70 to $50, $64.35 to $66 and $91.65 to $93 per 1,000 ft.

Rubber-Covered Wire.—Conditions and prices in the wire market remain unchanged. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Demand is moderate and jobbers' stocks are good.

Flexible Armored Conductor.—Demand for this material is fairly active, although a great deal of the business is taken on a competitive price basis. No. 14, two-wire, single-strip, is quoted from $43 to $45 per 1,000 ft. in that quantity. Double-strip is quoted from $45 to $47 per 1,000 ft. Jobbers have fair stocks and deliveries from manufacturers are much better.

Tape.—Both friction and rubber tape are quoted at 36 cents a pound in 100-lb. lots. Sales are in line with those of other wiring supplies and jobbers' stocks are ample.

Sockets.—Trade is fair and prices remain unchanged. Key sockets in standard-package lots of 500 are quoted at $18.15 per 100 and keyless in the same quantity at $16.50 per 100. Pull sockets in lots of 250 are quoted at $33 per 100.

Lighting Fixtures.—Commercial lighting fixtures, particularly those of the unit type, have been moving satisfactorily, while the demand for industrial reflectors has not been so good. Incandescent lamp sales to industrial companies are increasing, which is taken as a forecast of industrial activity. Sales of residential fixtures are spotty.

CHICAGO

Another week of comparative dullness in the electrical industry has passed, but the majority of dealers and jobbers have finished their inventories and are out after business. The return of activity in wiring materials has been slow but fairly steady since most of the orders are in small lots. Jobbers report a good call for the inclosed safety switches. Manufacturers of high-tension equipment announced several good sales during the week. Activity on poles and pole-line hardware has been rather dull for several weeks, but a better movement is now reported. A price reduction of 5 to 7½ per cent has been noted on glass insulators.

Wire.—Movement of No. 14 rubber-covered shows little change. While a few jobbers have been selling a fair amount, the majority of them report that buying has been slow. This wire is still available in 5,000-ft. lots for $6.75 to $6.85 per 1,000 ft. Neither the demand nor the price for weatherproof and bare wire has changed since the former is holding at 16¾ cents while the bare-wire base is 16¾ cents.

Rigid Conduit.—Stocks are good and there is a moderate demand, but jobbers state that the majority of orders are in small lots. The ½-in. black pipe is quoted at $46 to $47 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—Action on this material has been steady and jobbers report their stocks ample but not excessive. The No. 14 two-wire, double-strip, sells for $47.50 per 1,000 ft. in 5,000-ft. lots. For the single-strip it is quoted at $45 per 1,000 ft.

High-Tension Equipment—During the week one manufacturer sold a 1,200-kw., 44,000-volt substation to a cotton mill, one 600-kw., 22,000-volt substation for irrigation purposes in the West and some heavy busbars of the cantilever type for a Middle West central-station company. This company reports an inquiry on 66,000-volt switching equipment for a railroad electrification in South Africa. Another company reports a sale of a complete 5,000-kw., 66,000-volt substation to a sheet and tin-plate company in Ohio.

Safety Switches.—The demand for the 30-amp., two-pole switch has been on the increase, but stocks on hand are still sufficient to supply the normal requirements.

Poles.—Prices on Northern white cedar poles are firm and dealers report a slightly improved market. The 7-in.-top, 30-ft. Northern white cedar, f.o.b. Chicago in car load lots, is quoted at $8.40. This same size in a Western red cedar pole sells for $7.30. All dealers report stocks in good shape.

Pole-Line Hardware.—Prices on this material have not changed for some time and stocks are ample. While the movement of late has been rather slow, much better sales are expected by most dealers in 1922.

Insulators.—A price reduction on glass insulators of 5 to 7½ per cent has been noted. The regular 5,000-volt porcelain insulator in common use at central stations is quoted at $56.80 per 1,000 in lots of 1,000 f.o.b. Muncie, Ind.

BOSTON

Some improvement in trade is apparent, although day-to-day business is rather spotty. Building operations continue to run into larger totals than for this time last year. The textile mills are active and wage reductions averaging about 20 per cent have been instituted in some localities. Mercantile business appears to have made a good start this year. Central-station companies are picking up on outputs, and new steam-turbine installations will soon be made at New Bedford, Mass. (20,000 kw.), Manchester, N. H. (12,500 kw.), and for the United Electric Railways Company of Rhode Island (15,000 kw.) Appliance sales, while losing some of the impetus given during the holidays, are still fair in the lighter lines. Contractor-dealers are active in the wiring of both old and new residences, and considerable office building wiring is to be done in connection with new construction.

Wire.—Rubber-covered wire is moving around $6.75 per 1,000 ft. for No. 14 in 1,000-ft. lots, to meet the needs of scattered building wiring work now under way. The total of this work is respectably large, however. Demand for weatherproof and bare wire is devoid of spectacular features. Stocks are plentiful.

Lamps.—Continued fair business in lamps is noted. The demand is well diversified and stocks are easily meeting it. Interest in better industrial lighting shows no signs of slackening.

Loom.—Prices softened this week and stocks are still larger than current demand necessitates. In 5,000-ft. lots $\frac{7}{32}$-in. loom sells at $14.75 per 1,000 ft. and $\frac{1}{4}$-in. loom in the same quantity at $17.50.

Motors.—This line has not yet hit its stride for the year, but a great deal of proposition work is in hand and interest in the improved driving of machinery is clearly reviving in many parts of this territory.

Rigid Conduit.—Sales are uneven, but some pick-up business is coming along most of the time. Little is heard at present about stocks being too large, buying by jobbers having been light for so long. The distinct improvement noted in the building industry is likely to increase buying moderately in this line before many months. One-inch black pipe sells for $90.77 per 1,000 ft., in 5,000-ft. lots, and galvanized at about $100.

Fixtures.—Sales are beginning to reflect somewhat greater demand resulting from the construction of new residences and mercantile buildings. Stocks of distributers are still large in representative cases and little buying from the factories has been in evidence for some time. Prices are reasonably stable with some exceptions in retail circles.

Washers.—Revived interest is noted in various sections as a result of vigorous sales effort and renewed emphasis upon quality of product.

Storage Batteries.—Good movement of batteries for oil-switch operation and for railroad car lighting is reported. The demand for starting and lighting batteries is not yet very active. Stocks are sufficient and prices firm.

ATLANTA

Business has not yet entirely recovered from the slump following the holiday and inventory period, though there are numerous indications that the volume of business is slowly returning to a more normal basis. Few consumers are as yet placing heavy orders for restocking, indicating that confidence in the present scale of prices is not yet restored. Jobbers report a heavy number of inquiries for quotations, especially on certain classes of line material, pipe, wire and cable, thus indicating that orders will materialize as soon as purchasers feel that stable prices have been reached. The new year in Atlanta started off with an excellent record for new construction, the first fifteen days having piled up permits to the value of $800,000, an excess over the entire month of January, 1921. Active steps are also being taken for improvements under the recent bond issue and the general outlook is that this city will enjoy a prosperous building year in 1922. Business conditions in the rural districts still continue rather dull, and it is generally expected that more failures will be recorded in the months of January and February than in prior months.

Rigid Conduit.—With a brisk movement in this line, a price reduction of 5 per cent becomes effective this week. Heavy inquiries are being received for $\frac{1}{2}$-in. pipe, while the larger sizes continue very popular. Stocks are in good condition.

Outlet Boxes.—Fairly satisfactory sales are reported particularly on the smaller type of boxes used in residential work. The larger sizes continue to hold up quite well. No recent price changes have been recorded and local stocks are in good shape.

Wire.—Rubber-covered and varnished-cambric varieties are quite active, the latter more so than for some time past. Weatherproof is somewhat slow. Inquiries for the latter type, however, indicate a pick-up in the near future. Local stocks on all varieties are in good condition.

Fans.—Following the announcement of fan prices and preparation of contracts, jobbers report that orders for spring stocks are beginning to materialize. The general outlook seems to be that sales in 1922 will compare favorably with those of 1921, though, of course, weather conditions play a prominent part in this connection. Jobbers are stocking in quantities about equal to 1921.

Pole-Line Hardware.—This line is moving quite satisfactorily with considerable quantities going to small municipalities and steam railways. Inquiries on hand indicate a continued satisfactory movement in this line for some weeks.

Poles.—Sales of poles are not keeping pace with pole-line hardware, such purchases as are made being for maintenance. Municipalities are purchasing in small quantities. Pole yard stocks are in good shape.

Flexible Non-Metallic Conduit.—Sales have again been resumed, though they still have not entirely recovered owing to the flooding of the market some months ago. Local stocks are in good shape with $\frac{7}{32}$-in. being offered at $21 per 1,000 ft. in lots of 5,000 ft.

Sewing Machines.—This is about the only specialty in household appliance lines that is showing any activity. For the first time in many months sales are being registered and inquiries show a steady increase. Stocks are excellent.

ST. LOUIS

The controversy over wages in the building trades here is creating considerable interest in the electrical industry, for the amount of new construction work which will be projected this year will be materially influenced by its outcome. As was anticipated, the union organizations composing the Building Trades Council have rejected a proposal for a reduction from $1.25 to $1 per hour. However, it is reported that wage reductions on all future wage contracts will be ordered by the Master Builders' Association, and contractors at this time are said to be making estimates on bids for future work on the basis of a dollar-per-hour wage. The contracts of several of the trade unions have expired since the opening of negotiations about wage reductions, and the members are now working without contracts.

This uncertainty of the future working basis is also holding back certain building work which would otherwise proceed, and the resulting effect of the entire situation on the electrical jobbing field here is that business, though steady, continues light. Nothing of particular interest occurred during the past week. Sales were virtually all for small amounts. Stocks of all jobbers and dealers are consistently low, but care is taken to keep them complete. Prices are being fairly well maintained. One pleasing indication of improvement in business conditions is that the railroads terminating in St. Louis are placing large orders for new rolling stock.

Wire.—No. 14 rubber-covered moved in about the usual volume last week, but sales of the larger sizes of rubber-covered and of bare and weatherproof were small. In 10,000-ft. lots, No. 14 rubber-covered was priced from $6.50 to $6.70 per 1,000 ft., and the prevailing price in 5,000-ft. lots was $6.75 per 1,000 ft. The base prices on bare and weatherproof remain at 17 cents per pound.

Engine-Generator Sets.—Improvement in demand on the part of municipalities and industrial plants in the smaller communities was observed last week, at least two jobs being reported authoritatively. A municipality in the northeastern part of the state voted to expend $175,000 for power-plant enlargements.

Meters.—The demand slackened somewhat near the end of the year and has not returned to its former volume. Inquiries are good, however, indicating contemplated distribution extension work on the part of utilities.

Rigid Conduit.—The small sizes are selling better, but the larger sizes continue to move slowly. Stocks of most jobbers are in excellent condition. The following prices are made for bundle lots: ½-in. black, $4.73 per 100 ft.; ½-in. galvanized, $5.32; ¾-in. black, $6.20; ¾-in. galvanized, $6.86.

Lamp Cord.—Sales were slow at the beginning of the month, but the demand now shows improvement. Stocks are conservatively maintained. No. 18 twisted cord, in 5,000-ft. lots, is selling at the following prices per 1,000 ft.: Cotton, $11.50; silk, $24. No. 18 parallel silk sells for $27 per 1,000 ft. in 5,000-ft. lots.

Porcelain.—The demand is steady, with indications of slow improvement. Stocks are in good condition. "Nail-it" knobs are quoted at $19.50 per 1,000 in barrel lots. The 2½-in. tubes are priced at $5.75 per 1,000 and 3-in. tubes at $6.35 per 1,000, both in barrel lots. Two-piece fuseless rosettes sell for $9.90 per 100, one-piece for $6.

SAN FRANCISCO

A cold spell of unprecedented duration and intensity has doubtless done some harm to the fruit industry of northern and central California, where the rise of sap in trees has been congealed by the frost. In southern California the damage to the citrus crop is estimated as high as $15,000,000. With this exception business conditions for the coming year appear brighter every week and although it cannot definitely be said that normal business is assured, the year promises very much better than was expected a month or so ago. Collections are a little better. The financial condition of the state is shown pretty accurately by the fact that the San Francisco Federal Reserve Bank ranks next to New York and Chicago in clearings.

Poles.—Last year was a very poor year in the pole business because nearly all power construction was devoted to power plants and stations and the distributing lines were left to the future. It is expected that a large portion of this lateral line business will develop in 1922. If it does, it can be handled easily, there being no dearth of labor in the Northwest mills nor lack of railroad cars to ship the poles to tidewater. A noticeable feature is the growth of demand for treated poles. A sudden wind flurry on Christmas Day blew down a section of one of the main lines supplying San Francisco. Replacements for this and other breaks probably aggregated ten to fifteen cars.

Air Heaters.—Approximately 40,000 electric radiators were sold to jobbers in California during the present season. Dealers' stocks have been considerably lightened by the cold spell referred to above. Approximately 2,500 radiators have been carried over, compared with fully three times that figure for last year. However, the sales last season ran fully a third higher than they did this season. Lower prices, averaging from 20 per cent less on the popular sizes to 10 per cent on larger sizes, caused some stimulation of demand. Dealers are carrying a far better assortment of sizes and styles than formerly.

SALT LAKE CITY—DENVER

The money market is showing steady improvement from week to week. The two big Intermountain industries that are depending on credit for their rehabilitation are agriculture and live stock. At present it looks as if they will be adequately taken care of by the banks supplemented by liberal federal aid. The wool market is picking up and prospective favorable legislation by Congress is heartening the farmers for the season ahead. Plans are slowly maturing for another building campaign by the real-estate firms in the larger cities. The housing facilities are far from adequate and hundreds of cottages are scheduled for erection as soon as spring weather permits the resumption of construction. Many new apartment houses will also be constructed as investment projects. Electrical contractor-dealers are looking hopefully forward and making preparations for handling some good contracts. Electrical merchandise generally should find a broadened consumer market following the winter months. The labor situation is not encouraging. The building trade unions are solid for the retention of a high wage schedule, while contractors and dealers in building materials believe there must be a readjustment downward. Non-employment prevails to a serious degree.

The price tendency on electrical appliances is decidedly downward. No precipitous jumps are recorded, but little by little the bottom is being sought. Consumer buying meanwhile is scattered and generally unsatisfactory. The government investigation of prices is having the effect of accentuating the buyers' strike. Several smelters that have been idle for months have resumed operation, taking back employees on a wage scale that is 50 per cent reduced.

Bare Copper Wire.—Jobbers report a better movement of copper wire and firmer prices. There have been some good deals in both bare copper wire and weatherproof wire during the past week.

Heating Appliances.—Only those appliances that have come to be necessities are moving in any volume. Flatirons are selling much better since the reduced price schedule went into effect. One electrical concern has stimulated buying by offering reduced prices on irons and ironing boards.

SEATTLE—PORTLAND—SPOKANE

Lumbering and shipping, both of which are key industries of the Pacific Northwest coast, continue to show a healthy growth from month to month. The past week witnessed the breaking of the best 1921 records in shipments in the Puget Sound region. Lumber sales during the week were unusually good. Production for the week ended Jan. 14 was 84 per cent of normal, with a total production of 75,500,000 ft. Most mills are again in operation. A much larger percentage of present shipments than formerly is by rail, indicating a strong revival of domestic building throughout the country.

Prices of electrical supplies for the most part seem to have reached a condition of stability. The only important price changes during the week were a 10 per cent reduction on insulators and an advance of 10 cents per 1,000 ft. on No. 14 rubber-covered wire, the last applicable to Portland only.

The announcement by the California-Oregon Power Company that it would immediately begin the construction of a 110,000-volt transmission line from its properties in southern Oregon to the lines of the Mountain States Power Company, 115 miles north, was the most important event in electrical circles during the past week. The completion of this line will provide an outlet for surplus already developed by the company and will make a continuous connection from southern Washington to the Mexican border.

Porcelain.—Knobs and tubes being staples in the electrical line, the demand does not fluctuate much from time to time. "Nail-it" knobs are quoted at $26.40 per 1,000 in lots of 500 or more and $\frac{3}{16}$-in. tubes at $9.05 in similar lots. Prices are steady.

Sockets.—There is little fluctuation from week to week in the demand for sockets. Sales as a rule are in broken lots of from twenty-five to fifty. Prices are steady. Quotations are: Chain-pull sockets, $45 per 100 in standard package quantities; key sockets, $24.75, and keyless, $22.50 in similar quantities. Stocks are ample.

Line Insulators.—Orders at present are largely for replacements. New business in considerable volume is in prospect for the spring.

Cedar Poles.—Cedar-pole manufacturers in the Spokane region report an increased demand this month for cedar poles in 30-ft. and 40-ft. lengths for telephone and trolley construction in the East and Middle West.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Johns-Manville Cancels Wage Cut

Johns-Manville, Inc., electrical jobbers and large producers of asbestos products, have just announced that the 10 per cent wage cut put into effect by the company on Oct. 1, 1921, is to be cancelled and deserving employees are to go back on their former pay scale. Increased efficiency, it is believed, will absorb the difference and in that way will not increase the cost of the company's products. The announcement was made by the board of directors, who met on Jan. 16 at the New York office to plan for 1922.

"This action has been taken," the statement says, "in the belief that the tide of business has turned for the better. Even in the face of lower prices, it is our belief that salary increases at this time will stimulate personnel to harder work and more economical production and distribution and thus bring about a more speedy improvement of business."

American Fiber Conduit Closes Chicago Office

The American Fiber Conduit Corporation, Fulton, N. Y., has closed its Chicago office and has appointed J. E. O'Neil, formerly manager there, business manager of the company. The manufacturing plant of the company at East Chicago, Indiana, has been closed and dismantled for almost three years while the new plant at Fulton has been manufacturing fiber conduit and fittings of the homogeneous type.

Bridgeport Brass Company Reorganizes Staff

The staff of the Bridgeport (Conn.) Brass Company has been reorganized according to the company's announcement. Walter R. Clark, formerly manager of the company's Housatonic Avenue plant in Bridgeport, has been appointed general works manager, and the post of general superintendent has been discontinued. Arthur Brewer has been made works manager of the mill-products division, and E. R. Feicht has been placed in charge of the engineering and maintenance department. E. G. Oakley has been appointed works manager for the fabrication department, and Warren D. Blatz has been made general sales manager. The entire process-engineering department has been absorbed by the research engineering department under the supervision of William R. Webster, now vice-president and formerly general superintendent of the company. Paul Swartz will head the cost accounting department for the present.

Crocker-Wheeler Reports Better December Business

Improvement in business during December and a moderately bright outlook for the coming months is reported by the Crocker-Wheeler Company, through A. L. Doremus, one of the vice-presidents. Business during the fall has been mainly for renewal purposes, Mr. Doremus said, but there have been a number of new plants starting on a small scale, and while orders for this kind of equipment have been individually small, they have been numerous enough to make a good total. The outlook for the coming year, he continued, was complicated by the fact that large users of motors are in many cases over-equipped and that industrial building is not expected to increase very greatly; nevertheless, it is the expectation of the company that the influx of small orders will continue, while public buildings, hotels and office buildings will place a much larger share of the total business than in 1921. Later in the year larger orders may be expected as capacity operations are resumed in various plants while others change over to electric drive.

Speaking of general business conditions, Mr. Doremus said that the experience of his company in previous depressions had led to the opinion that the cycle between two peaks of prosperity could be divided into about twelve periods and that industry was now in about the tenth, or rising, period. The silk, food, leather and shoe, wool and cotton, and clothing industries in the order named had been the first to recover in other times of depression, and all of them now have passed the low ebb. In other lines, notably paper, building material, railway equipment, iron and steel, automobile, coal and oil, liquidation, in his opinion, has not been completed.

Appleton Assumes Control of Anderson Electric

The Appleton Electric Company, 1201 Wellington Avenue, Chicago, has taken over the business of the Anderson Electric & Equipment Company, manufacturer of automobile lighting equipment. The Appleton company will continue the manufacture of this equipment in addition to its regular line of conduit fittings.

Merger of Automatic Stoker Companies Announced

A consolidation of the Combustion Engineering Corporation of New York, Underfeed Stoker Company of London, Lopulco Systems, Inc., International Pulverized Fuel Company and Combustion Engineering Building, Inc., it is announced has been effected by stock purchase by the International Combustion Engineering Corporation, recently incorporated in Deleware with a 250,000-share capital. One-third of the capital stock of the Société Anonyme des Foyers Automatiques has been acquired. Automatic stokers and accessories are manufactured by a majority of the companies.

Unfilled orders of the companies at the end of the year were in excess of $4,000,000, greater than the entire business for 1921. The combined earnings of the Combustion Engineering Corporation and the Underfeed Stoker Company in 1921 were $669,464 after all charges and taxes had been deducted.

The officers of the new company are: George E. Learnard, president; W. R. Wood, J. Scott Skelly, Joseph V. Santry, Charles J. Peabody, vice-presidents; George H. Hansel, secretary and treasurer, and Benjamin Harrison, assistant secretary. All except the last two named are directors, together with George Foster Peabody, Stephen C. Millett, George W. Wilmot and Stuart H. Patterson.

Court Ends Heine Boiler Company Litigation

A decree signed in the St. Louis Circuit Court on Jan. 14 ends a long period of litigation over the interests of the Heine Boiler Company, St. Louis, and gives control of the company to C. R. D. Meier, its president. Mr. Meier is understood to have gained control by buying the interests of the other litigants. The history of the court proceedings extends back over sixteen years and in that time became most complicated.

The company was founded in 1884 by Col. E. D. Meier and Theodore Meier. At the time of incorporation a large block of stock was put in the name of Adolphus Meier & Company, a company founded by their father, which at the time was insolvent. The income from this block of stock was intended to pay off the debts of the older company. So successful was the boiler company that that purpose was accomplished in a short time and the block of stock, on account of its earning and voting power, became a bone of contention and the heirs of another brother of the founders of the boiler company brought suit.

C. R. D. Meier, son of Col. E. D. Meier, some time ago conceived the idea of buying out the claims of the other litigants in the suit, and this work has been going on quietly. The company is one of the large boiler manufacturers of the country and for many years was known as the Heine Safety Boiler Company. The word "safety" was dropped from the title only recently.

Crescent Electric Splits Into Two Companies

The Crescent Electric Company, formerly at 511 Jackson Boulevard, Chicago, has announced a division of its activities and personnel. The division of the company under the name of Crescent Electric Company will now devote all its time to electrical contracting. F. C. Reimers, who was in charge of the old company, will head this company. The new organization, called the Electrical Supplies Company, will operate at the old headquarters, 511 West Jackson Boulevard, and will serve as electrical jobber. A. A. Togesen, who acted as assistant manager of the old Crescent Electric Company, will be in charge of the Electrical Supplies Company.

Davies Company Incorporated to Manufacture Glassware

The Davies Glass & Manufacturing Company has been incorporated in Ohio to manufacture illuminating glassware, with general offices and works at Martin's Ferry, Ohio. The officers of the company are: T. W. Pursglove, president; E. K. Hoge, vice-president; A. J. Fallen, secretary; W. E. Thomas, treasurer, and William W. Davies, general manager. Arrangements have been made, it is announced, to bring to Martin's Ferry a corps of engineers and specialists with long experience in the design and manufacture of lighting glassware.

Westinghouse Reorganizes Railway Sales Department

The railway sales department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been reorganized, according to announcement by company officials. The department is now organized as follows: F. H. Shepard, director of heavy traction; M. B. Lambert, manager; E. D. Lynch, office manager; F. F. Rohrer, assistant to manager in charge of contracts; C. H. Long, section manager, railway equipment contracts and orders; R. Seybold, manager of price section; T. H. Stoffel, electric railway freight haulage exports; W. R. Stinemetz, manager, and R. W. Carter, assistant manager of the heavy traction division; K. A. Simmon, manager light traction division; J. L. Crouse, manager, and A. W. Lewis, assistant manager railway development and supply division.

Brush Book Issued by Corliss Company

The Corliss Carbon Company, Bradford, Pa., has issued a booklet treating of the selection and application of carbon brushes and is distributing it to its customers. The publication deals with the physical characteristics of carbon brushes, describes various grades, gives the mechanical details and illustrates various types. A chapter is devoted to determining the selection of suitable grades of brushes for given applications. One of the objects of the book, according to J. F. Kerlin, president of the company, is to enable any electrical engineer or electrician to diagnose any ordinary case of trouble and select the proper grade of brush to use.

Business of Harder Corporation Taken Over

The Fuels Utilization Corporation, 152 West Forty-second Street, New York, has taken over the sale of licenses to use the patents owned by the Harder Furnace & Engineering Corporation and the services of its engineering department. The Harder Corporation, formerly at 276 Fifth Avenue, has moved to the Forty-second Street address and will occupy offices adjacent to the Fuels Utilization Corporation. The personnel of the engineering department of the former company, it is announced, has been enlarged by the addition to its consulting staff of a number of experienced engineers. The company will continue to furnish designs, estimates and equipment for heating furnaces using fuels other than coal.

Milwaukee Better Lighting Campaign Under Way

The Milwaukee better-lighting campaign, under the auspices of the Electrical Development Association of Wisconsin, has organized a course in the fundamentals and practices of good lighting for all connected with the industry, the first session having been held Jan. 6. There will be sixteen sessions, covering the basic principles of good lighting, its design and installation and the demonstration of the value and benefits of better lighting in various types of buildings. Arrangements are being made to bring well-known lighting experts to lecture on the various subjects.

Other activities of the association in the campaign have been the use of display advertisements in the Milwaukee daily press, talks by men at the head of the lamp industry and short talks before various business associations of that city.

1921 Production Good at Pittsfield Works of General Electric

Production of large transformers and shipments of lightning arresters by the Pittsfield works of the General Electric Company were phenomenal during the past year, according to a report published in the house organ of that division of the company. Total capacity of large transformers shipped exceeded shipments of any previous year, while transformers of 220,000 volts for transmission for 250 miles were completed. Foreign orders for large transformers were large. Distribution transformer output was large but somewhat less than for 1920. Export business in distribution transformers was restricted.

Lightning-arrester shipments for 1921 were the largest in the history of the department. Shipments of motors and miscellaneous electrical devices manufactured at the Pittsfield plant decreased from 1920. The outlook is moderately good, according to the report, for as soon as central stations can obtain capital at lower rates of interest increased purchases of the class of electrical equipment manufactured by the plant may be expected.

The Roller-Smith Company, 233 Broadway, New York City, has appointed O. I. Eberhardt as a special sales representative in the counties of Bradford, Wayne, Wyoming, Luzerne and Lackawanna and parts of the counties of Carbon, Monroe and Schuylkill, Pa. He will have his headquarters in the Board of Trade Building, Scranton, Pa. The company manufactures electrical instruments, meters and electric circuit breakers.

The Tri-State Electric Company is the new name of the wholesale electrical supply house at 104 Prefontaine Place, Seattle, formerly called the Northwestern Supply Company. The company covers territory in Washington, Oregon and Idaho. A. W. Woodville is president and F. J. Jackson is secretary of the company.

The Pittsburg Gage & Supply Company, manufacturer of Gainaday household appliances, has appointed Albert A. Erdman Western sales manager and is preparing to extend its distribution to the Pacific Coast. Until warehouse and office facilities have been arranged Mr. Erdman will make his headquarters at the Clark Hotel, Los Angeles.

The People's Electrical Supply Company, 34-36 West Lake Street, Chicago, has started operations as a distributer of electrical supplies and fixtures. H. P. Landerman, formerly connected with the London & Landerman Company, is president of the new firm, and Ira L. Arkin is sales manager.

The Electro-Magnetic Tool Company, 2902 Carroll Avenue, Chicago, has doubled its manufacturing facilities by purchasing the plant of G. S. Blakeslee & Company, West 19th Avenue and South 52d Street, Cicero, Ill. This space will be used for the manufacture of electromagnetic equipment.

S. R. Fralick & Company, 15 South Clinton Street, Chicago, has become the sole distributer of the Hersh Duplex Signal, formerly the Electric Duplex Signal, a combination bell and buzzer built by the Hersh Electric Specialty Company, 850 Thirty-second Street, Milwaukee.

Fitts-Morse, Inc., manufacturers' agents, 161 Summer Street, Boston, have added to their service the New England representation of the Crescent Brass Products Company, Cleveland, manufacturer of lighting fixtures and fixture parts, and of the Hazard Manufacturing Company, New York City, manufacturer of insulated wires and cables.

Foreign Trade Notes

ELECTRIFICATION OF CENTRAL RAILWAY OF BRAZIL.—A complete translation of the announcement and call for tenders for the electrification of certain lines of the Central do Brazil Railway and for the supply of traction and transport material and material for construction of substations has been forwarded to the Bureau of Foreign and Domestic Commerce by Consul-General Gaulin of Rio de Janeiro. These specifications will be loaned to firms interested. Inquiries should be sent to the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., referring to file No. 877.

SUPPLIES TO BE PURCHASED BY THE ARGENTINE GOVERNMENT.—The Director-General of Navigation and Ports, Argentine Ministry of Public Works, Buenos Aires, will receive bids until Feb. 28 for material consisting of locomotives, two cranes, cargo towers, concrete mixers, electric motors, etc., for use in connection with port improvements and developments at Buenos Aires. A list of material, together with specifications and forms for submitting bids, has been sent to the Bureau of Foreign and Domestic Commerce. This information may be obtained from the Electrical Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to miscellaneous exhibit No. 233.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Nova Scotia (No. 621) desires to purchase portable electric lamps having colored pottery bases with shades to match.

An agency on commission is desired by a firm in India (No. 626) for the sale of electrical goods, etc.

A business man in Ontario, Canada (No. 634), who is about to organize an electrical appliance business desires to be placed in communication with manufacturers of electrical apparatus for home, farm and industrial uses.

A retail furniture house in Nova Scotia (No. 658) desires to purchase silk lamp shades and standards.

An electric supply house in Canada (No. 663) desires to purchase glass shades with fringe for electric lamps and boudoir table lamps.

An American commercial agent desires to secure representation in the Orient (No. 668), where he already has an organization of firms dealing in machinery, mechanical supplies, electrical equipment, hardware, etc.

An inquiry has been forwarded by Consul G. K. Stiles, at Patras, Greece, for a Greek firm which desires to represent American manufacturers of electric light plants for residences, stores, hotels, factories, etc. Further information relative to this may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to exhibit No. 43,595.

New Apparatus and Publications

WAFFLE RANGE.—The Perfection Electric Products Company, New Washington, Ohio, has developed an electric waffle range with removable waffle breakers, known as the "Excelsior." This range is distributed by George Borgfeldt & Company, Sixteenth Street and Irving Place, New York City.

COOKER.—An electric pressure cooker has been placed on the market by the Albert Sechrist Manufacturing Company, 1717 Logan Street, Denver.

STOVE.—A small electric stove, the "Little Chief," has been placed on the market by the W. B. McAllister Company, 2163-77 East Thirty-first Street, Cleveland.

STOVE AND TOASTER.—The National Stamping & Electric Works, 3212-38 West Lake Street, Chicago, has developed a combination "White Cross" electric stove and toaster.

SMALL CIRCUIT BREAKER.—A device for the protection of fractional horsepower motors, known as the "Minibreaker," has recently been placed on the market by the Miniature Breaker Company, Inc., Fourteenth Street and Governor Place, Long Island City.

SAFETY SWITCHES.—The Columbia Metal Box Company, 226 East 144th Street, New York City, has recently placed on the market a line of Class "B" externally operated inclosed switches.

DOOR OPENER.—The Electrical Products Manufacturing Company, 69 Sprague Street, Providence, R. I. is marketing the "Security" electric door opener.

HEATER.—The Xardell Corporation, Utica, N. Y., has placed on the market a small electric heater the helixes of which are made of a special alloy in which full heat is obtained without operating the resistance at a red heat.

New Incorporations

THE GRANVILLE ELECTRIC COMPANY has been incorporated under the laws of the State of Delaware with a capital stock of $100,000 to operate light, heat and power plants. The incorporators are Arthur W. Britton, Samuel B. Howard and Robert K. Thistle, 65 Cedar Street, New York City.

THE VULCAN ELECTRIC COMPANY, Akron, Ohio, has been incorporated with a capital of $10,000 by Harry A. Miller and Harry H. Slosower.

THE CUMBERLAND LIGHT COMPANY, Poor Fork, Ky., has been incorporated with a capital stock of $10,000 by J. C. Nash, C. H. Rosnick and R. C. Blair.

THE STOKES ELECTRIC COMPANY, Charleston, S. C., has been chartered with a capital stock of $5,000. The officers are: A. L. Stokes, president, general manager and treasurer, and C. V. Stokes, secretary.

THE POLLACK STOP LIGHT COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $1,000 by Arthur Krause, Ernest Peiser, A. Barbian, I. S. Burwitz and David M. Loeb.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 27, 1921)

1,401,754. Telephone Transmitter; Gaston Boissonnault, Hewlett, N. Y. App. filed July 22, 1921. For listening to speaker without his knowledge.

1,401,874. Safety Device; William J. Burke, Youngstown, Ohio. App. filed Dec. 14, 1920. Complete throwing of railroad switch.

1,401,881. Protecting Device for Electric Circuits; Nicholad J. Conrad, Chicago, Ill. App. filed March 31, 1917. Simultaneous operation of a number of switching units.

1,401,917. Tape Transmitter; Donald Murray, London, England. App. filed Aug. 14, 1914. For a multiplex printing telegraph.

(Issued Jan. 3, 1922)

15,258 (reissue). Automatic Starter and Controller; Ralph D. Ernest, Detroit, Mich. App. filed May 18, 1920. For combustion-engine generating sets.

1,401,947. Dynamo-Electric Machine; William A. Turbayne, Niagara Falls, N. Y. App. filed March 9, 1916. Combined motor and generator for automobile.

1,401,950. Printing Telegraph; Arthur H. Adams, Sparkill, N. Y. App. filed Oct. 29, 1918. Carriage return combined with line and ribbon feed.

1,401,962. Moisture-Proof Receiver; John J. Comer, Chicago, Ill. App. filed Dec. 29, 1917. Telephone.

1,401,986. Automobile Signal; Joseph Kershaw, Joplin, Mo. App. filed Sept. 25, 1919. Bell arrangement to prevent theft.

1,401,996. Dynamo-Electric Machine; Robert Lundell, New York, N. Y. App. filed Aug. 30, 1918. Two sets of current inlets and outlets to utilize winding for excitation and compensation.

1,401,998. System of Overhead Construction; Merrill W. Manz, Mansfield, Ohio. App. filed April 23, 1921. Suspending trolley and auxiliary wire from a messenger.

1,401,999. Trolley Device; Merrill W. Manz and Samuel S. Matthes, Mansfield, Ohio. App. filed Aug. 19, 1921. Maintaining proper alignment of two trolley conductors.

1,402,000. Electric Conductor Support and System; Samuel S. Matthes, Mansfield, Ohio. App. filed Sept. 2, 1921. Clamp for two trolley wires suspended from messenger.

1,402,021. Electric Water Heater; Walter O. Snelling, Allentown, Pa. App. filed Aug. 24, 1920. Current produced by induction used.

1,402,023. Suspension Device; William C. Starkey, Mansfield, Ohio. App. filed July 28, 1921. Self-clamping, for trolley wire.

1,402,025. Frequency Meter; Nikola Tesla, New York, N. Y. App. filed Dec. 18, 1916. Synchronous motor with a speed-responsive device.

1,402,037. Transformer; James C. Armor, Pittsburgh, Pa. App. filed April 2, 1920. For series lighting circuits.

1,402,048. Time-Limit Relay; George A. Burnham, Saugus, Mass. App. filed Nov. 22, 1918. Operates upon a definite, inverse or inverse-definite curve.

1,402,070. Reserve Cell; William Hoppie, Newark, N. J. App. filed Nov. 17, 1919. Primary cell acts only when placed in circuit.

1,402,076. Removable Trolley Shoe; William G. Lamb, Waterloo, Iowa. App. filed May 9, 1921. Combination sliding shoe and rolling contact.

1,402,096. Electrical Apparatus for Indicating and Repeating Movements at a Distance; Eugene Schneider, Paris, France. App. filed Sept. 13, 1918.

1,402,100. Lamp Box; Claude de F. Smith, Portland, Ore. App. filed Nov. 30, 1915. For illuminated signs.

1,402,120. Car, Air and Electric Coupling; Charles H. Tomlinson, Mansfield, Ohio. App. filed June 16, 1917. Combined in one.

1,402,128. Method and Apparatus for Electrically Promoting Chemical Reactions; Edson R. Wolcott, Los Angeles, Cal. App. filed Oct. 1, 1918. By electric arc.

1,402,202. Ringing Arrangement for Multiplex Circuits; Herman Affel, Brooklyn, N. Y. App. filed Sept. 26, 1919. Employs carrier currents.

1,402,213. Sanitary Transmitter Device for Telephones and Dictaphones; A. Connelly, Topeka, Kan. App. filed Nov. 11, 1920. Cover for mouthpiece.

1,402,224. Dry Cell; Harry F. French, Fremont, Ohio. App. filed March 4, 1920. Removable membrane of insulating material between anode and cathode.

1,402,235. Oscillation Generator; Harold Jorgenson, Racine, Wis. App. filed Jan. 22, 1920. Combination rotary spark gap and helix.

1,402,240. Means for Neutralizing the Effect of Earth Currents in a Polar Relay; Tom P. Masters, Vancouver B. C., Can. App. filed Sept. 24, 1919. Coil oppositely connected to the working coils of relay.

1,402,245. Electric Flatiron; Ernst Muntwyler, Lucerne, Switzerland. App. filed Sept. 13, 1920. Upper and lower parts adapted for ironing by reversing handle.

1,402,246. Electric Heating Apparatus; Ernst Muntwyler, Lucerne, Switzerland. App. filed Sept. 13, 1920. Combined flatiron, chafing dish and foot warmer.

1,402,250. Mixed Driving of Vehicles; Henri Pieper, Liège, Belgium. App. filed Dec. 22, 1913. Gas-electric drive for vehicles.

1,402,256. Titanium Complexes and Method for Producing Same; Henry H. Buckman, Jacksonville, Fla. App. filed Nov. 15, 1920.

1,402,258. Means for Protecting Ships from Collisions, Etc.; Samuel Shelly, Philadelphia, Pa. App. filed Oct. 18, 1918. Motor-propelled guard placed ahead of ship.

1,402,285. Manufacture of Primary Cells; Harold De Olaneta, New Haven, Conn. App. filed Nov. 26, 1919. Manufacture of depolarizing material.

1,402,305. Electroresponsive Device; William W. MacFarlane, Philadelphia, Pa. App. filed Sept. 10, 1917. To produce powerful magnetic field.

1,402,322. Anti Side-Tone Hand Set; George K. Thompson, Maplewood, N. J. App. filed June 28, 1918. Humming reduced by balancing impedances.

1,402,335. Automatic Electric Brooder; William J. Anderson, Caulfield, Victoria, Australia. App. filed April 5, 1920. Automatic heating and ventilating.

1,402,376. High-Temperature Electric Heater; Sebring I. Phelps, Wilmette, Ill. App. filed Feb. 20, 1919. For kitchen range.

1,402,386. System of Electric Current Distribution; Charles A. Turner, Chicago, Ill. App. filed Feb. 16, 1920. Produces small voltage from 110-volt supply.

1,402,396. Therapeutic Vapor-Lamp Appliance; Fred F. Burdick and Fritz A. Anderson, Milton, Wis. App. filed April 15, 1920. For mounting and safe operation.

1,402,461. Carburetor Heater; Earl G. Watrous, Chicago, Ill. App. filed March 17, 1919. By electric current.

1,402,516. Lighting Fixture; Carl A. Kopfstein, Cleveland, Ohio. App. filed Nov. 20, 1919. For wall use.

1,402,523. Self-Indicating Target; Arnold Michoud, Yverdon, Switzerland. App. filed Jan. 28, 1914. Electrically operated.

1,402,546. Telephone Receiver; Louis Steinberger, Brooklyn, N. Y. App. filed June 12, 1919. Deadens extraneous sounds that reach diaphragm.

1,402,548. Generator Attachment Means for Gas Engine. Henry Tiedemann, Newark, N. J. App. filed Oct. 27, 1919. Chain-driven.

1,402,570. Electrical Switch Gear; William A. Coates, Chorlton-cum-Hardy, England. App. filed Jan. 20, 1921. Interlocking device for switch and circuit breaker.

1,402,585. Vaporizer; Hirsch Epstein, Jacob J. Mitnick and Joseph M. Bernstein, Chicago, Ill. App. filed March 7, 1921. Electrically heated for automobiles.

1,402,587. Adjustable Resistance; Sydney Evershed, London, England. App. filed April 22, 1919. Obtains uniform changes.

1,401,591. Receptacle for Storage Batteries; Charles Gallus, Philadelphia, Pa. App. filed Jan. 26, 1921. Made of rubber allowing for expansion of electrolyte.

1,402,599. Battery-Cell Seal; William H. Grimditch, Philadelphia, Pa. App. filed March 4, 1920. Does not require special tools for separation.

1,402,631. Process and Apparatus for Treating Storage-Battery Plates; Harold M. Martin, New York, N. Y. App. filed April 6, 1920. Heated gas applied to strengthen plates without diminishing capacity.

1,402,656. Voltage Regulator; Durl P. Ruger, Chicago, Ill. App. filed April 21, 1920. Arrangement to prevent jerky movements of core.

1,402,673. Storage-Battery Cover; James M. Skinner and Stockton H. Mortimer, Philadelphia, Pa. App. filed Oct. 6, 1916. Convenient introduction of liquid and escape of gases.

1,402,691. Telephony; Hubert S. Turner, San Diego, Cal. App. filed May 20, 1916. Automatic means of evenly distributing calls among operators.

1,402,714. Method of Manufacturing Artificial Abrasives from Bauxite and Emery; Clarence J. Brockbank, Philadelphia, Pa. App. filed Oct. 21, 1920.

1,402,715. Vaporizer; Harold L. Bumbaugh, Stanford University, Cal. App. filed Nov. 30, 1920. For combustion engines.

(Issued Jan. 10, 1922)

15,261 (reissue). Electric Exchange System; Alexander T. Brown, Syracuse, N. Y. App. filed Aug. 16, 1921. Automatic selective communication.

1,402,750. Electrical Insulating and Heat-Conducting Material; Robert W. Earle, Chicago, Ill. App. filed June 27, 1918. For sadirons, soldering irons, stoves, etc.

1,402,751. Storage-Battery Electrode and the Production of Same; Thomas A. Edison, West Orange, N. J. App. filed Sept. 5, 1919. Nickel-hydroxide film on thin metallic plate.

1,402,756. Connector for Toy Electric Railroads; Albin Frohne, Chicago, Ill. App. filed May 31, 1921. For making connection to rails.

Construction News

Projects, Plans, Bids and Contracts
Contemplated or Under Way

New England States

NEW BEDFORD, MASS. — The street-lighting committee of the City Council has approved recommendations of William P. Briggs, inspector, for improvements to the street-lighting system during the next twelve months. An appropriation of $140,000 will be asked for this work.

NORTH ADAMS, MASS. —The North Adams Gas Light Company has filed petition with the Department of Public Utilities for permission to sell 8,000 shares of stock at $100 a share, the proceeds to be used to pay a floating indebtedness and for certain proposed additions to its plant.

SHELBURNE FALLS, MASS.—The proposal to install a new lighting system in the business section of Shelburne will be submitted to the voters of the towns of Shelburne Falls and Buckland. The plans provide for forty-five lamps, of which thirty will be erected on the Shelburne side and the remainder, or a few more, on the Buckland side of the village.

Middle Atlantic States

AVON, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, will, it is reported exercise its option to purchase the property of the Livingston-Niagara Power Company, Avon, which furnishes electricity in the villages of Avon, Lima, Livonia, Honeoye Falls, Scottsville and Caledonia.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has received permission from the Public Service Commission to construct an electric substation for lighting service in certain parts of Broome County.

BROOKLYN, N. Y.—Bids will be received at the Torpedo Depot, United States Army, Fort Totten, N. Y., until Feb. 10, for furnishing f.o.b. contractor's factory and f.o.b. army supply base, Brooklyn, 16 miles of one-conductor rubber-insulated and armored submarine cable and 16,000 ft. nineteen-conductor rubber-insulated and armored submarine cable. For further information address the officer in charge of torpedo depot. (Circular 22-3.)

BUFFALO, N. Y.—A movement has been started by the Polish American Business Men's Association for improvements to the street-lighting system on Broadway, Fillmore Avenue and Sycamore Street. Walter K. Missall, 964 Sycamore Street, is president of the association.

CATSKILL, N. Y.—The Upper Hudson Electric & Railroad Company has filed notice of an increase in its capital stock from $500,000 to $600,000.

NEW YORK, N. Y.—The New York Edison Company is having plans prepared by William Whitehill, architect, Forty-first Street and Sixth Avenue, for the construction of a two-story and basement power house at 122 East Thirteenth Street.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has filed notice of an increase in its capital stock from $25,000 to $60,000.

BOGOTA, N. J.—The Bogota Paper & Board Company has awarded a contract to the Austin Co., 217 Broadway, New York, for the erection of a one-story power house and factory addition, to cost about $43,000.

CALDWELL, N. J.—The Borough Council is considering the installation of 50-cp. lamps in certain sections of the municipality, replacing present lamps. Service is furnished by the Public Service Electric Company, Newark.

EGG HARBOR, N. J.—The Ingram Motor Company, Joseph Ingram, 2 Rector Street, New York, president, now building a local plant, will hold in temporary abeyance the erection of a power house at the works, plans for which have been prepared.

IRVINGTON, N. J.—A power department for electric and steam service will be installed in the new hospital to be constructed by the Town Commission to cost about $250,000.

TRENTON, N. J.—An appropriation of $75,000 has been recommended by Governor Edwards for a new power, heating, lighting and cold-storage plant at the Trenton Normal School.

ALLENTOWN, PA. — The Pennsylvania Power & Light Company has made application to the Public Service Commission for permission to take over and merge a number of electric power companies recently organized to operate in Northumberland County.

EASTON, PA.—The Pennsylvania Edison Company, 160 Ferry Street, has completed plans for the erection of a one-story addition to the generator department at its Dock Street plant, 30 ft. x 56 ft., to cost about $55,000. The company will also construct a new mechanical shop and office building, 40 ft. x 65 ft., on Dock Street, to cost approximately $35,000.

HAZLETON, PA.—Under the terms of a new lighting contract the Pennsylvania Power & Light Company will furnish electricity for lamps at every intersection of streets in Hazleton. The plan includes the erection of many new poles, replacing the whole system of rectifiers in the West Diamond substation and the erection of a number of new lines.

PHILADELPHIA, PA.—Bids will be received at the office of William S. Twining, director, Department of City Transit, 1211 Chestnut Street, until Jan. 31, for block signals and interlocking for the Frankford Elevated Railway. (Contract 615.)

PHILADELPHIA, PA.—Plans are under consideration by the Ferris Shoe Company for the construction of a factory and power house at Sixth and Duncannon Streets. Simon & Simon, 249 South Juniper Street, are architects.

PHILADELPHIA, PA. — The John T. Lewis & Brothers Company, Lafayette Building, has commenced excavations for the erection of a two-story power plant, 60 x 70 ft., at its paint factory, Aramingo Street, near Cumberland Street, to cost about $100,000, including equipment.

SHAMOKIN, PA. — The Philadelphia & Reading Coal & Iron Company, Reading Terminal, Philadelphia, is planning to erect an addition to its electric power plant at the Locust Spring colliery, near Shamokin, Pa. New machinery to double the present capacity of the plant will be installed.

BALTIMORE, MD.—The Board of Awards, City Hall, will receive bids until Feb. 1 for furnishing and installing two 2,000,000-gal. motor-driven centrifugal pumps and electrical equipment at the Belair Road pumping plant of the Water Department. William A. Megraw is water engineer.

BALTIMORE, MD.—The Electrical Commission, City Hall Annex No. 1, Charles F. Goob, chief engineer, will receive bids until Feb. 1 for about 100,000 ft. of single vitrified clay conduit for underground electrical service.

BALTIMORE, MD.—The Board of Trustees, Johns Hopkins University, has plans under way for electrical equipment to be installed in the new Pathological and Women's Clinic buildings, to be constructed at a cost of about $725,000. Bids for the electrical apparatus will be asked shortly.

OAKLAND, MD.—The Kendal Lumber Company is planning to rebuild its power house, recently destroyed by fire.

RIVERDALE, MD. — The Citizens' Improvement Association, Dr. J. S. Caldwell, president, is considering tentative plans for the erection of a municipal electric power plant. It is proposed to purchase electricity to be distributed by the municipal station.

CHARLESTON, W. VA. — The Raleigh-Wyoming Coal Company, Professional Building, will build a new power plant at its properties near Glen Rogers, W. Va. Electrical machinery will also be installed for mining service.

CHARLESTON, W. VA. — An electric plant will be installed in the new ice-manufacturing plant to be constructed by the Diamond Ice & Coal Company, 912 Bullit Street, 100 ft. x 100 ft., to cost about $300,000, including equipment. A. C. Bishop, 427 Guardian Building, Cleveland, Ohio, is engineer.

CHARLESTON, W. VA. — The United Light & Power Company, recently organized, is planning to construct a transmission line in the vicinity of Iaeger, W. Va. H. P. Musser and C. H. Elston head the company.

SOUTH CHARLESTON, W. VA.—The City Council is considering issuing $300,000 in bonds for improvements to the street-lighting system and streets and the installation of a waterworks plant

North Central States

FOWLERVILLE, MICH.—The Detroit Edison Company, Detroit, has acquired the local municipal lighting plant and equipment and in the future will furnish service here. A ten-year franchise has been granted.

IRON MOUNTAIN, MICH.—The Ford Motor Company will commence the immediate installation of an additional turbo-generator at its local power plant. The company has commenced the construction of a dam at Flat Rock, near Brooklyn, Mich., across the Huron River, preliminary to the construction of a hydro-electric plant here.

JACKSON, MICH.—The T. S. Rogers Company has work under way on a new two-story power house at its plant, 25 ft. x 35 ft.

MICHIGAN CITY, IND.—Subject to the approval of the Public Service Commission, the Northern Indiana Gas & Electric Company has completed arrangements with the Chicago, Lake Shore & South Bend Railway Company, for the leasing of the latter's generating plant at Michigan City for a period of twenty years. The electric company heretofore has purchased energy from the railway company, and in the future the first noted will furnish service to the railway.

COLUMBUS, OHIO.—The City Council has adopted a resolution authorizing the installation of two-lamp inverted globe standards on West Broad Street from the bridge to Central Avenue.

FINDLAY, OHIO.—A power house will be built by the Glenwood Motor Car Company, East Seventy-first Street and Euclid Avenue, Cleveland, in connection with its proposed new local plant.

HAMILTON, OHIO.—The City Council has awarded contract to the Froehlich & Emery Engineering Company, Second National Bank Building, Toledo, to prepare plans for the proposed municipal electric light plant at Hamilton. The cost of the plant is estimated at $650,000.

MEDWAY, OHIO.—The Indiana, Columbus & Eastern Traction Company, Cincinnati, it is reported, has applied to the federal court at Telodo for permission to shut down its Medway power plant and purchase electricity from the Dayton Power & Light Company. The plans provide for the installation of entirely new equipment in each of the eighteen substations to allow for change in its system from 25 cycles to 60 cycles.

LOUISVILLE, KY.—Arrangements have been made by the public service and publicity committee of the Louisville Real Estate Board for a conference with the Louisville Gas & Electric Company to discuss the cost of a suggested ornamental lighting system on a portion of Broadway.

HAMMOND, IND.—Bids, it is reported, will be received early in the spring by the Board of Works for the construction of an electrically operated pumping plant, to cost, with machinery, about $90,000. W. F. Bridge, Rimbach Block, is engineer. A. G. Kinert is clerk.

INDIANAPOLIS, IND.—The Indiana Electric Corporation has filed a petition with the Public Service Commission for permission to construct a power plant in the coal fields on the Wabash River. The company has also requested to consolidate seven Indiana public utility companies.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis and Eastern Traction Company has two propositions under consideration, the first for additions to the West Tenth Street power station and the other for the construction of a new power plant in Vigo County or in an adjacent coal field. The cost of the project is estimated at $3,000,000. Nothing definite has been decided upon. Robert I. Todd is president.

INDIANAPOLIS, IND.—The Indiana Hydro-Electric Power Company, recently organized, has disposed of a bond issue of $1,250,000, the proceeds to be used in part for the erection of a new hydro-electric generating plant at Norway on the Tippecanoe River, to be followed by the erection of three other similar plants in this same section, near Monticello, with total plant capacity of about 29,000 hp. The entire output of the company will be purchased by the Middle West Utilities Company, with which the Indiana company is closely connected. Samuel Insull is president of the new company.

SEYMOUR, IND.—The Interstate Public Service Company, Indianapolis, has started work on the erection of a high-tension transmission line from Reddington to North Vernon. When completed it will be connected with the line extending from Louisville to Indianapolis. Electrical energy will be purchased by the North Vernon Electric Light Company. The Interstate company is also erecting a transmission line from Mineral Springs to Elizabethtown, in Bartholomew County, to supply electricity to farms and residents along the line.

LENA, ILL.—The United Utilities Co. will soon begin active work on the construction of its new hydro-electric power plant on the Pecatonnica River, Martintown, Wis. The station will cost about $85,000. Holland, Ackerman & Holland, 100 East Liberty Avenue, Ann Arbor, Mich., are engineers. E. F. Benifer, Lena, is president.

SPRINGFIELD, ILL.—The Illinois Power Company, recently organized, has been authorized by the Illinois Commerce Commission to take over the properties of the Springfield Gas & Electric Company and the Springfield Consolidated Railway Company and also the DeKalb and Sycamore Electric Company operating in DeKalb and Sycamore. The new company, in addition to financing its share of the downtown improvement plan, which includes placing wires underground, etc., will have sufficient funds for additions to its power plant at Tenth Street and Capitol Avenue and for the removal of the gas plant from First and Washington Streets to the northern part of the city. The amount to be spent on immediate improvements will be approximately $3,000,000. A. D. Mackie is general manager of the new company.

MILWAUKEE, WIS.—The Board of Education, Tenth and Prairie Streets, will build an addition to the power house at the school on Center Street.

VERONA, WIS.—The Dane County Board, care of M. Sommers, 512 West Wilson Street, Madison, is having plans prepared for the construction of a one-story power house, 45 ft. x 50 ft., in Verona, to cost about $150,000. A. D. Conover, Tenney Block, Madison, is architect.

BOONE, IA.—Plans are being prepared for the erection of a municipal hydro-electric plant on the Des Moines River. Burns & McDonnell, 402 Interstate Building, Kansas City, Mo., are engineers.

DEVILS LAKE, N. D.—Savage & White, 913 Pioneer Building, St. Paul, Minn., are taking bids for the erection of a one-story addition to their local power house, 40 ft. x 60 ft. A. H. Savage is head.

ABERDEEN, S. D.—The Aberdeen Light & Power Company is contemplating the installation of an additional generating unit at its plant. R. E. Crockett is superintendent.

COWLES, NEB.—The City Council has plans under way for the installation of a complete electric lighting system. Grant, Fulton & Letton, 505 Bankers' Life Building, Lincoln, Neb., are consulting engineers.

Southern States

DURHAM, N. C.—The construction of an electric lighting system in Durham is under consideration. R. W. Rigsby is city manager.

WILSON, N. C.—Bonds to the amount of $30,000 have been authorized for extensions to the municipal electric light system.

MEIGS, GA.—The City Council has approved plans for remodeling and improving the municipal electric lighting plant and for the construction of a new transmission line, the latter to cost about $10,000. R. E. Davis is Mayor.

CRESCENT CITY, FLA.—The construction of an addition to the municipal electric power plant is under consideration. A. B. Harbison is chairman of the board of trustees.

ORLANDO, FLA.—The City Council has preliminary plans in progress for the installation of new equipment at the municipal lighting plant.

PERRY, FLA.—The City Council is considering the installation of an electric light system in Perry, to cost about $3,000. S. P. Clowell is clerk.

WAVERLY, TENN.—The Hurricane Light & Power Company, recently incorporated with a capital stock of $1,000,000 by Roy Carter and others, contemplates the construction of a dam and power plant across Hurricane Creek. The present plans provide for a plant with an initial output of 1,500 hp. and an ultimate capacity of from 5,000 hp. to 6,000 hp., and also for creating a lake to cover from 2,000 to 3,000 acres. Electricity will be furnished to towns from Dickson to Hollow Rock. E. T. Stanfield, Little Rock, Ark., is engineer.

LAMBERT, MISS.—The Common Council will soon make improvements in the municipal electric lighting system. A bond issue has been sold.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company is considering the installation of an additional generating unit consisting of a 3,500-kw. generator. The cost is estimated at $150,000.

ORANGE, TEX.—The Orange Water, Ice & Light Company contemplates the installation of additional equipment to double the output of its electric power plant.

PARIS, TEX.—The City Council is considering plans for the installation of a complete waterworks plant and system, including an electrically operated pumping plant, etc., to cost about $1,000,000. John B. Hawley, Cotton Exchange Building, Fort Worth, is consulting engineer.

VERNON, TEX.—Bonds to the amount of $100,000 have been voted for the construction of a municipal electric light plant.

WELLINGTON, TEX.—Plans are under way by the Council for the construction of a municipal electric light and power plant, for which bonds to the amount of $50,000 have been approved.

Pacific and Mountain States

LEAVENWORTH, WASH.—The City Council is considering the construction of an electric light and power system in Leavenworth.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company contemplates improvements to its system, including increasing the output of its electric generating plant from 24,000 hp. to 44,000 hp. and extensions to its gas mains and pole lines throughout the city and county. The sum of $1,500,000 has been appropriated for improvements and extensions during 1922. H. H. Jones is president and general manager.

TURLOCK, CAL.—An appropriation of $110,000 has been made by the Pacific Gas & Electric Company, it is understood, for extensive reconstruction work in connection with the Turlock electric system. The plans provide for the erection of a new 60,000-volt transmission line from Modesto to Hughson, to cost about $40,000; new substation at Hughson, $30,000, and rebuilding the Turlock substation at a cost of $15,000. Charles S. Northcutt is division manager.

PRICE, UTAH.—The City Council is considering, among other improvements for the coming year, extensions to the municipal electric plant and improvements to the street-lighting system on Main Street.

RICHFIELD, UTAH.—The establishment of a municipal power plant is reported to be under consideration by the city officials.

SALT LAKE CITY, UTAH.—George W. Davy of Salt Lake City has filed application with the State Engineer for the use of 25 sec.-ft. of water from Otter Creek or Daniels Creek in Sevier County for power purposes. The present plans provide for developing 1,400 hp. under a head of 724 ft. for use in Sevier, Emery and Wayne Counties.

BOISE, IDAHO.—The board of directors of the Idaho Power Company has authorized an expenditure of $200,000 for construction on projects under way, including the Mountain Home-Featherville transmission line and the rebuilding of the Seventeenth Street substation in Boise.

Canada

COURTRIGHT, ONT.—Surveys are being made for the installation of an electric light and power system in Courtright. The cost is estimated at about $35,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

WOODSTOCK, ONT.—The Electrical Commission is contemplating extensions to the electric transmission line and the installation of new transformers. Prices are wanted on materials and equipment. The cost is estimated at $28,000. J. G. Archibald, Woodstock, is engineer.

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What Patent Paralysis Costs

GREAT injury is being done to the American people, and especially to our industries, by the existing state of paralysis in the United States Patent Office. Through the foolish parsimony of Congress Patent Office examiners have been paid so poorly that the organization has gradually disintegrated, with deplorable results.

In 1918 the number of applications totaled 57,000. In 1921 it had grown to 109,238. The examining staff in that period increased by only 5 per cent, because technical men of the type required cannot live on a salary scale established, much of it, in 1852. In consequence there has been a turnover of one-fourth of this entire force in the last sixteen months, the Patent Office stands today 60,000 applications behind, and it sometimes takes a year for a patent application to receive attention.

IN SHORT, the Patent Office is breaking down at the very moment when it should be responding to the industrial needs of the country and helping to provide new commercial opportunities and new employment. The House at last has passed a relief bill. The Senate waits. And in the meantime we save a few paltry dollars on salaries and add millions to the cost of patent litigation which will be a burden on the cost of production for the next ten years. We pay $1,500 to a man responsible for passing on patents of incalculable value.

For it is not a question of what it costs today, but what it will cost five or ten years from now.

The insulator patents were in the courts eleven years. The first decision on the incandescent-lamp patents was rendered in 1915 and the last in 1921. Tremendous sums are expended on patent suits which might be avoided if patent rights could be established promptly and clearly. Such delay and discouragement are woefully destructive. For not only do they add a tax to the cost of the patented device, but they clog the courts and hold back industrial progress. And for this everybody pays.

AMERICAN business demands better treatment for the Patent Office, that it may serve the people adequately. Every possible encouragement must be given for the improvement of our machinery and methods if we are to meet the closer competition that economic restoration will develop in the world. And this can only be assured by the maintenance of a sufficient personnel of skilled and experienced men at work in Washington, assisting the inventive genius of the country to apply itself.

It is gratifying to know that the united voice of our technical societies threw the light upon this critical condition and spurred the House to its belated action. Industry now looks to the Senate. The Patent Office needs immediate help—not politics, but pay.

Gerard Swope

An engineer and executive who is building an American electrical export trade on the firm foundation of sympathetic understanding.

LACK of sympathetic interest in European and South American problems and conditions is probably the greatest single fault that has been charged against American electrical manufacturers engaging in foreign trade. Such a charge, however, can never be made against Gerard Swope, president of the International General Electric Company, the largest electrical export organization in the United States. Mr. Swope has obtained his interest and information about conditions abroad at first hand. He has traveled extensively, especially in the Orient. By education and early training as an electrical engineer, Mr. Swope has been able to understand and appreciate foreign problems and so bring to his thinking plans that would lay a lasting foundation for the continued use abroad of American electrical equipment. Moreover, his intimate first-hand knowledge of foreign business affairs enabled him to do with dispatch what had never been done before by an American electrical manufacturer, namely, to build an efficient working international trade organization with offices and local banking affiliation in almost every important country.

Born in St. Louis, Mo., Dec. 1, 1872, he received his elementary education in the local public schools and was graduated from the Massachusetts Institute of Technology in 1895. That fall he entered the employ of the Western Electric Company. Starting from the bottom in the shops at Chicago, where he was first assigned, he worked his way up department by department to an executive position. His first promotion was to the power apparatus engineering department as designing engineer. Next he organized and was first manager of the company's St. Louis house, opened in 1901. Four years later he was called back to Chicago and made manager of the power apparatus department. When in 1908 the company went out of the power apparatus field Mr. Swope was transferred to New York as general sales manager, and in 1913 he was elected vice-president. This connection he severed Jan. 1, 1919, to take up his present duties.

During the war Mr. Swope served as one of the principal advisers and assistants to the Director of Purchase, Storage and Traffic. It was due to his foresight and co-operation that the great procurement program of 1918 was so successfully planned and carried out. For his services in this connection he was awarded the distinguished service medal. Appreciation of his war services has also come from the French government, which only last week decorated him with the insignia of the Legion of Honor. Recognition has also come to Mr. Swope in many ways as the result of his international activities. Among the tangible evidences of the esteem in which he is held abroad is the Japanese decoration of the Order of the Rising Sun.

Editorial Comment

Electrical World, February 4, 1922

Volume 79 Number 5

Research, Not Money, Will Solve Inductive-Interference Problems

BECAUSE of certain conferences that took place a year or so ago there has been just a suggestion in the minds of many people that the financial interests back of the light and power and telephone industries are going to step in and settle the inductive-interference problem. The inference from statements made from time to time is that orders from the proper individuals will put an instant end to the whole controversy. Biblical history tells of a successful effort on the part of Joshua to make the sun stand still, and legend and song tell stories of like import concerning the miraculous control of natural forces, but every-day mortals know no way to harmonize these forces when they conflict except to group them in such a manner that they will counteract each other. The inductive-interference problem is the product of the action of natural forces that are no more susceptible to the power of financial fiat than the sun in its daily course. This problem will be solved when the interests dealing with it find ways and means of arranging their property units in such way that the wasteful manifestations of physical force which produce the phenomena will be prevented by the reactions of equal forces. Money will accomplish this only as it is intelligently used to arrange properly the plant units that are affected. To this end no small amount of study and research is still necessary.

The Industry Must Consider the Farmer

THE one outstanding and commanding figure in the political horizon at the present time is the farmer. While we are reminded by Secretary Wallace that "the agriculture of the nation is in a bad state and our entire business and industrial life is suffering in consequence," let us not shut our eyes to the important fact that the farmer is in the saddle and intends to ride. As the business interests of the country now know, the "agricultural bloc" is effective and to buck it is vain. We may declaim as much as we like about the perniciousness of "blocs" and how incompatible they are with our system of government, it does not alter the fact. Those that are wise recognize a superior force where they meet it and endeavor to come to some effective agreement whereby harmful actions may be avoided. Such a course is expedient in the present emergency. Certainly retaliation at this juncture will lead to nothing but bitterness and react on those who instigate such measures. We must accept the situation and help the farmer to act wisely and justly in dealing with national issues and problems. Particularly must the electric public utilities make every effort to bring their rural-service lines within his reach. The farmer is in a position to demand it, and if he is denied will force the state to supply him with electric service. State ownership can only be avoided by propitiating the farmer. He now occupies a strategic position, and he must be cultivated, if for no other reason than self-interest.

Why Should Accidents Due to Unaccountable Carelessness Occur?

WHY do men so often incur serious injury or go to a premature death by doing things of whose danger they are fully aware? What, for instance, leads an experienced lineman to climb a pole and come in contact with a live circuit after he has previously performed his task many times in the proper way, first making safe the circuit on which he is to work? The occurrence of just such unaccountable acts of apparent carelessness or recklessness is familiar to every operating official in charge of work which concerns hazards to life and limb. Why they occur is an unsolved problem of psychology. Lapse of memory is not a satisfactory explanation. Ordinary methods of safety training do not seem to reach the seat of the trouble. Perhaps the prolific familiarity that began to breed contempt long before the earliest days of copybook headlines is largely to blame. Perhaps the American readiness to "take a chance" overcomes the remonstrances of prudence. Perhaps a well-developed grouch against his job in particular or the world in general induces in the workman a temporarily disordered frame of mind which consigns safety rules and common sense alike to Hades. Perhaps personal troubles so preoccupy his mind that he forgets what he is doing. Perhaps it is a simple case of mental aberration or absent-mindedness that overcomes him "like a summer's cloud." Whatever the explanation, the occasions for futilely seeking it should be brought to the irreducible minimum by the adoption of rigid rules of safety to be observed under penalty of discharge. Not only humanitarian but operating and financial reasons demand that this be done.

Building Business Around an Idea

THE electrical industry is slowly learning the value of a good idea when properly merchandised. For instance, the plan which has made the slogan "Have you had your iron today?" suggest the buying of five-cent packages of raisins by the millions is by no means confined to that product. Perhaps the closest approach to it that has been worked out by electrical men is the development of the electrical home idea which is now being successfully and co-operatively advertised in many cities. In the main such a campaign not only makes the home owner look around his own four walls to see how much more convenient the use of electric service could be made, but it associates the electrical idea with home comforts, economies and the elimination of heavy housework in such a way as to react psychologically when the new home is being built, when friends are discussing their plans, and when the cook or the laundress gives notice.

Simply building an electrical home and advertising it does not create a ready-made demand for a completely electrified abode. It suggests the way to the electrification of every home, and just to the extent that this idea is driven in is the idea far-reaching and a builder of electrical sales. To be sure, the real-estate agent finds the advertised electrical home a ready seller, but the electrical contractor-dealer, the electrical jobber and the electrical manufacturer should see far beyond this in possible sales of wire, outlets, fixtures, washing machines, vacuum cleaners and all the other domestic socket devices. The "cashing in" on the idea as it spreads is just as important as the promotion of the plan. That is just what the raisin manufacturers have done with their slogan, through adequate distribution and the constant iteration of the same inquiry—"Have you had your iron today?"

This example suggests a printed slogan for display in every electrical store and every other place where electrical home-wiring devices and conveniences are sold. Such a slogan might read: "*Your* house, too, can be electrical!" Eventually, when he who reads on the run stops to learn the answer, another electrical customer will result.

Highway Lighting—a Fertile Field for Activity

LAST of our illumination problems, but not least in its promise of business and general welfare, comes the problem of highway lighting. Quite frequently now we find sections of the country much interested in the proper lighting of important roads. It seems that the public, after insisting on better illumination on streets and boulevards, is starting to demand the extension of similar systems to all highways where there is much travel. From the safety standpoint alone the proper illumination of roads would be very justifiable. The number of highway accidents in the United States is increasing day by day as the amount of road travel increases. Every one knows the blinding effects of headlights of automobiles and trolley cars and the glare that they produce on rainy days. The difficulty of seeing any object on the road that has not its own source of light is also common knowledge. All such troubles would be eliminated with proper lighting.

Safety, however, is not the only consideration. Highway transportation is becoming an important factor, and the increased speed and comfort in driving would soon repay the expenditure necessary for proper illumination. The large amount of trucking done nowadays at night would be greatly facilitated also.

While at present in most instances only small groups of progressive citizens or township boards plan and contract for highway lighting, it is a matter of a short time when illumination of the highways will be just as much a part of road construction as are grading, ditching and the other necessities. The greatest problem—one which the manufacturers mainly must solve—is the design of highway lighting units that will use light efficiently and will be relatively cheap to install, requiring rather small poles or supports and a limited amount of special fixtures. The demand for highway lighting is here to stay, and there seems to be at present no more promising field of business. Any expenditure for development will be justified, not only in the revenue obtainable from satisfactory development of this business but from the standpoint of the additional comfort, safety and effectiveness of our highways.

Echo from Europe on Maximum Voltage Stress in Cables

RECOLLECTION is still fresh of the group of important papers presented to the American Institute of Electrical Engineers about a year ago on the manufacture and performance of high-tension cables. One important topic of discussion upon which there was considerable difference of opinion was the value of the maximum permissible stress on cable insulation. The prevalent feeling was that, owing to faults and imperfections arising in manufacture and subsequent handling, hot spots are apt to occur in cables at values of voltage stress far below that marking the strength of the insulating materials used. Consequently maximum stress is not a satisfactory criterion for cable rating, and if used at all it must be placed low so as to provide a factor of safety against the troubles mentioned.

Nevertheless, and probably because of the absence of a more satisfactory method, discussion frequently centers on the permissible maximum stress, and at the time mentioned one group of engineers advocated a rather low limiting value, apparently with the purpose of preventing ionization in possible voids or gas pockets and providing a safe margin of stress against other types of fault. Exception to this position was taken by others, and a number of specific cases were cited in which cables have been operating for long periods with insulation stressed well above the limiting values proposed.

An echo of this discussion comes from Europe, where several cables of foreign manufacture are said to have shown remarkable properties as regards dielectric loss, freedom from ionization and maximum voltage stress. In the last particular figures from four to six times the low limit mentioned above are given, approaching fairly close to the ultimate strength of the insulation. It is intimated that some manufacturers may have advantages over others and that the suggestion of so low a limit of voltage gradient would not be necessary if all could be constructed by the methods used for some of the cables mentioned. The figures given are certainly striking, but it appears probable that they represent exceptional cases; moreover, they would doubtless on investigation be duplicated in this country.

The position taken by the advocates of a low-voltage gradient is that by this means ionization losses and hot spots will be excluded from the greater proportion of cables, recognizing the while that many single cables may come through which will stand up to much higher service. Obviously it is possible to err on the safe side and place the limiting stress too low, but it must be remembered that under the most careful attention to design, assembly and installation obtaining with the best manufacturers, good and poor cables of the same type will both appear. So long as this is the case it would seem unwise to base the permissible maximum voltage gradient on the better cases; rather should due account be taken of the general level of quality in this particular.

Co-ordination Essential in Engineering and Sales Department Work

SINCE every effort must be made to encourage business of the type involving nominal or minimum investment in plant in order to work existing equipment as efficiently as possible from the capital and operating viewpoints, a close understanding between the technical staff and the commercial forces is now vitally important. The development of business latent on existing systems can be pushed to greater advantage where the engineers appreciate the commercial problems involved in securing it and where the sales staff thoroughly grasps the economies of the daily load curve and the physical layout of the generating plant, transmission and distribution system. While it is true that important new contracts commonly receive the close scrutiny of executives with these considerations in mind, it is very desirable that both these departments shall function with minimum lost motion through failure to appreciate the limitations under which each is obliged to work.

A clear understanding of rate schedules by every responsible man in the engineering forces of a central-station company, intimate contact with the course of sales departmental activity for such men, and at least a general comprehension by the commercial staff of the technical situation from week to week or from month to month, will go a long way toward insuring close articulation of these branches of the utility organization.

Specific Heat and Bracing of Current Transformers Need Attention

THE danger to insulation from high temperature usually arises in sustained heavy loads. Short circuits unless prolonged do not usually increase in any considerable amount the temperature rise of such equipment as generators and power transformers, since the short-circuit currents do not reach markedly abnormal values and are of short duration. When, however, the outputs of several units are combined in one bus, or the output of individual buses is increased as in recent practice, limitations not present in the larger equipment begin to appear in auxiliary apparatus.

The current transformer is an interesting case in point. It appears that the increasing kilovolt-ampere outputs to be measured have overtaken past practice in the design of the insulation of this type of transformer and have resulted in the interesting condition that a short circuit of one-tenth or two-tenths second duration may cause a rise of temperature sufficiently high to destroy the insulation. It is not a matter of radiation or dissipation of heat, but, owing to the brief duration of the load, solely a question of the specific heat of the materials of the transformer. Thus neither the shape nor the area of exposed surface plays any part, and the question is answered only by a more liberal attitude in fixing the current rating of the transformer to be used. Attention is drawn to this condition by J. B. Gibbs and L. Dorfman in an article in another column of this issue.

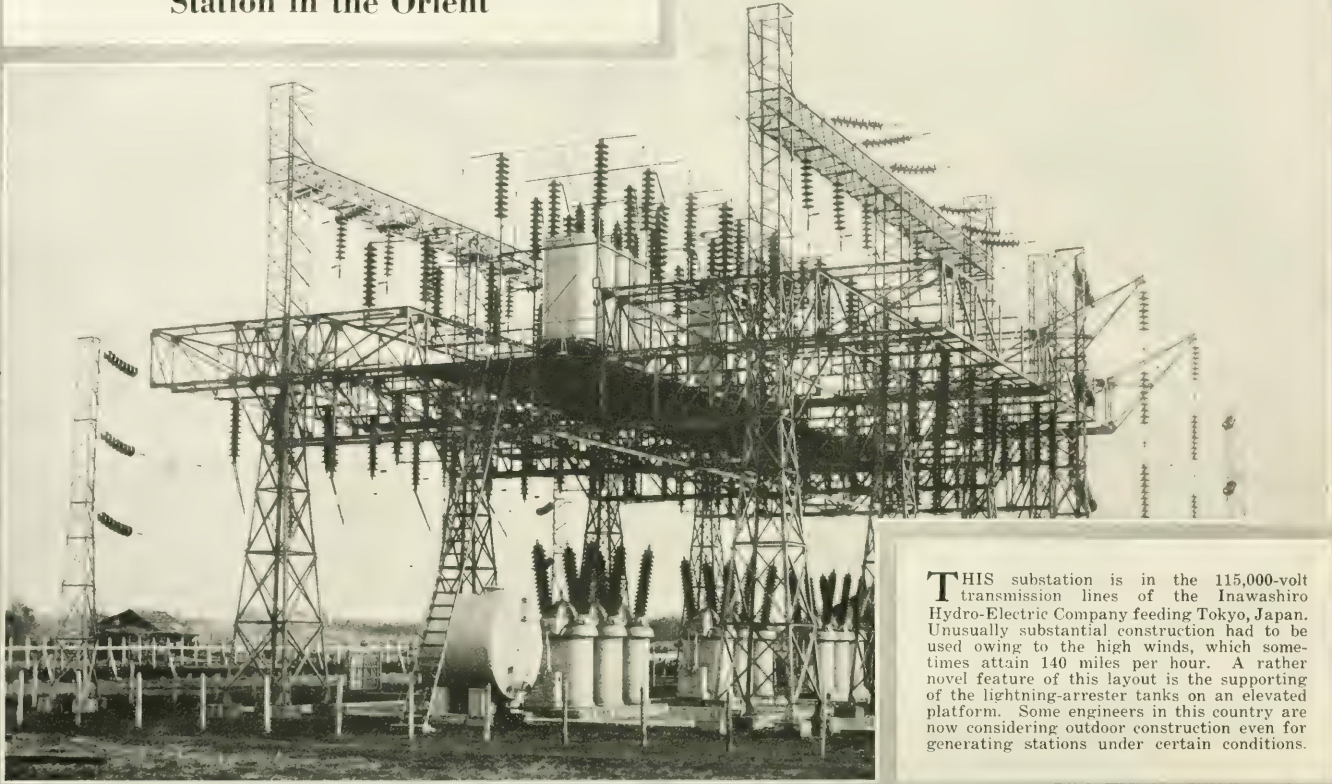
Another limitation of current transformers, also due to short-circuit conditions, as pointed out in the same article, lies in the mechanical stresses arising between primary and secondary coils. This is a well-recognized danger in generators and power transformers, and the provisions to be made for protection of current transformers are the same as in those cases, namely, proper design of coils and bracing of exposed ends. Thus the best design is the "through type," with circular magnetic circuit, and this type is practically proof against disturbances of the kind referred to. Of other types those having circular concentric coils are the strongest, those with flat coils parallel to each other the weakest. Even with the former, trouble may arise if the electromechanical centers are not exactly opposite each other. Thus a transformer was wrecked under a short circuit giving 130 times normal current, and it is shown that in ordinary circumstances much higher values may now be reached, thus indicating the importance of bracing or other means of prevention. In reading of such shocks to the current transformers one cannot but give a sympathetic and anxious thought to the instruments on the secondary side; what happens to them?

Municipal Plants Should Be Compelled to Follow Standard Accounting Procedure

SOME rather forceful comments on the accounting methods of municipally owned utilities were presented in the Dec. 31 issue of the ELECTRICAL WORLD by E. O. Edgerton, who as former president of the California Railroad Commission has had numerous opportunities for close investigation of facts. The thing which he especially endeavored to drive home is the necessity of open, well-organized and standard accounting for public utilities, regardless of whether they are municipally or privately operated. As Mr. Edgerton indicated, municipally owned utilities have been peculiarly lax in their departures from ordinary and reasonable accounting practice. He mentioned that there are instances in California where virtually no overhead charge has been made whatever against the municipally owned utility, all items of expense of this character being carried by the citizens through taxation. Of course, one must readily admit that if the public desires to carry part of the expense of its utilities as a general public charge, it is at liberty to pursue this course, although it seems to most people somewhat undesirable. The essential point of the matter is that if such a step be taken it should be done openly so that there may be a free choice between paying the way of a utility through general taxes and through charges to those in the community who benefit from it.

In other words, whatever disposition is made of charges against public utilities, the facts as to their legitimate amount should be reckoned exactly as they would be in a privately owned utility. Then every citizen knows where the enterprise stands and can vote intelligently on any question relating to it which may be laid before the electorate. With accounting done in this way, with the "cards laid upon the table," it is common, perhaps usual, for a municipally operated utility to disclose excessive costs. Such is not always the case, but according to our observation the chances of efficient and economical operation in a public utility are greatest in those enterprises wherein the number of employees and running charges are a minimum compared with the total investment. These conditions result more often under private than under municipal operation. Mr. Edgerton's discussion of the subject is one which is extremely sensible, and we indorse his contention that municipally operated plants should be compelled to follow the same accounting procedure that is enforced in the case of private utilities.

Double-Deck Outdoor Switching Station in the Orient



THIS substation is in the 115,000-volt transmission lines of the Inawashiro Hydro-Electric Company feeding Tokyo, Japan. Unusually substantial construction had to be used owing to the high winds, which sometimes attain 140 miles per hour. A rather novel feature of this layout is the supporting of the lightning-arrester tanks on an elevated platform. Some engineers in this country are now considering outdoor construction even for generating stations under certain conditions.

Temperature and Mechanical Stresses in Current Transformers

Such Apparatus Should Be Carefully Investigated to Ascertain Thermal Capacity and Mechanical Strength If It Is Liable to Be Subjected to Very Heavy Short-Circuit Currents

By **J. B. GIBBS** and **L. DORFMAN**
Transformer Engineers Westinghouse Electric & Manufacturing Company

THE increase in the kilovolt-ampere output from individual buses has introduced new problems in current transformer design because of the severity of the short circuits which may occur. These problems include:

1. Designing the transformer so that if a heavy short circuit occurs on the line, the transformer insulation will not be destroyed by heat.
2. Designing the transformer to withstand the mechanical stress caused by a heavy short circuit on the line. In certain types of transformers this may include special bracing of the coils.

The solution of the heating problem is very simple when the magnitude and duration of the short circuits are known. In the first place, the insulating material should be able to withstand a comparatively high temperature without injury. The winding must then be made liberal enough to insure that its temperature during the interval of short circuit will not reach a point which is dangerous to the insulation. At first thought it might appear that the coil could be kept cool under such conditions by increasing its radiating surface, and this would be true if the heat were generated slowly; but the duration of the short circuit is so brief that almost no heat has time to escape. The temperature of the coil, therefore, depends upon its thermal capacity and not on its radiating ability. As would be expected, the temperature of the coil varies almost directly as the time during which the short circuit continues. The speed of breaker operation, therefore, is an important factor.

As an example of the currents which current transformers can carry without overheating, it may be of interest to cite a particular case. The insulation on a certain current transformer will stand, for a short time, a temperature of 200 deg. C. without injury. Assuming that there is no radiation of heat during the time of short circuit and that the normal operating temperature is 70 deg. C., 23,400 watt-seconds of energy will be required to bring each pound of copper up to 200 deg. C. Then, if 0.15 second is the duration of the short circuit, the loss in the copper necessary to cause a rise of 95 deg. C. would be $23,400 \div 0.15 = 156,000$ watts per pound. The normal current in this transformer causes a loss of 4.75 watts per pound, and the permissible short-circuit current would therefore be $\sqrt{156,000 \div 4.75} = \sqrt{32,850} = 181$ times normal.

If the short circuit were to continue for one and one-half seconds instead of 0.15 second, the allowable loss would be only $23,400 \div 1.5 = 15,600$ watts per pound, which would correspond to a current of $\sqrt{15,600 \div 4.75} = \sqrt{3,285} = 57.4$ times normal.

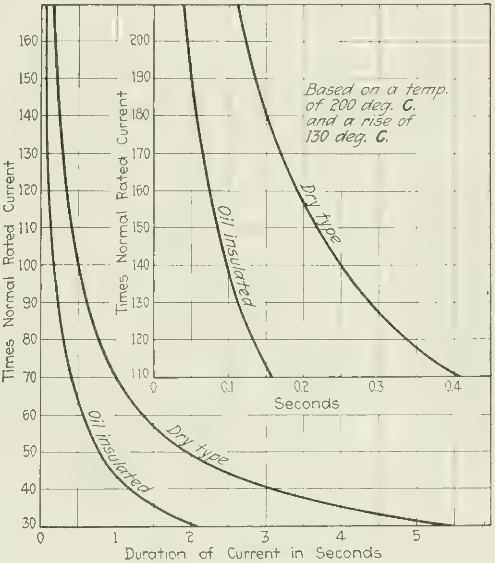


FIG. 1—THE MAGNITUDE AND DURATION OF SHORT CIRCUITS SHOULD NOT EXCEED VALUES SHOWN

Circuits of relatively small capacity connected to large power systems may be subjected to very heavy short circuits. For instance, power for the station auxiliaries in a certain station is drawn from a 2,500-kva. transformer bank having an impedance of 4.17 per cent. One of the pump motors in the station draws approximately 50 amp. normally and in case of short circuit at the motor 14,000 amp., approximately, or 280 times full rated current would flow in the line. For this reason the motor circuit was equipped with a 150/5-amp. current transformer instead of the 50/5-amp. current transformer which would be indicated by the connected load. In this case it was thought advisable to sacrifice something in accuracy in order to reduce the stress to a safe value.

The length of time that various overloads can be carried on a typical dry-type current transformer and a typical oil-cooled current transformer is shown by Fig. 1. A shorter time is allowed on the oil-cooled transformer because better dissipation of heat due to the oil allows the transformer to be worked at a higher current density for normal loads, and consequently there is less margin for overloads.

The shape of the coils has almost no effect on the

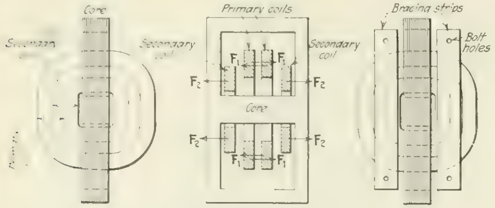


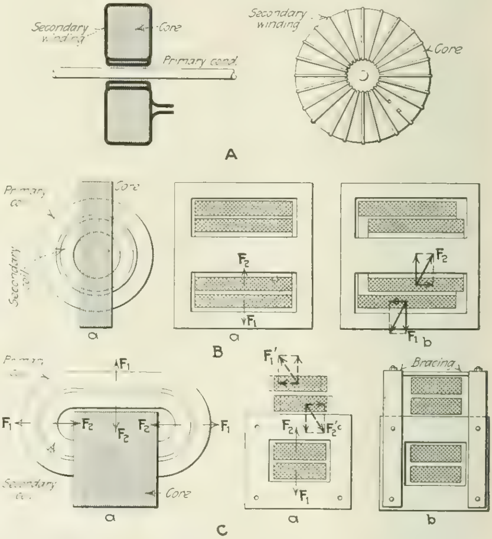
FIG. 2—SPECIAL BRACING IS USUALLY UNNECESSARY IN HIGH-VOLTAGE CURRENT TRANSFORMERS OF THE PANCAKE-COIL TYPE

temperature reached during a short circuit, but it practically determines the ability to withstand the mechanical stresses due to short-circuit current. The best type of current transformer from the standpoint of mechanical strength is the "through type." This consists of a secondary circuit wound on a core of circular or rectangular shape and a primary circuit composed of a single conductor which runs straight through the opening in the core. The primary conductor is frequently a busbar or cable which forms a part of the circuit to be metered. (See Figs. 3 and 6A.) The forces in such a transformer are perfectly balanced and no amount of overload can cause mechanical distortion. Unfortunately, such transformers cannot be built to give good accuracy for low current ratios. They are generally unsatisfactory for instrument use with ratios below 600/5, although they are used for tripping circuit breakers with ratios as low as 50/5. With ratios between 600/5 and 1,000/5 they will give fair instrument accuracy, and with ratios of 1,200/5 or higher their accuracy is excellent. In some circuits where reliability is of extreme importance and where heavy short circuits are likely to occur this rugged type of transformer has been applied even though accuracy must be sacrificed somewhat.

Of wound-coil current transformers, the type best adapted to withstand mechanical stresses is the circular concentric-coil type (Figs. 4 and 6B). So long as the electrical centers of the two coils are directly opposite each other the force between the coils is radial and is opposed by the tensile strength of the wire in the outer coil. If the electrical centers are not directly opposite, there is a component of this force which tends to move the coils axially with respect to each other. The iron of the transformer in the construction shown is sufficiently rigid to prevent any motion of the coils.

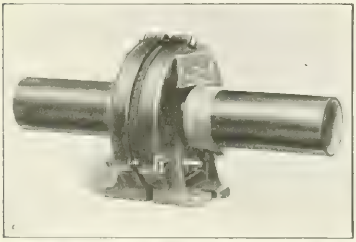
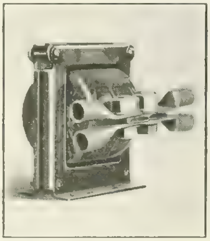
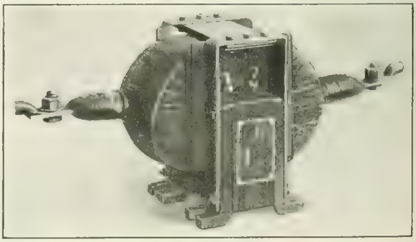
Some current transformers have coils which are concentric but not circular (Fig. 6C). The iron sometimes embraces both sides of the coils and sometimes only one side. When the iron surrounds both sides of the coil it gives sufficient support to the coil to prevent distortion. If the iron surrounds only one side of the coil, it is advisable, if the transformer is liable to very heavy short circuits, to put additional bracing around the unsupported side of the coil.

The magnitude of the mechanical force between coils may be considerable. Take, for instance, a transformer of the type shown in Fig. 6C in a circuit in which the short-circuit current may reach 280 times normal. The repulsive force between two parallel wires carrying current in opposite directions is proportional to the product of their currents and the length of the parallel and inversely proportional to the distance between the wires. In calculating the mechanical stress between transformer coils it is assumed that the total ampere-turns of each coil are concentrated at the "electrical center" and that the force is in the direction of the line joining the electrical centers. The calculated force between primary and secondary in this case would amount to about 40,000 lb. (18,144 kg.). This force would be opposed by the tensile strength in the copper of the outer coil, which is about 0.9 sq.in. (5.8 sq.cm.) in cross-section on each side. The stress in the copper, therefore, is about $40{,}000 \div (2 \times 0.9) = 22{,}000$ lb.



FIGS. 6 A, B AND C—SECTIONS OF TYPICAL THROUGH-TYPE AND CONCENTRIC CIRCULAR AND NON-CIRCULAR COIL TYPE CURRENT TRANSFORMERS

The through-type is almost entirely safe from mechanical damage and the concentric type is relatively so if the iron surrounds both sides of the coils.

FIGS. 3, 4 AND 5—TYPICAL THROUGH-TYPE, CONCENTRIC-COIL-TYPE AND BRACED-PANCAKE-COIL-TYPE CURRENT TRANSFORMERS per square inch (1,540 kg. per sq.cm.). If the coils of this transformer are displaced mechanically $\frac{1}{8}$ in. (3.2 cm.) and if the distance between the electrical centers of their cross-sections is $\frac{11}{8}$ in. (17.5 cm.), the axial component of the force between them will be 7,300 lb. (3,311 kg.). In order to find how much overload is permissible in a transformer of this type without bracing one was tested by putting successively heavier short-circuit currents through it until it failed by distortion of the coils. This took 130 times full-load current. From this it appears that transformers of this type should be specially braced when short circuits of more than about 100 times normal current are possible. The weakest construction, mechanically, is composed of flat pancake coils arranged parallel to each other (Fig. 2). The full repulsion between primary and secondary is exerted on the outer coils, tending to bend them where they emerge from the iron, but bracing is comparatively easy so that they can stand any required short-circuit stress. Bracing is rarely applied, however, to transformers of this type because the circuits on which they are used generally have characteristics which prevent short-circuit currents of dangerous magnitude. Such transformers are used on high-voltage circuits where the normal load is a fairly large proportion of the generator capacity and, consequently, the short circuit is limited.

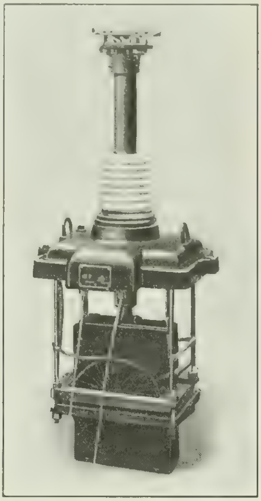


FIG. 7—HIGH-VOLTAGE PANCAKE-COIL CURRENT TRANSFORMER

Suitability of Copper-Cadmium Wire for Electrical Transmission

By W. C. Smith

Metallurgist, United States Metals Refining Company

ELECTRICAL engineers are constantly being confronted* with problems the solution of which requires the use of metallic conductors possessing properties not inherent to hard-drawn copper wire. An alloy of rather unusual properties, and one unknown to the average engineer, is copper-cadmium. Wire drawn from copper containing a small amount of cadmium has a much greater tensile strength, is considerably harder and has a higher annealing temperature than a pure copper wire of the same size, and its electrical conductivity has been reduced to a less degree than in the case of any other known alloy of equivalent tensile strength.*

The results of some laboratory experiments made by the writer during 1918 and 1919 are shown in the accompanying curves. In every case considered the wire tested was a No. 12 B. & S. gage (approximately 0.081 in. in diameter). The tensile strength tests were made on hard-drawn wire, and the conductivity tests were made on annealed samples.

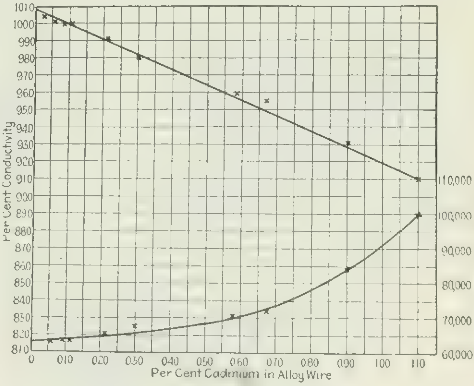
Annealing was done by passing 150 amp. through each sample for sixty-five seconds. Preliminary experiments indicated that a complete anneal could be made under these conditions. A series of laboratory experiments on the annealing temperatures of copper-cadmium wire as compared with pure copper wire indicated that the annealing temperature of the copper-cadmium increased as the cadmium content was increased, and that a wire containing 1.10 per cent cadmium withstood a temperature of 260 deg. C. (500 deg. Fahr.) for one-half hour, with only slight evidence of softening, while the pure copper wire was dead soft after the same treatment.

Harder Than Pure Copper

A hardness test made on a cast alloy containing 1.10 per cent cadmium indicated that the alloy was about 20 to 22 Brinell numbers harder than cast copper. No Brinell tests were made on wire, but it was observed that the alloy wires were somewhat stiffer and harder to file than wires of pure copper.

Mill tests indicated that wire bars containing up to 1.20 per cent cadmium could be hot-rolled, but when the cadmium content of the alloy was further increased the bars cracked in passing through the break-down rolls.

The melting point of copper is approximately 1,083 deg. C. (1,980 deg. Fahr.), of cadmium 321 deg. C. (609 deg. Fahr.), and the boiling point of cadmium is approximately 778 deg. C. (1,332 deg. Fahr.). This explains the failure of our first attempts to produce an alloy of uniform composition by the direct addition of cadmium to molten copper. Experimental work developed the fact that a uniform alloy could be produced by introducing the cadmium into the molten copper in the form of an alloy of copper and cadmium rich in cadmium. For this work alloys containing from 30 to 75 per cent cadmium have been used. The base alloy generally employed contains about 50 per cent cadmium. It was found that the base alloy could be produced from molten copper and solid cadmium with the loss of very small amounts of cadmium if the temperature were accurately controlled.



STRENGTH AND ELECTRICAL CONDUCTIVITY OF COPPER-CADMIUM WIRE

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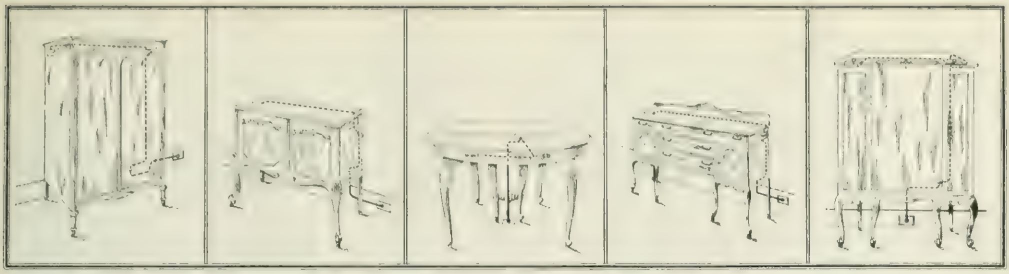
*The method of production of the base alloy and its use to produce copper-cadmium alloy of the desired composition is covered by U. S. patent No. 1,307,642 (June 24, 1919).

The First Exhibition Suite of Electrified Furniture

Ten articles of modern walnut furniture which have been wired and equipped with self-contained electrical convenience outlets by the United Electric Light & Power Company, New York City. This pioneer electrified furniture was first exhibited at the New York Electrical Show last fall and has since been on display in prominent furniture showrooms in New York City.



SCALE DRAWINGS OF THE "CHIFFEROBE," SERVING TABLE, DINING TABLE, BUFFET AND CHINA CLOSET

The Use and Future of Electrically Equipped Furniture

What the Furniture Man Thinks of It — The Purpose in Each Case — The Standard Specifications for Wiring — The Opportunity It Offers

By **EARL E. WHITEHORNE**
Commercial Editor ELECTRICAL WORLD

ELECTRIFIED furniture is something new under the sun. It was first talked about in 1915, but during the war there was no time to think of it. Last June, however, the subject was revived by Joseph F. Becker, sales manager of the United Electric Light & Power Company, New York City. He exhibited a full set of miniature household furniture before a meeting of the N. E. L. A. Commercial Section executive committee at Association Island and discussed the situation. He was appointed chairman of a committee and received an appropriation to develop a set of specifications for wiring furniture. Mr. Becker thereupon, at the expense of his company, proceeded to purchase and electrically equip a complete set of household furniture, which was exhibited first at the New York electrical show last fall and thereafter in the furniture departments of various large New York department stores. Electrified furniture, therefore, is not only being talked about; it has been produced.

Now, the point that interests me most about this idea is not what the electrical man thinks, nor even what a woman says when she first hears of it. It is the opinion of the furniture people. For they know furniture. And they have said that the electrical equipment of household furniture is a real inspiration which is going to win a great popularity. R. Braun, president of the New York Furniture Exchange, has put it this way:

> There is no doubt in the world that electrified furniture will sell, provided only that the cost of electrifying it is brought down to a proper level. The cost of the suite which was exhibited last fall at the electrical show and the two suites which were electrified for the recent furniture exposition and are now in our display room was, of course, high—it represents the usual high cost of development work—but furniture should easily stand a charge of 12 per cent for wiring. Our two suites were priced at $325. They should carry an additional $40 for wiring.
>
> If we had had a basis for estimating the cost of wired furniture during the furniture exposition, we could have sold many suites, for great interest was shown in it. I believe that the furniture trade will welcome this innovation. Since the coming of "Mission" furniture and the later introduction of Italian trends, this is the first new idea which the furniture dealer has had to offer. It will provide a style appeal that should produce much business. I believe that electrified furniture has a big future.

Therefore, as far as the furniture aspect is concerned, the idea is apparently right. Electrified furniture will sell. And it will sell even though some men

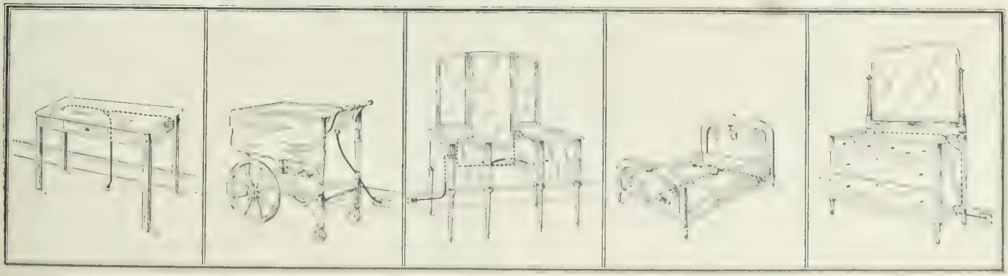


DIAGRAM SHOWING HOW THE KITCHEN TABLE, TEA WAGON, VANITY TABLE, BED AND DRESSER WERE WIRED and women when they first hear about it are not enthusiastic. Furniture has never been electrified and the thought is somewhat startling. They do not at once see the necessity for it. But, by the same token, the use of electrical appliances is in itself new, and this further step in making their use convenient will not be thoroughly understood until it is explained. It is an idea that at first will have to be "sold."

All electrical appliances, of course, have one inherent and unescapable feature of inconvenience. They must forever be attached to the electric outlet while in use. If there are not an adequate number of conveniently located outlets to which the fan or toaster or heat pad may be connected, it is not easy to use them, and from the beginning that has been a serious obstacle to their habitual use and popularity. People naturally want to use these devices right where they happen to be sitting. The grill, the percolator and the other small cooking appliances are commonly used at the dining table or the sideboard. The vibrator, hair dryer and curling iron are commonly used at the dressing table. The fan is almost always standing upon a bureau or sideboard or table. The heat pad and bottle warmer are needed usually beside the bed. The convenience of the vacuum cleaner depends upon being able to plug it in at any point where you want to clean. But few houses, at present, have more than one or at most two baseboard outlets in the principal rooms, and most of these were installed before the furniture was in place and are not as handy as they should be.

PROVIDES MORE HANDY OUTLETS

There is the condition. And the equipping of the furniture itself with convenience outlets is the best idea that has ever been suggested to relieve it. For in this way we can automatically provide a large number of additional receptacles exactly where they can be reached most easily at the precise point where they will always be wanted, no matter how the furniture is moved. Each piece of furniture connects by an attachment cord directly to the house wiring by plugging into a baseboard receptacle, and its own more accessible receptacles are used to connect the appliances by short cords. There is no stooping down therefore each time some device is to be used. The bed or the table remains plugged in.

There are ten pieces of walnut furniture in the model set which has been prepared by Mr. Becker's company. The photographs reproduced here show how the receptacles have been installed, although to make them visible in these halftones it has been necessary to make these receptacles more prominent and conspicuous. The method of wiring is shown in the diagrams. The purpose in wiring each has been very definite:

Bed.—The bed is provided with three receptacles, placed under the left-side board at the head of the bed to connect a heat pad, the bedside lamp, the fan, the baby's bottle warmer or a grill for the bedside breakfast. In addition, a toggle switch operates a lamp beneath the bed which illuminates the floor sufficiently to make it comfortable to walk about without disturbing a sleeper or making the interior of the room visible from out of the window. All this equipment has been attached to the one section of the bedstead so that the bed may be taken apart without interference with the wiring. The following material was used in wiring this bed:

Two two-gang ccs F. H. tandem boxes (Chicago Fuse Company),
Three small handy boxes, OA, Corey,
Three small handy covers, OB, Corey,
Eight ½-in. box connectors for No. 16 BX,
Eight brass straps, No. 16, cable BX,
Twenty-five ft. No. 16 armored cable.
Three Bryant shallow receptacles, No. 120,
Two two-gang plates (E. S. E. M. special),
Three ⅜-in. Chase bushings and locknuts,
One Hubbell attachment plug, No. 5967,
Two G. E. special plugs, No. 718,
One condulet, Crouse-Hinds, type E,
Two K. A.-Bryant plugs and caps, No. 113,
One G. E. toggle switch, No. 1299.

Chifferobe.—The "chifferobe" has two receptacles for the convenience of the man, and they are often needed when this piece of furniture accepts the darker corner in deference to the greater needs of the dresser. They provide for the connection of a boudoir lamp or a shaving lamp, a fan or an electric clock, and the wardrobe section is automatically lighted as the doors are opened. This material was used in its wiring:

Two 2-in. F. H. ccc boxes (Chicago Fuse Company),
One small handy box, U. A. (Corey),
One ½-in. box connector for No. 16 BX cable,
Three ⅜-in. box connector for No. 16 BX cable,
Ten brass straps for No. 16 cable,
Twelve-ft. No. 16 armored cable,
Two shallow receptacles, Bryant, No. 120,
Two single plates,
One Hubbell attachment plug, No. 5467,
One G. E. special plug, No. 718,
One condulet type E ½-in. and cover (Crouse-Hinds).

Dresser.—The dresser has four receptacles to connect two candlesticks or a boudoir lamp, a violet ray, or vibrator or hair dryer or curling iron or fan. This material was used:

Four 2-in. F. H. boxes ccc (Chicago Fuse Company),
One small handy box U. A. (Corey),
One small handy box cover O. B. (Corey),
One ½-in. box connector for No. 16 BX cable,
One ⅜-in. box connector for No. 16 BX cable,
Twelve-ft. No. 16 BX cable,
Four Bryant shallow receptacles, No. 120,
Four single plates,
One Hubbell attachment plug, No. 5467.
One special plug (G. E.) No. 718.

Vanity Table.—The vanity table has two receptacles for use with any of the appliances mentioned in connection with the dresser. This material was installed:

Two 2-in. F. H. boxes, ccc (Chicago Fuse Company),
One small handy box U. A. (Corey),
One small handy-box cover O. B.,
One ½-in. box connector for No. 16 BX cable,
Three ⅜-in. box connector for No. 16 BX cable,
Six brass straps for No. 16 cable,
Twelve-ft. No. 16 armored cable,
Two Bryant shallow, No. 120 receptacles,
Two single plates,
One Hubbell attachment plug No. 5467,
One special G. E. plug No. 718.

Sewing Table.—The wiring of the sewing table is also suggested where it is desired. Two receptacles can be installed for use in connecting a flatiron for pressing work, a lamp for evening sewing, the sewing machine motor or a fan. This material will be required:

Two 2-in. FH boxes ccc (Chicago Fuse Company),
One small handy box U. A. (Corey),
One small handy box cover O. B. (Corey),
One ½-in. box connector for No. 16 BX cable,
Three ⅜-in. box connector for No. 16 BX cable,
Six brass straps for No. 16 cable,
Ten-ft. No. 16 armored cable,
Two Bryant shallow No. 120 receptacles,
Two single plates,
One Hubbell attachment plug No. 5467,
One special plug No. 718 G. E.

Dining Table.—The dining table is undoubtedly the one article of furniture most greatly in need of its own wiring. Although it is usually not possible to operate more than one table appliance at a time owing to the excessive load, as a matter of practice it is not necessary or customary. The percolator is started as soon as the first member of the family comes in to breakfast, or by the maid before that. By the time the fruit and cereal are finished the coffee is done and the grill or toaster has come into service. So only one appliance is needed at a time, but to be convenient it should be possible to disconnect the one and connect the other without getting up, and this is rarely possible where the table itself is not wired.

Too often an indirect-lighting fixture over the dining table makes it impossible to connect an appliance without running a tangled cord across the rug and risking an unwary foot that may jerk the toaster off the table; and the attachment of table appliances to any type of lighting fixture on the table is an abomination because the hanging cords are both unsightly and troublesome. A wired table, however, may be connected to a floor receptacle through parted fibers in the rug, and the appliances, with shortened cords, are plugged into the receptacles in the skirt of the table. Meanwhile the lighting arrangements are not disturbed. This material was used:

Two 2½-in. F. H. ccc boxes (Chicago Fuse Company),
Two small U. A. handy boxes (Corey),
Two small O. B. bandy box covers (Corey),
Six brass straps for No. 16 BX cable,
Two ½-in. box connectors for No. 16 BX cable,
Two ⅜-in. box connectors for No. 16 BX cable,
Nine-ft. No. 16 armored cable,
Two Duplex receptacles, Bryant No. 122,
Two Duplex plates, Bryant No. 555,
Two ⅜-in. Chase bushings and locknuts,
Two ½-in. Chase bushings and locknuts,
One Hubbell attachment plug No. 5467,
One G E. special plug No. 718.

Buffet.—The buffet is fitted with two receptacles which may be used for connecting electric candles or any cooking appliance which might be operated by the maid at the sideboard or at the table. Also in summer a fan often stands here. It requires:

Two 2-in. F H ccc boxes (Chicago Fuse Company),
One small handy U. A. boxes (Corey),
One small handy O. B. box cover (Corey),
One ½-in. box connector for No. 16 BX cable,
Three ⅜-in. box connector for No. 16 BX cable,
Eight brass straps for No. 16 cable,
Ten-ft. No. 16 BX cable,
Two No. 120 Bryant shallow receptacles,
Two single plates for No. 120 receptacles,
One Hubbell attachment plug No. 5467,
One G. E. plug No. 718.

Serving Table.—The serving table is equipped in the same way as the dresser as an alternative or supplementory convenience for attaching the same appliance or candles. It requires for wiring:

Four 2-in. F. H. boxes ccc (Chicago Fuse Company),
One small handy box U. A. (Corey),
One small handy box cover O. B. (Corey),
One ½-in. box connector for No. 16 BX cable,
One ⅜-in. box connector for No. 16 BX cable,
Twelve-ft. No. 16 BX cable,
Four Bryant shallow receptacles, No. 120,
Four single plates,
One Hubbell attachment plug, No. 5467,
One special plug (G. E.), No. 718.

China Closet.—The china closet is wired to provide light with both an ormental and a utilitarian purpose. Beautiful glass and china is most attractive when lighted and low-powered tubular lamps within a cabinet bring out the fire of cut and iridescent glass and the coloring of china most effectively and without undue display. This light also serves to prevent breakage when glass is being taken out or put back by making it easier to gage the space and distance. On top of the china closet there are also two receptacles to connect a fan or an electric clock. This material was used in wiring:

One small handy box U A (Corey),
One small handy box cover O B (Corey),
Three ½-in. box connector No. 16 BX cable,
Three ⅜-in. box connector No. 16 BX cable
Twelve brass straps for No. 16 BX cable,
Three Hubbell attachment plugs No. 5467,
Sixteen-ft. No. 16 Armored cable,
One special G. E. No. 718 plug,
One Frink reflector with lamps,
Two two-in. FH boxes ccc (Chicago Fuse Company),
Two Bryant receptacles No. 120,
Two plates for Bryant receptacles No. 120.

Tea Wagon.—The tea wagon is another case where wiring has a great practical value. The wagon is taken about the house to any room or on the porch, to be used beside the fireplace or at the chair where the hostess may be sitting. On it may be a samovar or percolator and also a chafing dish, grill, toaster or waffle iron. Yet seldom is it convenient to connect two appliances and perhaps a little table lamp just at that point. With a wired tea wagon the attachment cord is carried to the nearest baseboard outlet and the appliances, with shortened cords, plug into the tea wagon's own two receptacles. A hook is provided to coil the wagon's attachment cord over when not connected. This material is required to do the wiring:

One two-in. F. H. box ccc (Chicago Fuse Company),
One Bryant duplex receptacle,
One Bryant duplex receptacle plate,
One special G. E. receptacle,
Six-ft. No. 16 flexible cord,
One Bryant plug and cap.

Kitchen Table.—The kitchen table is the main domestic workbench, and more and more electrical equipment is becoming available for use on it. Two receptacles have been installed to connect the electric mixer, the grinder, the polisher, or the flatiron. This material is used.

Two F. H. boxes ccc (Chicago Fuse Company),
Two-ft. ⅜-in. armored cable,
Two-ft. ½-in. armored cable,
Six-ft. No. 16 armored cable,
Four brass straps for armored cable,
Two Bryant receptacles No. 120,
Two plates for Bryant receptacles No. 120,
One special G. E. receptacle,
One U. S. handy box,
Six-ft. No. 16 flexible cord,
One Bryant plug and cap.

Kitchen Cabinet.—The kitchen cabinet has two receptacles for connecting the same devices listed above for use on the table and in addition a heating receptacle for attaching a flatiron or a fireless cooker. It requires this material for wiring:

Two F H boxes ccc (Chicago Fuse Company),
Three-ft. ⅜-in. armored cable,
One-ft. ½-in. armored cable,
Eight-ft. No. 16 armored cable,
Six brass straps for armored cable,
Two Bryant receptacles No. 120,
Four receptacle plates,
One special G. E. receptacle,
One small handy box U. S.,
Six-ft. No. 16 flexible cord,
One Bryant plug and cap for No. 120 receptacle.

In the equipment of this original set of electrified furniture, of course, it was necessary to use available standard fittings which are in many cases larger and more conspicuous than are appropriate. New fittings for furniture will undoubtedly be developed having smaller plates and other characteristics more suitable for this use, and this will naturally stimulate the wiring of furniture. One leading furniture manufacturer has said that if smaller fittings were available he would begin to electrify his dining-room tables, tea wagons and some other pieces at once, and other producers will follow suit. It offers both the maker and the dealer a new style in furniture, a new idea that can be talked about and advertised and sold. It is something that they all want and will gladly push. And every sale of wired furniture brings more outlets into some home, more places to use appliances, and nothing influences the purchase of more appliances so much as a handy waiting outlet. Such a piece of electrified furniture will add from one to four more outlets and increase the use and comfort of every kind of a household device. There will be a place to plug in a fan or vacuum cleaner in every room and corner of the house.

WILL WIRE IN FACTORY AND HOME

Of course, the bulk of this wired furniture will ultimately come direct from the factory. It will be made that way and bought by people who want the added style and convenience which it offers them. Also, as the idea spreads there will be much old furniture wired by people who wish to add this feature to their own possessions. The work must be done by an experienced cabinetmaker who can cut the holes for the electrical contractor to set his fittings in.

It is a big idea, and it has a big future, and electrical men will do well to push it energetically. Today it sounds like a radical innovation that will not have wide popular appeal, but the furniture man knows better than we do about that. Motor cars were considered complete before the first self-starter came, but we know now that a car was but half an automobile as far as convenience was concerned before that further refinement was introduced. We are going to find that wiring will bring just this kind of a convenience to our furniture and that people will adopt it gladly once they see how much it will do for them in comfort. And the electrical industry will benefit tremendously.

Westinghouse, the Champion of Alternating Current

A LIFE OF GEORGE WESTINGHOUSE. By Henry G. Prout. Published by Charles Scribner's Sons, New York City, for the American Society of Mechanical Engineers.

MEN have been known to toil and to create without much thought of worldly recompense, content to achieve and to glory in it. Such a man was George Westinghouse—big in heart and in accomplishment. Of him it can rightly be said, he lived "in deeds, not years; in thoughts, not breaths; in feelings, not in figures on a dial." To evaluate him is therefore no easy task because his life cannot be resolved into a formula.

Two things stand out prominently from all the contributions by George Westinghouse to society, namely, the air brake and his sponsorship of alternating current. While it is, of course, difficult to assign to each its relative importance, it is not unfair to say that alternating current has in less than half a century of commercial existence changed both industrial and domestic life in almost all the world. Only with alternating current could electricity have gained such a widespread use as it has today. It seems strange now to look back at the statements made in that most bitter war between the proponents of the two kinds of current, with Edison championing the direct-current forces and Westinghouse, sincere in his belief, fighting almost alone for alternating current. Even Lord Kelvin was not won over to alternating current for power generation and distribution until as late as 1893, but a short time before his death in speaking of Westinghouse he said: "The electric development we know today would long have halted without his daring and resourcefulness."

Westinghouse's Life a History of Achievements

The present volume is the second biography of a great American engineer to be published by the American Society of Mechanical Engineers, the first, an autobiography of John Fritz, having been published in 1912. In the present instance the society is to be congratulated upon its choice for biographer—Col. Henry G. Prout, who before joining the Union Switch & Signal Company, of which he later succeeded Mr. Westinghouse as president, had made a name for himself as one of the greatest editors in the technical publishing field. Although he was assisted by a very able committee and many others well qualified for the work because of long years of intimate contact with George Westinghouse, Colonel Prout had for many reasons a task of unusual difficulty before him. Westinghouse did not devote himself to one single line of endeavor. His activities were many and varied. It is doubtful if many men have lived with minds so fertile, for he is credited with one patentable invention every six weeks for forty-eight years. Still, he left no written record except in the files of his numerous companies. He kept no journals or even notebooks. For that reason any life of Westinghouse must necessarily be a history of the developments in which he took such a leading part. The volume consequently is not a chronological narrative, but rather a series of chapters each devoted to one important phase of the varied activities that filled his busy life.

Born in the little village of Central Bridge, N. Y., Oct. 6, 1846, of Westphalian stock, George Westinghouse grew up in an atmosphere of machinery. His father, a manufacturer in a small way of agricultural and mill machinery and small steam engines, was a man of considerable mechanical skill and ingenuity. It is recorded that he took out eight or nine patents for his inventions. It was in his father's shop, located, strange to relate, at Schenectady, at the very gates of what are now the works of the General Electric Company, that the boy began his career. He was then just past thirteen, and until the Northern army claimed him in 1863 he intermittently worked and went to school. At the close of the Civil War he entered Union College, but three months later he was back in the shop and this was the end of his college life.

Rotary Steam Engine First Invention

Although he was such a dominant figure in the field of electricity, Westinghouse was essentially a mechanical engineer. His first invention, worked out before he was nineteen, was a rotary steam engine. This led eventually to one of the most interesting chapters in his life. Though the rotary engine was not a success, Westinghouse showed one of his characteristic traits by turning it into a water meter and thus founded another great industry. Having found the steam engine because of its bulk to have a very limited scope, it was a logical step for him to espouse the steam turbine. He had watched Parsons' work in England and, becoming satisfied that the turbine was the suitable prime mover for electric generators, he took out a license under the Parsons patent for manufacturing it in the United States for other than marine use. He made many improvements in the turbine art, the greatest of which is his invention of the single-double flow turbine. His own inventions, however, were the least part of his work in this field. He stimulated others and forced developments.

Air Brake the Foundation of His Fame

While it was in the steam engine field that the inventive mind of Westinghouse first displayed itself, he obtained his first great engineering triumph in the field of transportation. The air brake was the foundation of his fame and fortune. He was twenty-two when he took out his first brake patent. In the next four years he took out twenty-odd air-brake patents, and more still in later years as he saw ways of improving previous devices. For twenty years he was engaged in perfecting an automatic brake. His greatest original contribution to the art of power braking was in the invention, development and perfection of the triple valve.

On the other hand, his interest in safe railroading, was not confined to train braking. Experiments both in England and the United States with interlocking signals and switches engaged his attention. Quickly he sensed their importance, and in the early eighties the record shows that he acquired the American rights for some English patents for the control of signals by track circuits, thereby laying the foundation of another great industry. His own work in this field was necessarily, because of other more pressing activities, of short duration. It was intense, however. In the year 1881 alone, for instance, he took out six patents in signaling and interlocking, one of them fundamental and revolutionary.

Some of the achievements of Westinghouse in the field of transportation, like the work just mentioned, were overshadowed by his greatest contribution, the air brake. Thus little is heard of the name of Westinghouse in connection with friction draft gear.

When we come to the part Westinghouse played in the field of electrical development we leave the inventor and take up the promoter. It is true that he invented many useful accessories, but his great work was in stimulating, combining and directing the work of other men. It was through William Stanley that Westinghouse entered the electrical field. He had invented a self-regulating dynamo and with E. P. Thomson had also invented an incandescent lamp with a carbonized silk filament. Stanley happened by chance to meet H. H. Westinghouse, a younger brother who had invented a high-speed engine that was self-regulating, and the immediate result was that young Stanley went to Pittsburgh in the employ of George Westinghouse to manufacture his dynamo and lamp and to develop a complete electric lighting system. This was in 1884. Because of outstanding patents, however, both for lamps and self-regulated dynamos, Westinghouse hesitated to push the electrical products. Still, research work went ahead, and in 1886 the first Westinghouse central-station equipment was installed in Trenton. He also took up arc lighting by purchasing in 1888 the Waterhouse Electric & Manufacturing Company. Although this system was later dropped, the Westinghouse Electric Company did a great deal for arc lighting in original research, in developing lamps and other apparatus and in commercial effort. The important year for Westinghouse, however, so far as the electrical art is concerned, was 1885. In this year he became interested in the work of an erratic Frenchman named Gaulard and an Englishman named Gibbs who had worked out a plan for distributing single-phase alternating current by means of what they called "secondary generators," now known as transformers. This system was first shown in public in 1883 at the Royal Aquarium in London. Through Pantaleoni, his personal representative then in Turin, Westinghouse secured an option in the American rights of the Gaulard and Gibbs system. The first transformer was brought to America late in November, 1885, and in three weeks the essential conceptions were formed. From that time forward Westinghouse was the world's champion of alternating current.

GEORGE WESTINGHOUSE, 1846-1914

Westinghouse was satisfied that here was the way to transmit electricity great distances and economically. It had already been demonstrated that the economic limit of the distance to which direct current could be transmitted was small because of the great amount of copper required. Accordingly on Dec. 23, 1885, he formed the Westinghouse Electric Company to develop the alternating-current system. Stanley in the meantime had gone to Great Barrington, Mass., to regain his health and while there worked on the transformer, making in 1886 the first operating alternating-current installation in the United States. In November of that year the first commercial alternating-current system was installed by the Westinghouse company in Buffalo.

Coincidentally with the development of the transformer Westinghouse brought out a new alternating-current generator designed by Stanley.

The alternating-current system, however, was still imperfect. It had the generator and transformer but not the motor. This did not come until 1888, when patents were issued to Nikola Tesla for the induction motor. Exclusive rights were secured by Westinghouse. It was strange that the alternating-current meter, which is really an induction motor, should have come just a few days after Tesla's invention, the work of Shallenberger, one of Westinghouse's engineers. To the Chicago World's Fair in 1893, interesting in many ways in the life of Westinghouse, is given a full chapter in the volume under review because it removed the last serious doubt of the usefulness of the polyphase system. It was at Niagara Falls, however, that the deathblow to direct current was really given. In obtaining the contract for the equipment for this development Westinghouse won the battle for the supremacy of alternating current.

Electric traction began to claim the attention of Westinghouse in 1889. He urged his engineers to dig into this field. Among the developments that resulted are the single-reduction gear motor for street-railway cars and the single-phase system for electrification.

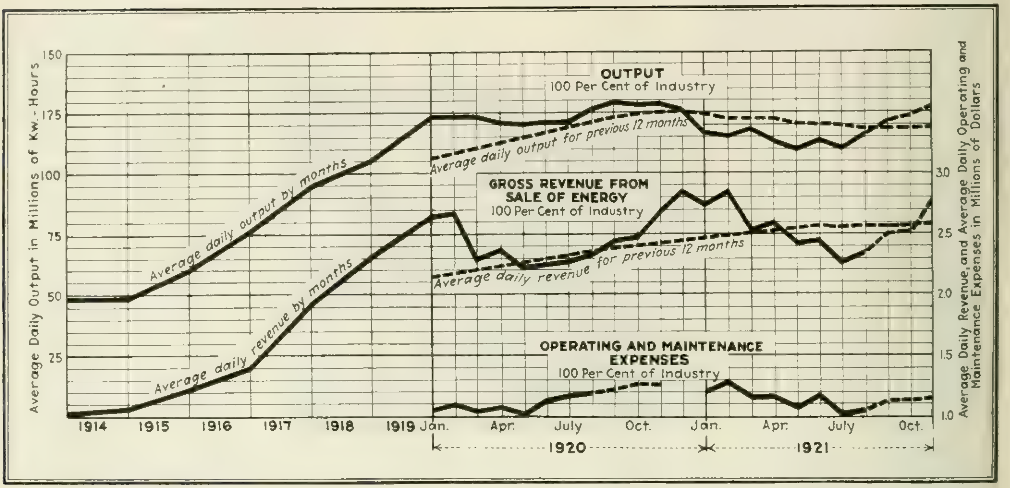
There are numerous other electrical developments with which Westinghouse was intimately associated but of which space does not permit a detailed mention. Thus, for instance, he introduced the Nernst lamp into the United States and for a while, until the tungsten lamp came along, it gave promise of great success. He personally financed Peter Cooper Hewitt in the development of his mercury-vapor lamp.

So much for his contributions to society. Personally he was a strong, rugged man of severe determination. He drove others, but none so hard as himself. Outside of his own strong mind his greatest asset was his ability to inspire others.

There are those who believe that the world would have been richer had Westinghouse stuck to engineering and left financial affairs to some one else. This, however, he was never willing to do, and one of the greatest blows he ever received was the loss of the executive control of the electric company following its financial reorganization after the panic.

His most important faculty perhaps was his imagination, for from it sprang actualities. From his resourcefulness came the enrichment of the world to a degree that it is given to few men to accomplish.

Large Increase in Energy Output in November



CENTRAL-STATION OUTPUT AND GROSS REVENUE SHOW MATERIAL INCREASES DURING NOVEMBER

REPORTS received by the ELECTRICAL WORLD for the month of November from central generating and distributing companies representing 79 per cent of the installed rating of the country indicate that the average daily electrical energy requirements during that month were the largest since November, 1920. A slight general increase in the use of industrial energy, and, of course, the increased lighting requirements due to the advancing season, added to the consumption of new customers, explain the increase in average daily output of 3,440,000 kw.-hr. over that reported for October.

From an economic viewpoint the November returns are most encouraging to the electric light and power industry, especially when the industry is compared with other primary industries of the country. The electric light and power industry, while selling only 1.1 per cent more energy in November, 1921, than in November, 1920, reported gross revenue from sale of energy 5.1 per cent in excess of that received during November, 1920. In addition, the operating and maintenance expenses during November were 8.5 per cent below those of November, 1920. From this it is apparent that there has been a considerable increase in the high-priced energy consumption, which is but a reflection of the ELECTRICAL WORLD estimate that a total of 1,001,700 new residential customers were added to the lines of the distributing companies during the year 1921. Furthermore, when comparing one month with the corresponding month in the year previous, sight must not be lost of the added consumption by new customers connected during the intervening months.

The output of electrical energy during November reflected industrial activity throughout the country slightly above that of October. Increased industrial activity was especially noticeable in the Middle Atlantic States. Slightly increased operations were reported by the textile mills in New England during November,

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
Dec.	71	2.792.554	2.648,746	5 4	66	$57,697	$48,580	18.6
		1921	1920			1921	1920	
Jan.	76	2,765,632	2,943,349	-6.0	70	58,855	50,861	15.8
Feb.	76	2,453,671	2,711,800	-9.4	70	55,540	48,633	14.3
Mar.	77	2,806,609	2,989,581	-6.1	72	55,513	49,071	13.3
April	78	2,675,949	2,895.067	-7.0	72	55,326	49,064	12.8
May	78	2,668,457	2.889,174	-7.6	72	53,901	47,932	12.6
June	78	2,686,479	2,872,900	-6.4	72	52,385	47,977	9.3
July	78	2,706,016	2,949.132	-8.2	72	50,747	49,195	3.4
Aug.	78	2,839,498	3,041,927	-6.7	72	51,931	50,848	2.1
Sept.	78*	2,848,212	2,937,339	-3.0	72*	54,501	52,955	2.9
Oct.	78†	2,996.604	3,041,511	-1.5	73†	57.288	55,533	3 1
Nov.	79‡	3,018,591	2,983.488	1.1	73‡	61,073	58,063	5.1

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	43	15,085	13,640	10.5	55.6	54.5	22.9	26 0	44.1	47.3
Mar.	53	18,757	17.248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	53	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	53	17,274	16.727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	54	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50 9
July	54	18.633	20.964	-11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	55	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	55	19,765	21,359	-7.5	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	56	19,822	22.128	-10.3	51.6	60.8	21.3	20.9	45.6	50.8
Nov.	57	19,849	21,715	-8.5	49.9	58.9	23.1	23.3	43.4	50.5

*Includes estimates for 33 companies, representing 3.2 per cent of the total installed rating of all central stations.

†Includes estimates for 45 companies, representing 4.8 per cent of the total installed rating of all central stations.

‡Includes estimates for 89 companies, representing 11.4 per cent of the total installed rating of all central stations.

but other primary industries in this section were operating at about the same capacity as during October. These slight increases in industrial requirements, augmented by an increased lighting load and new lighting and industrial customers, resulted in an average daily electrical output of 300,000 kw.-hr. in excess of that reported for October.

Increased Activity in Atlantic States

In the Middle Atlantic States the first sign of general industrial improvement was reported in August, and a very gradual increase in industrial operations continued during September, October and November. This improvement was especially noticeable in the iron and steel industry, reports showing that activity in this industry was about doubled during this ninety-day period. While plants and factories in this section were working at practically full time, only a few were calling for electrical energy sufficient for capacity operation.

The South Atlantic States continued to report slow increases in industrial activity. Almost a million more spindles were operating in the textile mills of the cotton states than were reported for November, 1920, and slightly increased energy requirements were reported by the lumber, coal-mining and fertilizer industries of this section during November. Increased water supply, due to precipitation in November, resulted in greatly increased production of energy by hydro-electric plants and the elimination to a large extent of the operation of steam auxiliary plants.

Taking the Atlantic section as a whole, the increase in industrial requirements, in conjunction with the increased consumption of electrical energy for lighting purposes and new domestic and industrial customers, resulted in an average daily central-station output of 47,000,000 kw.-hr., which is about 2,200,000 kw.-hr. in excess of that reported during October.

The iron and steel industry, textile, lumber and packing mills and factories and the zinc and lead industries in the North Central States reported slightly increased activities during November. On the other hand, the mills in the wheat belt reported the normal seasonal curtailment in operations and a consequent decreased energy requirement was reported by this industry. In the aggregate, the industrial energy requirements were probably about the same as during October, but the seasonal increase in lighting requirements and new customers was sufficient to raise the average daily energy output of the North Central States by 500,000 kw.-hr. over that reported for October.

Increased energy requirements were reported by the lumber and iron and steel industries of the South Central States, which, taken in conjunction with the seasonal increase in lighting requirements and new customers, resulted in an average daily energy requirement of about 380,000 kw.-hr. in excess of that reported for October.

Irrigation Load at Low Ebb

Industrial activity in the Mountain States during November was distinctly downward, the lumber industry being probably the only primary industry to call for materially increased electrical energy. Other primary industries were operating at about the same rate

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase		1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT																				
Dec.	82	210,494	227,403	-7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	200,269	247,800	-19.2	77	1,003,223	1,043,650	-3.9	73	860,643	956,078	-10.0	62	144,936	145,336	-0.3	81	556,561	550,685	1.1
Feb.	81	178,694	216,890	-17.6	77	902,030	970,539	7.0	73	789,539	882,873	-10.6	63	131,654	132,537	-0.7	81	451,754	508,961	-11.2
Mar.	81	205,348	230,309	-10.8	79	1,029,120	1,119,428	-8.1	73	894,500	941,893	5.0	63	139,381	136,017	2.4	81	538,260	561,934	-4.2
April	81	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	73	828,457	894,028	-7.3	63	132,075	135,421	-2.5	[illegible]	555,048	586,894	-5.4
May	82	191,141	219,298	-12.8	79	934,973	989,408	-5.5	73	819,506	899,657	-8.9	63	136,573	138,416	-1.3	89	586,264	642,495	-8.7
June	82	192,007	219,476	-12.5	79	940,443	1,003,727	-6.3	73	806,270	880,934	-8.5	63	136,011	129,120	5.3	89	611,128	639,637	-4.5
July	81	187,622	218,995	-14.3	79	934,822	1,026,390	8.9	73	804,009	884,572	-9.1	64	140,795	141,450	-0.6	89	639,768	678,725	-5.7
Aug.	81	205,351	224,324	-8.5	79	992,681	1,054,124	-5.8	73	848,803	923,210	-8.1	64	147,967	154,353	-4.1	89	644,696	685,916	-6.1
Sept.	81	221,364	223,269	-0.8	79	1,004,252	1,051,268	-4.5	73	851,671	886,370	-3.9	64	149,758	151,680	-1.2	89	621,167	624,752	-0.5
Oct.	81	249,202	221,929	12.1	79	1,103,006	1,117,482	1.2	73	920,190	930,235	-1.0	64	154,266	156,713	1.5	89	569,940	615,152	-7.3
Nov.	81	248,604	216,723	14.9	80	1,129,342	1,118,957	0.9	74	919,352	913.798	0.6	64	156.666	151,391	3.4	90	564,627	582,619	3.1
REVENUE																				
		1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
Dec.	82	$6,548	$5,744	14.0	65	$22,332	$19,149	16.7	57	$16,004	$13,142	21.8	54	$3,722	$3,113	19.8	79	$9,091	$7,432	22.3
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	81	$6,379	$6,170	3.5	74	$22,180	$19,225	15.3	59	$16,818	$14,436	17.3	62	$4,155	$3,484	19.3	81	$9,323	$7,546	23.6
Feb.	81	5,925	5,728	3.4	74	21,492	18,327	17.4	59	15,971	14,070	13.6	62	3,915	3,329	17.6	81	8,237	7,179	14.7
Mar.	81	5,784	5,566	3.8	76	21,822	18,934	15.3	59	15,853	14,103	12.4	63	3,747	3,246	15.5	81	8,307	7,222	15.0
April	81	5,665	5,554	2.0	76	21,504	18,609	15.8	60	15,506	13,822	12.2	63	3,744	3,312	13.2	88	8,817	7,767	13.6
May	82	5,362	5,342	0.4	76	20,795	17,613	18.0	60	14,866	13,558	9.8	63	3,516	3,179	10.7	89	9,362	8,240	13.7
June	82	5,285	5,397	-2.4	76	20,058	17,438	15.0	60	14,485	13,519	7.1	63	3,536	3,152	12.2	89	9,021	8,439	6.9
July	81	5,180	5,121	1.1	76	18,798	17,155	9.2	60	14,158	14,689	3.6	63	3,509	3,145	11.3	89	9,101	8,733	4.3
Aug.	81	5,297	5,483	-3.3	76	19,050	17,926	6.2	60	14,465	14,594	-0.8	63	3,612	3,536	2.2	89	9,507	9,309	2.1
Sept.	81	5,694	5,857	-2.7	76	19,992	18,750	6.6	60	15,324	15,192	0.8	63	3,811	3,673	3.7	89	9,680	9,482	2.0
Oct.	81	6,332	6,072	4.2	76	21,486	20,049	7.1	60	16,089	16,174	-0.5	63	3,920	3,903	0.4	89	9,461	9,335	1.3
Nov.	81	6,789	6,214	9.2	76	23,285	21,522	8.1	61	17,030	16,810	1.3	64	4,242	4,181	1.4	90	9,727	9,336	4.1
OPERATING EXPENSES:																				
		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan.	34	$1,098	$1,288	-14.7	48	$6,373	$5,411	17.8	28	$3,941	$3,451	14.2	37	$1,015	$905	12.2	54	$2,135	$2,030	5.2
Feb.	35	1,069	1,242	-13.9	53	6,799	5,937	14.5	29	3,958	3,445	14.8	44	1,217	1,053	15.5	55	2,042	1,963	3.9
Mar.	45	1,576	1,651	-4.5	59	7,969	7,241	10.0	35	4,570	4,228	8.2	51	1,776	1,514	17.2	79	2,866	2,614	9.7
April	45	1,418	1,479	-4.1	59	7,590	7,168	5.9	36	4,347	4,112	5.7	51	1,567	1,403	11.6	79	2,893	2,479	16.8
May	48	1,548	1,577	-1.8	56	6,921	6,660	4.0	37	4,274	4,292	-0.4	52	1,563	1,486	5.2	81	2,969	2,713	9.5
June	46	1,737	1,862	-6.7	56	6,916	6,878	-0.5	39	4,843	5,152	5.9	60	1,835	1,678	9.4	83	3,565	3,519	1.3
July	47	1,712	2,077	-17.6	53	6,772	7,111	-4.8	39	4,940	5,800	-14.8	62	1,870	2,039	-8.2	83	3,339	3,937	-15.1
Aug.	48	1,861	2,088	-10.8	53	6,871	7,131	-3.6	39	5,028	5,793	-13.2	62	1,892	2,003	-5.5	88	3,648	3,884	-6.0
Sept.	49	2,049	2,262	-9.4	54	6,851	7,294	-6.0	40	5,353	5,687	5.8	63	1,949	2,184	-10.7	88	3,563	4,032	-11.6
Oct.	48	2,141	2,095	2.1	57	7,172	7,825	8.3	39	5,011	6,126	-18.2	63	1,990	2,192	9.2	88	3,508	3,890	-9.8
Nov.	51	2,056	1,969	4.4	58	7,185	7,835	-8.2	40	4,967	5,940	-16.3	63	1,974	2,187	-9.7	88	3,667	3,784	-3.0

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8

as during October, or at a lessened capacity. The irrigation load of the central stations of the Pacific States was at a low ebb during November by reason of the normal seasonal agricultural inactivity, and other primary industries in this section were operating for the most part far below normal. As the result of these adverse conditions, and notwithstanding a substantial increase in lighting requirements and new customers, the Mountain-Pacific section as a whole reported only a small increase in output over October.

Rural Electrification Increasing in Finland

FOR economic reasons the electrification of the rural districts of Finland is of prime importance to that country, and already in 10 per cent of the rural districts electrification is an accomplished fact. A report on this situation has been made to the Bureau of Foreign and Domestic Commerce by Leslie A. Davis, American Consul at Helsingfors, Finland, and is condensed in the following paragraphs:

Rural electrification dates in Finland from 1912 and 1913, when several parishes in the province of Abo at their own initiative established their own electric power plant. This example was followed by other parishes. An electrical consulting bureau was established in 1915, and districts which it was thought could be electrified in the near future were charted.

The greatest impetus to electrification was given in 1918 by the lack of lighting material. When it was reported that the stocks of oil were giving out farmers began to plan for electrification. Building on any considerable scale could not be thought of, but fifty small plants and three large ones were erected. Seventy waterfalls were investigated during the winter of 1918-19, but only five or six districts were able to build plants.

Building was more active in 1919. A plant was then constructed in Halikko extending over several districts and having 200 km. of lines. Another plant was built in Sallila extending over five districts with a total length of lines of 190 km. Other plants were constructed with a total of 900 hp. As fast as these plants were completed the smaller ones, which had been built especially for lighting purposes, ceased operating. In 1920 the Vihtis district was electrified, having about 160 km. of lines, and the Lassila plant was completed near Bjorneborg. During 1921 electric co-operative associations were formed in many villages. A number of these associations in northern Finland have formed a central association. Plans are being made by landowners for the construction of an electric power plant at the Juuri falls in the Kalajoki River. Progress has been made in the electrification of the district around Tammerfors.

A company with a capital of 1,000,000 Finnish marks (a mark was formerly worth 19.3 cents, but its value is now greatly depreciated), which may be increased to 3,000,000 marks, has been organized to build a central station at Iitti, in southern Finland, and steps are to be taken for the building of a plant near Wasa. Extensions of the lines in southern Finland have recently been completed. The Sallila Electric Company has decided to increase its capital to 3,000,000 marks. Farmers will be the chief subscribers. A high-tension line has just been built to Ypaja, where a separate company has been organized.

At the present time about 30,000,000 kw.-hr. is consumed in Finland. There is said to be about 7,000 hp. in the country in Diesel engines, which use 500,000 kilos of oil, of a value of 6,000,000 marks, for which electric power might be substituted. It is estimated that if all the electric power used in Finland were generated by water, as is possible, a saving of 600,000,000 marks at the present prices of fuel would result. Only about 170,000 turbine horsepower is now in use, but the rapids which can be utilized have a total power, according to the state committee on rapids, of about 1,160,000 hp., of which the state owns about one-third.

Demand Factor of Coal Mining Motor Loads*

Considered with Relation to Hoisting, Pumping, Mining and Transportation—How Demand and Load Factors Affect Rating of Equipment

BY CARL LEE
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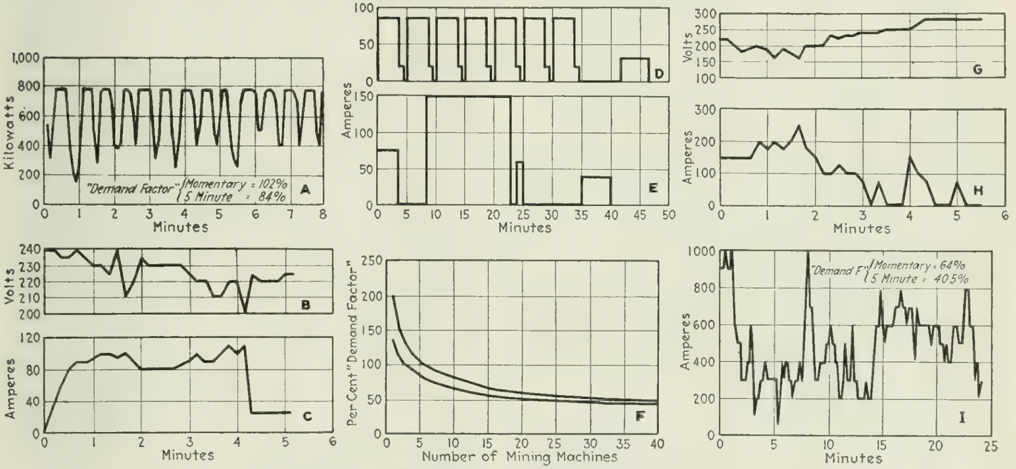
LOAD factor and demand factor are the principal factors to consider in determining the rating of service equipment for coal mines. To discuss these factors they will be taken up in their relation to the principal operations in coal mines, namely, ventilation, hoisting, pumping, mining, and transportation. The load factor of mine ventilating fans and their demand factor vary between 60 and 110 per cent. The mechanical efficiency of fans varies from 45 per cent to 65 per cent from pulley to air delivered. The volume of air depends on tonnage of the mine and number of splits. The pressure depends on the length of airways, their size and condition and the number of splits. With all these constants given the necessary size of the motor can be readily determined; but to allow for extension of the mine it is always well to have the motor somewhat oversize at the time of installation so that it will be possible to speed up the fan. The load factor of a fan is usually unity; the demand factor varies between 60 and 110 per cent.



LOAD CHARACTERISTICS OF TYPICAL COAL MINING OPERATIONS

A—Typical load curve of 950-hp. motor of flywheel set serving 1,300-hp. hoist.
B and C—Load curve for breast machine making one cut.
D and E—Comparison of load curves for breast and short-wall mining machines (24-ft. room).
F—Decrease in demand factor with increase in number of machines connected.
G and H—Load curve of 7-ton locomotive hauling 19.8 tons of coal and 9 tons of cars a distance of 3,540 ft.
I—Load curve of 175-kw. generator supplying two 15-ton and one 13-ton locomotive hauling 7,800 ft.

Electric hoists are special in their application, and each case should be estimated by competent engineers. In a well-designed hoist of the Ilgner type the five-minute demand factor is approximately unity since the motor driving the flywheel set is just fully loaded when operating at the rated capacity of the hoist. The momentary demand factor is, of course, higher. Curve A shows a load curve on a 950-hp. motor of a flywheel set driving a 1,300-hp. direct-current hoist. Here the momentary demand factor is 102 per cent and the five-minute demand factor is 84 per cent. This indicates that the output of the hoist could be increased by decreasing the caging time or increasing the speed of the hoist, or both. The average efficiency of four Ilgner hoists of 675 hp. to 1,300 hp. in operation for several years is 45 to 48 per cent. Thus the kilowatt-hour input and demand factor can be ascertained.

Pump motors are usually very liberally selected in order to allow for different load conditions that may be encountered either at the original location or some other new location. In one mine with fourteen motors totaling 225 hp. connected to pumps the demand factor is 44.5 per cent. Another mine with seven motors totaling 65 hp. has a demand factor of 54 per cent.

Manufacturers of mining machines have learned through years of experience what size of motor should be installed in a certain type of machine. The motors are rated on a one-hour basis since the work is intermittent. A breast machine requires on an average a 22-hp. to 25-hp. motor, while a short-wall machine calls for a 30-hp. to 50-hp. motor. In extremely hard cutting a single machine of either type may reach a five-minute demand factor of 150 per cent. In easy cutting the same machine might not exceed 75 per cent of its rating. An actual test on a breast mining machine for one cut is shown in Curves B and C. The operation of a breast machine is such that continuous load on the motor will not ordinarily exceed five minutes. Curves D and E show a comparison of characteristic loads of the two types of machines and represent the average results of a number of tests on machines. The presence of impurities known to the miner as sulphur balls, black jack, slate or clay increases the load on the mining machine. Worm gears, cutter heads, guides and chains increase the load; lack of oil and dull cutter bits also increase the load rapidly. In some cases a set of bits may last a day, and in worse conditions six to twelve sets may be required per day. The number of bits used indicates the hardness of cutting and may be used as a guide in estimating the demand factor of a single machine.

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* Abstract of paper presented before Western Society of Engineers.

Using the curve for the short-wall machine and superimposing it a number of times on itself so as to insure the lowest peaks, the lower curve on Chart F is derived. Next assuming a momentary demand factor of 200 per cent for one machine and the maximum continuous capacity, or about 50 per cent of the one-hour capacity, of a total of thirty machines, the upper curve is obtained. It is evident that for the assumed conditions the average actually obtained lies between the two curves. For easier cutting or less regular work than that assumed for the Curves in D and E both the curves are lower. Thus it appears that for a large number of machines the demand factor for the group approaches but never reaches the load factor of a single machine over the same period. Therefore it is necessary to know how much each individual machine works each day before the demand factor can be estimated.

The highest demand factor of a locomotive properly operated is usually predetermined by the manufacturers. The one-hour current rating is about 90 per cent of that required to slip the wheels; thus the demand factor for a single locomotive is 110 per cent. The eight-hour rating is only 45 to 55 per cent of the one-hour rating, so that the load factor does not exceed 40 to 50 per cent. Coal-mine service of locomotives is extremely variable, and the factors entering this consideration are length of haul, ruling grades, condition of track and cars, voltage regulation, system of haulage, required output and concentration of coal.

A test on a haulage locomotive with a load factor for the run of 38 per cent is shown in Curves G and H. The return trip with the empties requires about three-fourths the time and two-fifths the power, so that, with the time waiting on the parting and on the bottom, the load factor does not exceed 25 per cent for one round trip. This, however, is too low for some installations where the run is longer and where the grades are very small, in which case large trains are hauled, giving a steady load. Gathering locomotives have about the same momentary demand factor as haulage locomotives, but only in exceptional cases have they as high as five-minute demand factor. The load factor for a single gathering locomotive is lower than for a haulage locomotive, and the demand factor is the same for both, so that the demand factor for a large group of gathering locomotives is lower than for the same number of haulage locomotives.

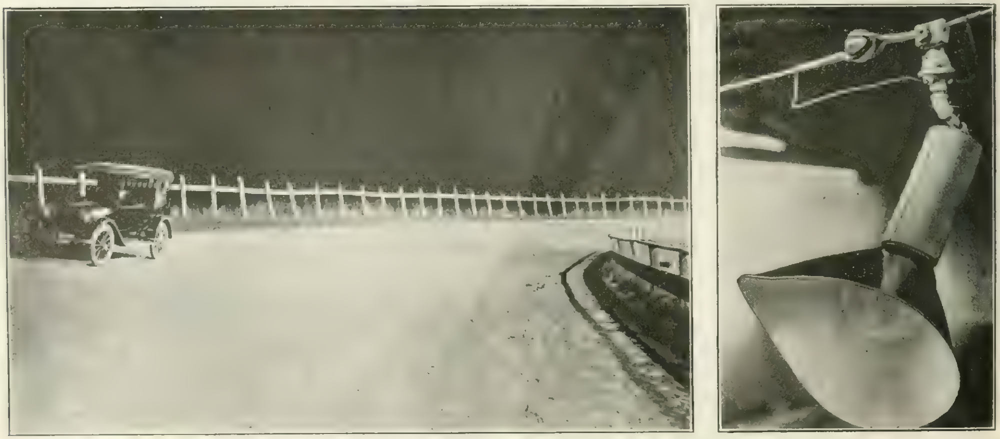
Readings in Curve I were taken every ten seconds on a 175-kw. generator serving two 15-ton and one 13-ton locomotive hauling an average distance of 7,800 ft. The load factor for twenty-four and one-half minutes is 48 per cent, and it probably would be 40 per cent for eight hours. The momentary demand factor here is 64 per cent and the five-minute demand factor is 40.5 per cent.

Novel Method of Road Illumination

A NOVEL method of road illumination, which may find application for other purposes than that for which it was designed, was employed for night racing at the Oregon State Fair last fall. The lighting equipment consisted of sixty-eight 1,000-watt, 120-volt lamps supported in enameled-steel elliptical angle reflectors equipped with special hoods made to receive "mogul" series sockets. Hangers were fitted into the hood and receptacle and in turn fastened to a $\frac{3}{8}$-in. messenger cable with one-bolt cable suspension clamps, spaced 80 ft. apart. The fixtures were hung at an angle of about 20 deg. from vertical. This was done so that the lighting units might be hung at least 10 ft. from the edge of the track to keep the light as much as possible out of the racers' range of vision and at the same time give the proper distribution of illumination. The elliptical type of reflector was chosen because a very wide distribution was wanted parallel with the track.

Forty-foot poles were used to support the messenger cable at an average height of 32 ft. above the ground, which brought the centers of the lamps about 30 ft. above the ground. The poles were spaced 240 ft. apart on the curves and 320 ft. on the straightaways. The use of the series system of circuits reduced the cost of the wiring materially and made it possible to use the messenger cable for the conductor by placing an insulator in the cable at each fixture.

The illumination produced was about 2 foot-candles in the center of the track immediately opposite one of the units, and 1½ foot-candles midway between units in the center of the track. The illumination was designed by the Portland Railway, Light & Power Company.



ROAD ILLUMINATED BY LIGHTING FIXTURES LIKE THAT SHOWN ON RIGHT

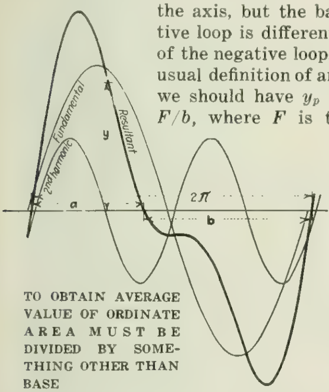
Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Average Value of an Unsymmetrical Alternating-Current Curve

To the Editors of the Electrical World:

A question has presented itself recently as to the true average value of a curve such as is shown in the attached figure. This curve is a superposition of a fundamental and of a second harmonic. The area of the curve above the axis of abscissas is equal to that below the axis, but the base, a, of the positive loop is different from the base, b, of the negative loop. According to the usual definition of an average quantity, we should have $y_p = F/a$, and $y_n = F/b$, where F is the area of either loop, y_p is the mean positive ordinate and y_n the mean negative ordinate. On the other hand, from the electrical point of view, there seems to be only one mean value, the same for either loop, and this value is $y_m = F/\pi$. Let, for example, the given curve represent a voltage to be measured with a d'Arsonval instrument through a rectifier, which reverses the polarity of one of the loops. The instrument will measure $2F/2\pi = F/\pi = y_m$. If the circuit of the measuring instrument is opened during one of the loops, the indication will be $F/2\pi = \frac{1}{2}y_m$. Thus it seems that in this particular case we divide the area of a curve not by its base, but by something different, in order to obtain the average value.



TO OBTAIN AVERAGE VALUE OF ORDINATE AREA MUST BE DIVIDED BY SOMETHING OTHER THAN BASE

Cornell University, **Vladimir Karapetoff.**
Ithaca, N. Y.

Brightness of Light Sources

To the Editors of the Electrical World:

The brightness of several different light sources has been measured by different methods and previously reported. The values given in the accompanying table include some additional data. The first method used was to measure the brightness with an optical pyrometer having a yellow-green glass as a monochromatic screen. This pyrometer was calibrated, using a black body as standard, so as to give values in candles per square centimeters. The second method was to measure the brightness through a small opening of known size by means of a regular photometer. The third method used was to measure the color temperature and the brightness and from these values and the known brightnesses of a black body to calculate the brightness. The results that are given in the table were all obtained by the use of at least two of these methods wherever it was possible, and those for the different sources—in particular the white "Mazda" and the frosted lamps—are the average of readings obtained on a number of different lamps. Some results previously published are added for purposes of comparison. **W. E. Forsythe.**

Nela Research Laboratories,
Cleveland, Ohio.

COMPARATIVE BRIGHTNESS OF DIFFERENT LIGHT SOURCES

Source	Brightness, Candles per Square Centimeter
Kerosene flame	1.3
4-watt carbon filament....	51.0
0.9-watt tungsten filament	227.0
Same lamp frosted.	2.5
50-watt white "Mazda"—outside......	1.29
50-watt white "Mazda"—filament.	408.0
2,000-watt "Mazda"—outside coil..	864.0
2,000-watt "Mazda"—inside coil...	2,021.0
Same type lamp frosted—outside.....	105.0

An All-Electric Home

To the Editors of the Electrical World:

Your editorial on "Are Electrical Men in Earnest?" is mighty fine and well put. We hope it will bring results. However, I wish to take exception to one statement—"no one has ever heard of anybody living in a real electrical home." I owned and operated a real electrical home for more than five years here in Seattle. There never was any fuel or power of any kind used except electricity, and never was there a cleaner, healthier, less expensive or more comfortable home. The equipment of my six-room home was as follows:

Heating System.—Rate, 0.75 cent per kilowatt-hour; Apfel electric radiators for each room with three-heat control on each radiator; cost of operation during five years, lowest $88 for twelve months, highest $128.50; repairs, zero; average maximum load for heating, 10 kw.

Cooking.—Copeman and Westinghouse ranges; rate, 2 cents per kilowatt-hour; average number of persons cooked for, 4; average cost, $2.45 per month.

Water Heating. — Coppersert 600-watt continuous, 60-gal. tank; rate, flat, $3.60 per kilowatt per month, or $2.16 per month for 600-watt size.

Lighting.—Nineteen outlets, six base plugs, semi-indirect lighting; rate, 5½ cents per kilowatt-hour; average cost, $1.25 per month.

There is only one way to provide perfect electric heating, namely, to equip each room with a heater of rating high enough for the most severe weather; locate all radiators on outside walls and under or near windows; have three-heat regulation on every radiator and reduce heat when not required, and eliminate drafts and flows of cold air by properly distributing heat.

Most power companies now have surplus power, yet refuse to make reasonable heating and water heating rates because the kilowatt-hour rate must be low. However, the real factor which determines profit or loss is the return per kilowatt-year. With a flat water-heating rate of 0.5 cent per kilowatt-hour, or $3.60 per month, for continuous operation, the return ($43.20) per kilowatt-year is much more than most if not all power companies receive per year even from lighting rates.

P. F. Apfel.

Electric Heating & Manufacturing Company,
Seattle, Wash.

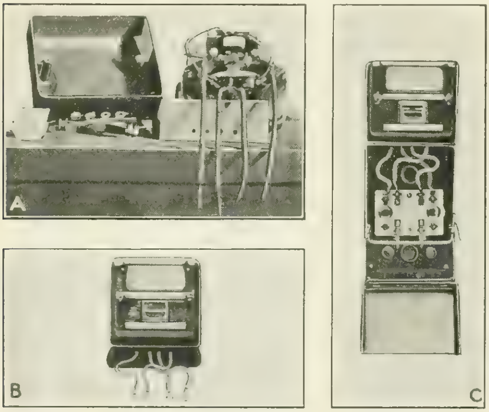
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Adapting Old Types of Watt-Hour Meters to Safety Entrance Boxes

THE attention given recently to the inclosing of service entrances and meter connections has brought up the question how best to handle the older types of meters having connection terminals on the side or top. This can be done at little expense in most cases.

The top-connected meters can be fitted to the entrance box very nicely by using a reversible end wall in the box. Care must be taken to select a box that will indicate "on" and "off" correctly in either position of end wall. With the side-connected type I meter the leads must be changed to enter all at the bottom. Several thousand of these meters were changed recently by the Northern Ohio Traction & Light Company. Whenever a meter of this type was disconnected it was brought into the shop. The meter was removed from the case and four leads were fastened directly to the coils, as shown in the illustrations. Four holes were drilled in the bottom of the case and fitted with fiber bushings through which the leads were run. Another method is to place the old terminal blocks at the bottom of the meter case, connecting the leads from the meter coils into these blocks instead of directly to the service switch. The service wires are brought up to the blocks in the same way as they are to a standard bottom-connected meter. Before this is done approximately one-fourth inch of the terminal box must be sawed off in order that the meter element may be easily removed. Side holes are blanked by riveting a small galvanized plate over them and then applying hard shellac with an alcohol blowtorch to seal. After these changes the meter can be applied to a standard entrance box using the same end wall as with the bottom-connected meter.



SIDE-CONNECTED METER WHICH HAS BEEN ARRANGED FOR BOTTOM CONNECTION

A—Leads were attached directly to coils and placed so that they will pass through four holes in bottom of case. B—Wires must be crossed for proper connection to safety cabinet switch as shown in C.

The connections from the meter to the entrance switch are made by crossing the wires as shown.

The advantages of adapting the meter by this method are: (1) It costs less than $0.50 per meter as compared with $3, the list price for type I meter adapter; (2) neatness in appearance due to the rectangular lines of meter and box; (3) economy of space, and (4) the entirely inclosed meter connections, using a standard end wall.

It was first suggested that a metal adapter be used with the side-connected type I meter to inclose the side connections. However, the following objections were found to this method: The adapter is expensive, hard to apply and of poor appearance; it takes up space unnecessarily and does not entirely inclose the wiring.

S. C. HENTON,
Superintendent Meter Department.
Northern Ohio Traction & Light Company,
Akron, Ohio.

Preparation Necessary for Tests on Steam Equipment

PREPARATION for mechanical tests on boilers and other steam equipment often takes much time, and quite frequently some very important piece of equipment is forgotten and as a result time and money are lost, especially when a large testing crew is employed. The first thing to do is to look over the job and plan the location of the apparatus, so that the readings may be taken by the fewest men with the minimum effort. Do not expect a man to walk up and down two or three flights of stairs several times an hour for from eight to twenty-four hours. Neither allow a man who is working in a hot place to be exposed to a cool draft in order that he may take readings. Keep all apparatus away from electrically charged wires and unprotected moving parts of machines.

Several things must be taken into consideration in the preparation for a test—first, apparatus required; second, location of apparatus; third, location of job; fourth, shipping facilities for apparatus; fifth, hotel accommodations for men (if necessary); sixth, assignment of men to readings and, seventh, making out sample data sheets.

In the preparation, consideration must be given to whether the apparatus required for the particular job can be spared from the jobs already on hand. This, of course, depends upon the total amount of test apparatus owned. A card index should be kept of all the apparatus and its location, whether it is already installed or not at the test location; also of which apparatus can be carried, which has to be shipped and which has to be installed by a machinist previous to the test. If the equipment has to be shipped, time must be allowed. If enough apparatus is owned, time and money may be saved by leaving such apparatus at a station where it will be used often or in the district in which there are several stations. Apparatus which must be installed should be left in place when once installed, if practicable, for to have it installed often necessitates stopping machines besides taking a machinist's time, which may be needed for other work. Apparatus which must be shipped or installed is included in group A below, while apparatus which can be carried is in group B. Some of the apparatus may be left at the stations, if it can be spared.

When it is necessary for the test crew to remain away from headquarters, hotel rooms must be provided.

In the assignment of jobs to the men, the men must be considered. If a regular test crew is employed, each man knows his own job, but if a temporary crew of young high-school or college men who want the experience is employed, they should be shifted around from job to job, especially on a long test. In this case good supervision is necessary. The making out of sample data sheets for the various readings makes it easier for the men to work in on the job.

Just before going on the job, the apparatus should be checked against a list similar to the one printed here, the card index should be corrected, and a complete list of the apparatus shipped or carried should be made. The apparatus should be checked against this list before leaving the job and the card index again corrected when the apparatus is returned to headquarters. This list of apparatus will suffice for practically all mechanical tests in a power plant, such as those on boilers, turbines, pumps, condensers and motors, and for scale calibration. FRANK H. BROOME.

Jersey City, N. J.

LIST OF APPARATUS FOR BOILER, TURBINE AND OTHER MECHANICAL TESTS

Group A—Apparatus which must be shipped or installed beforehand:

Nozzle plug, flow nozzle and orifice tube all for flow meter, installed.
Throttling calorimeter, installed.
Water meter, installed.
Platform scales, located.
Test weights, wheelbarrows.
Ash cans, scoop shovels and dirt tamper for ash and coal samples.
Thermometer wells, installed.
Pipe connections made for pressure, draft and vacuum gages and for manometers and orsat.
Water rheostat, water tanks.
Steam-flow meter with pipe fittings (portable or station type).
Water-flow meter with pipe fittings (portable or station type).
Pitometer cock, installed.
Provisions made for installing high-temperature-measuring device.

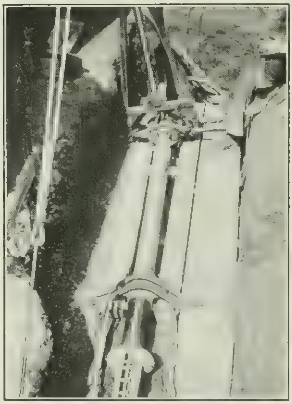
Group B—Apparatus which can be carried to the job by the testers.

Pressure gages, calibrations and gage seals.
Manometers, draft gages.
Thermometers, 150-, 300- and 700-deg.
Pyrometer, thermocouple, resistance or other high-temperature thermometer.
Tachometer, speed counter, stop watch.
Barometer, pitometer, solutions, cocks and hydrometer.
Hygrometer and tables, anemometer.
Gage tester, vacuum gage.
Orsat, solutions and siphon.
Wattmeter, voltmeter, ammeter.
Switches, wire and wire connectors.
Potential and current transformers.
Wrenches, stillson, monkey and solid (for flow meter).
Pliers, screwdriver, level, steel scale, 6-ft. rule.
Small funnel, straws (to clean glass tubes).
Sample cans and sampling shovel for coal and ash samples.
Valves and pipe fittings, including reducers for rubber tubing.
Rubber tubing, mercury.
Thread for tachometer, wire and string.
Glass tubes and rubber washers for portable flow meters.
Steam tables, calorimeter curves, flow-meter curves.
Previous tests, instructions and note books.
Data sheets, cross-section paper, slide rule.
Wood or card backs for data sheets.
Overalls, gloves, etc., soap and towels, carrying cases, packing boxes.

Conduit Forced Through Embankment by Air Drill

AN AIR drill was put to rather novel use recently by the Commonwealth Edison Company in extending its underground plant beneath a railroad right-of-way. The railroad at the point is elevated about 18 ft. above the normal grade and the embankment is 75 ft. wide. The company has a distributing pole line in the alley adjacent to the railroad and desired to make a crossing but did not wish to employ overhead construction because of the height of pole necessary. After discussing various methods of making the crossing it was suggested that 3-in. iron pipe be driven through the embankment, employing an air drill to rotate the pipe and using the rotation to force the pipe forward. An extra-heavy coupling for 3-in. wrought-iron pipe is 4.1 in. in outside diameter.

A cone-shaped pilot was constructed, the cone being 2 ft. long and 4.5 in. in base diameter and terminating in a cylinder 3 in. long. The cone was hollow and served partly as a lubricant reservoir, six holes being pierced through the shell to allow the lubricant to ooze out. This action was aided by a piece of steel tubing containing a piston and a spring, the spring forcing the piston against the charge of lubricant. On the outside of the cone were six pitched flanges, arranged in pairs, the pitch being such that as the pilot was rotated from left to right the flanges would act to drive it forward through the earth. For about 30 ft. it was possible to feed the pipe into the embankment in this way. At that point progress became so difficult that more positive feeding was necessary. Consequently a sleeve with a threaded interior was anchored to two anchors so that its axis coincided with the axis of the pipe. A hollow jack-screw 6 ft., 6 in. long was passed over the pipe and through this sleeve. In front of the jack-screw and fastened to it was a split pipe clamp. The jack-screw was then turned by the air drill, forcing the pipe forward.


CLOSE-UP VIEW OF JACK SCREW AND THREAD SLEEVE

When 6 ft. of the jack screw was turned through, the clamp was loosened, the air drill reversed, the clamp pulled back 6 ft., again tightened on the pipe and again forced forward. It was then necessary to use a short piece of pipe as a spacer until the permanent pipe was far enough forward to insert another standard length. After the pilot was in 45 ft. it turned with great difficulty. A resident of the vicinity told the foreman that the pilot had struck the slag ballast that was under the track before elevation. It took eight hours to go forward 12 ft. Then it began to rotate more easily, and in another six hours 75 ft. of pipe was in. An excavation was made and the pilot uncovered. It was found to be only 4 in. off the desired line. The second pipe was installed in the same fashion, except that the pilot arrived on the other side 18 in. out of line. The total time for the two pipes was eight days. Much time was used unproductively because this was a first attempt. It seems probable with the experience gained that the performance could be repeated in four days.

The total cost of the equipment and crew for eight days was $336. This does not include the cost of the pipe. The cost of trenching over the embankment was difficult to estimate in detail because the fill included large rocks. In addition because of the continual passage of trains during the day, it would have required night work, with a railway force on hand to place any bridging required. It was felt that $500 would be the minimum cost for this method.

Chicago, Ill. **Field Editor Electrical World.**

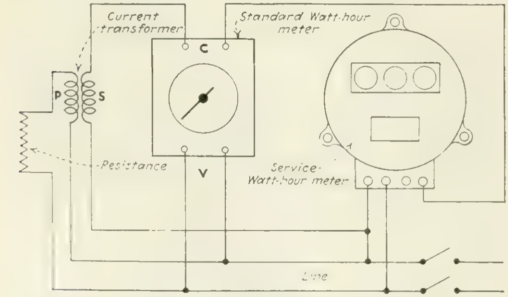
Organization Chart that Correlates Work

The usual chart of an organization shows only the names and positions of the various men and their relations one to another. The chart which is employed by the electrical distribution department of the Utah Power & Light Company gives the duties of the various employees in addition to giving the names of the men and their positions, thus avoiding duplication of efforts and overlapping of work. **R. A. Hammack.**

Superintendent of Electrical Distribution.
Utah Power & Light Company,
Salt Lake City, Utah.

Current Transformer Used as Phantom Load for Testing Meters

In testing large watt-hour meters the writer has found that a current transformer may be used to supply the heavy testing current without drawing an excessive current from the supply service. Such a scheme is particularly desirable when the meters are tested on a small board not equipped to furnish heavy currents. This current is obtained from a current transformer, connected as shown in the accompanying illustration. A 5-amp. to 100-amp. ratio transformer may be used, with the 5-amp. side connected in series with a variable resistance, such as a lamp bank. A small current through the resistance will produce a comparatively large current through the series coils of both meters, thus effecting a large saving in power and size wire in supply line. **Dan C. Hoffmann.**



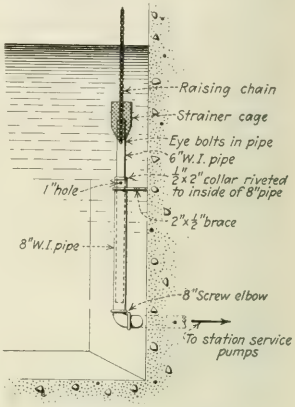
METHOD OF USING A TRANSFORMER TO FURNISH CURRENT FOR TESTING LARGE WATT-HOUR METERS

Brenham, Tex.

Pump Intake Screen Which Can Be Raised for Cleaning

Much trouble and inconvenience and no little expense were experienced formerly at one of the Southern Canada Power Company's hydro-electric plants through the intake to station service pumps becoming clogged with leaves, chips and other débris. It was even necessary at times to employ a diver to renew the screen. The sketch shows a simple and inexpensive expedient which was devised to overcome the trouble and which proved entirely successful. As illustrated, it consists of a suitable length of pipe bearing the screen and of size such that it slides freely in an extension to the original intake pipe arranged in vertical position. A hoisting chain is provided so that the screen can be readily raised and cleaned with a wire brush as conditions demand. **J. S. H. Wurtele,**

Southern Canada Power Co., Ltd., Plant Manager.
Montreal, Canada.



STRAINER TO INTAKE PIPE MAY BE RAISED FOR CLEANING

Indicating Map Used to Show Stage of Underground Development

A map which can be changed from time to time has been developed by the Hartford Electric Light Company to show the extent and state of progress of the underground distribution system that is rapidly replacing the overhead system. During the course of the change from overhead to underground distribution four stages are noted. As soon as the construction of a section of underground is authorized it is marked in solid red on the map, and the red does not entirely disappear from a block so marked until all overhead wires have been removed. The second step is noted by marking over the red lines with green dashes when the manholes and conduit are finished. A street at this stage is shown on the map as a line in which the red and green dashes are of equal length. When only part of the wires are placed underground this condition is indicated on the map by covering alternate red dashes with green, making a line one-quarter red and three-quarters green. When the last overhead wires are removed the street is shown as a continuous green line. An advantage of this system is that no erasing is required.

This form of map was devised by the engineering department of the Hartford Electric Light Company to show the system as a whole, and it in no way replaces the large-scale maps on which details of construction are recorded. Since its adoption several months ago it has repeatedly shown its value.

Boston, Mass. **Field Editor Electrical World.**

Trend Toward Standardization of Trailing Cables for Mines

A CONFERENCE on the subject of electric cables used for trailing coal-mine machines was held by coal operators, manufacturers of cables and mining machines and engineers of the Bureau of Mines at the Pittsburgh Experiment Station of the bureau on Jan. 10, 1922. The objects of the conference were to investigate and study the problems dealing with the use of trailing cables and to adopt means for more reliable and efficient service. Among the features discussed were the size, flexibility and covering for conductors, protection for terminal ends and from short circuits.

In regard to the size of wire used in this kind of work, machine manufacturers thought the present conductors adequate, while the cable manufacturers advised increasing the size. Operators said they had experienced very little trouble with the cables on 500-volt circuits where they were properly fused. It was found that it was necessary to use small conductors in order to handle cables easily and to reel them properly. Cables could be safeguarded to a large degree by a requirement that the voltage in the machine circuits should not fall below a predetermined value.

Greater Flexibility Needed

In order to obtain satisfactory flexibility of the conductors, cable manufacturers advocated that forty-nine wires be used for sizes up to No. 4 and 133 wires for cables larger than this. Up to the present time no specifications have been adopted for the number of strands that a conductor should contain, the machine manufacturers merely asking for a flexible cable. It has been found that the old type of twin cable kinked badly, but very little trouble has been encountered in the concentric type. There is a possibility of using a rubber construction of the twin conductor that is said to be "non-kinkable," but this is usually too large and unwieldy for machine service.

A better grade of insulation is required than is specified in the code requirements. Cable manufacturers are now working on standards for cables and probably would be willing to co-operate in the establishment of standards for mine service. In the past competition has largely governed the kind of cable used, but this has resulted in inferior insulation in many cases, according to the conference. Conductors having a rubber outer covering similar to that used on automobile tires have been tested out by one company and found to give good results as a means of protection from abrasion. This would add greatly to the safety of operation since there would be less danger of the conductor being severed and causing an arc when run over by a locomotive. All manufacturers are able to make this type of cable if trade conditions warrant such procedure.

The Bureau of Mines, it was decided, should continue to require insulated handles or other means of connecting machine cables to the source of power without personal hazard to the one making the connection. When this is done in a section of a mine where there is a likelihood of gas interlocking switches should be used. At present there are no suitable switches for this purpose on the market, but the operator is ready to purchase them when they are developed.

As a preventive for short circuits, fuses should be installed at the point where the trailing cables are connected to the power supply or at a place in the power circuit which would afford adequate protection to the conductors. If the fuses are placed in gaseous sections of a mine, they should be installed in explosion-proof compartments.

It was recommended by the conference that the Bureau of Mines require frequent inspection of all mines where trailing cables are used. Details for the establishment of a list of approved cables for new machines or renewals were left with the bureau to be worked out later. FIELD EDITOR ELECTRICAL WORLD.

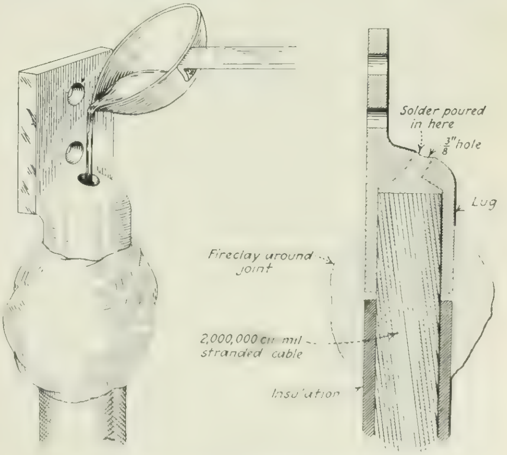
New York.

Cable Lugs Accurately Sweated in Vertical Position

IN ORDER to sweat lugs on a number of 2,000,000-circ.mil cables installed in a new San Francisco substation, a departure from the usual practice was made with the result that a much better alignment of the cables was effected and the cable was not strained by bending. The usual practice is to consider the lugs as cups and fill them with molten solder and then immerse the prepared end of the cable into the end of this lug. The cable must then be bent into position. With heavy cables such as were used this bending causes strains in the cable. The practice that was adopted in the present case was to set the cables in position and then sweat on the lugs without much further bending of the cables.

The end of a cable was bent only a short distance from the board and the end prepared for the lug, which slipped over it. Clay was placed around the lower end of the lug and the upper end of the cable insulation abutting the lug. The solder was poured through a hole bored in the upper end of the lug running down into the interstices of the stranded cable and making a much better connection than could be made by the ordinary method of connecting such lugs. In a few places where it was desired to leave the best appearance the solder remaining in the holes was drilled out and copper plugs were inserted. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis. FIELD EDITOR ELECTRICAL WORLD

San Francisco, Cal.



HOLE DRILLED IN TOP OF LUG FOR POURING IN SOLDER

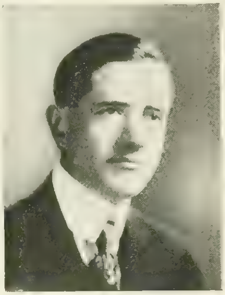
Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Central-Station Company as Merchandiser Is an Asset to the Industry

From a Paper Read Before the Massachusetts Electrical Contractors by C. E. Greenwood, Superintendent of the Boston Edison Company's Appliance Department

THE question has been asked, "Should not central-station companies go out of the merchandising business and leave the appliance business to the contractor-dealer?" Perhaps this broad question can best be answered by another: "Why ought the central-station companies to go out of the appliance business, and is it time for them to think of going out of the business?" From the earliest days of the appliance industry the electric light and power company has been the one most vitally interested in the apparatus to go on its lines, and it was the branch of the industry most justified in promoting the sale of electric devices provided that they would give suitable service. This interest cannot be lost.



C. E. GREENWOOD

In addition to the load-building possibilities of appliances is the dependence of customers upon the company to guide them in the selection of the best devices. It is in no way detracting from the standing of the manufacturer to state that, generally speaking, the guarantee of a device by the central-station company in good standing in a community is deemed of greater value by the purchaser of an appliance than the guarantee of the manufacturer. The local company is the point of contact which the customer chooses of his own volition. Since this responsibility is in a measure placed upon the central station, it is perfectly logical it should sell the devices for which it is held indirectly responsible.

Again, in any specialty business such as the sale of electric appliances considerable capital is necessary for promotion. The central-station company is the natural one to do this work, but the income derived from the energy used by these devices is not all profit, and is it unfair therefore that the company should get some return in profit by selling the devices?

The question of merchandising appliances is also a local problem. In a community which is not adequately served by electric dealers should the public be left without any proper place to purchase appliances when the supply company is operating there?

Investigation has proved that more electric appliance business is done by other electric interests if the central station company sells appliances on true cost principles. This has been found to be true by manufacturers and by jobbers and by leading exponents of correct electric merchandising ethics. Candy stores open on every other corner. All do more business and the people eat more candy. Food shops are keenly competing, but all are growing and the public is buying more food in the shops. Electric shops led by the central-station company in fair competition can all grow by making a larger buying public through greater interest in electrical devices.

There are certain places where electric light and power companies do not merchandise and dealers have built up a very good merchandise business. There are no facts to disprove that they might not do a very much better business if the central-station company was selling and promoting also. It is possible that the companies will some day go out of the merchandise business, but will the majority of all branches of the industry vote that now is the time? A continuation of aggressive promotion and selling of electric devices by the central-station company on strictly merchandising principles will aid in the development of a healthier business for other electrical merchants.

California Securities Market Shows Healthy Condition

THE market in California for the higher grade of securities, such as those of power companies, is in a very healthy condition at the present time and is showing improvement daily, according to a statement of A. F. Hockenbeamer, vice-president and treasurer of the Pacific Gas & Electric Company, to a representative of the ELECTRICAL WORLD.

Mr. Hockenbeamer said that the ten-million-dollar issue of bonds of his company which was placed on the market recently was passed on to the hands of investors within three hours. This issue was underwritten by a capable syndicate, which placed approximately 60 per cent of the bonds in the hands of California investors, while the remaining 40 per cent went East.

During the last seven years the Pacific Gas & Electric Company has followed out its program of placing its securities in the hands of its consumers and has sold over $26,000,000 worth of them. The cost of doing this has been approximately 96 cents per share. Within the past year, when over $7,000,000 of these securities were issued and sold to consumers and others in the territory served by the company, the cost has been approximately 72 cents per share. The Pacific Gas & Electric Company has found that the rate of increase in the number of its security holders in its territory has been on a rapid upward trend, showing that each new security holder acts as a salesman and influences his friends to invest.

Contractors and Central Station Stage Successful Electrical Show

THE accompanying picture shows a corner of a successful electrical show recently held in Chicago Heights through the co-operative effort of the electrical contractors and dealers and the Public Service Company of Northern Illinois. More than 6,000 people visited the show during the three days it was open and as the population of this district is only 20,000 this attendance was extremely satisfactory. The organization of the Electrical League of Southern Cook County, composed of the local electrical fraternity has been formed to promote better service in the Chicago Heights district and to create harmonious working conditions among its members.

VIEW OF ONE CORNER OF CHICAGO HEIGHTS ELECTRICAL SHOW

By-products Saved in Lumber Plant Pay Power Bills and Show a Profit

BY H. W. DERRY

Power Engineer Hartford (Conn.) Electric Light Company

REMARKABLY good economies have been brought about by central-station service in the establishment of the Edwin Taylor Lumber Company, Hartford, Conn., through the use of complete individual motor drive and the sale of by-product wood wastes. For fifteen years the Hartford Electric Light Company has served this concern, which formerly operated an isolated plant and burned waste material for fuel. The plant has been gradually changed over to individual motor drive, until the present equipment totals 456½ hp. in motors ranging from ¼ hp. to 50 hp. in size. The lighting load connected totals 3.465 kw.

The owners of the lumber company realized that one of the greatest advantages of electric drive was the savings to be made in handling waste material which formerly had been burned to operate the power plant. A blower system was installed on each machine and the shavings and sawdust were conveyed to distributing centers. The sawdust is separated from the shavings and graded into bins. Edgings and rough ends are taken from the machines and sorted into sizes so that they can later be cut into other useful products of smaller size. These include crate sticks, surveyors' stakes, florists' sticks for tying plants, sticks for crating umbrellas, etc., and finally that portion which cannot be used to greater value is used for kindling wood.

The sawdust and shavings are sold in various forms according to the character of the trade built up. The shavings are used by local stables, by dairy farmers for bedding cattle and by the local factories for packing goods for shipment. The sawdust is used locally by merchants and factories for drying and for sweeping floors, and numerous other outlets have been developed. Shavings in excess of those sold are fired in a boiler for heating the factory and for kiln drying.

The income from sawdust and shavings alone during the past four years, except in 1920, has been more than twice the amount of the power and light bills, as shown in the accompanying tabulation:

	Yearly Cost of Power and Light	Income from Sale of Sawdust and Shavings
1917	$3,908.69	$8,428.43
1918	3,665 27	7,602.48
1919	3,906.08	6,855.22
1920	5,261.77	8,736.61

For the year ended Aug. 19, 1921, this concern consumed 161,110 kw.-hr. for motor service at a total cost of $5,310.40; lighting consumption totaled 2,450 kw.-hr.

This business has taken several years to build up, but it has been well worth the trouble, to say nothing of the salvage of wood waste which formerly burned in the power house.

What Other Companies Are Doing

Springfield, Ohio—Members of the Rotary Club of this city were the guests of the Springfield Light, Heat & Power Company at an electric luncheon at the company's plant, Jan. 9, following which they were addressed by General Manager C. I. Weaver on the development of the local company, its facilities and the outlook in the electrical industry. Manager Weaver then conducted the guests on a tour of inspection of the plant.

Boston, Mass.—Eight central stations operated by Charles H. Tenney & Company reported a 27.4 per cent increase in combined kilowatt-hour outputs for the week ended Jan. 14, 1922, compared with the corresponding week of 1921. The total gain was 713,077 kw.-hr., and energetic cultivating of diversified service is responsible for this result.

Oklahoma City—The Oklahoma Gas & Electric Company has inaugurated a school for salesmen in the security department under the management of A. A. Brown. Classes will be held on Wednesday evening of each week. General and local financial conditions will be studied, sales methods investigated, and subjects of interest to stock salesmen taken up in detail. To allow security salesmen in other company divisions outside of Oklahoma City the benefit of this course, the class subjects will be furnished them through correspondence.

Worcester, Mass.—Forty-five house-wiring contracts aggregating ninety-nine meters and totaling $7,538, were closed by the Worcester Electric Light Company in eight days, following the opening of a thirty-day campaign on Jan. 10. A striking offer to the public requiring only $2 down and allowing two years in which to pay featured the program. Edwin Mandeville is head of the company's lighting department. Merchandising Manager O. R. Underhill states that the company's December appliance sales gained about 30 per cent in dollars over December, 1920, notwithstanding the price reductions which featured last year.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

The Proportioning of Steam-Turbine Blading.—HAROLD M. MARTIN.—The first of a series of articles calculating the proportioning of steam-turbine blading throughout the various stages. This article gives means for determining the effective head of wet and dry steam in the exhaust stages of the turbine.—*Engineering (London)*, Jan. 6, 1922.

Hydraulic Reaction Turbines.—D. J. McCORMACK.—The last of a series of articles dealing with this type of turbine. This article treats of the mechanical construction of runners, speed rings, casings, pit liners, curb and crown plates, main bearings, shafts, gate mechanisms and draft tubes.—*Electrical Journal*, January, 1922.

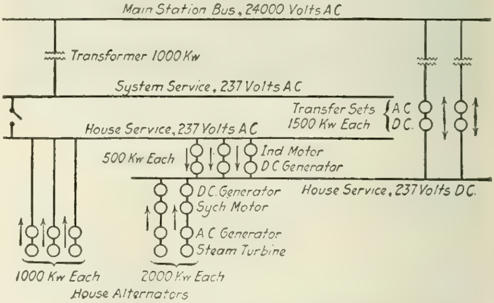
Lamps and Lighting

Illumination and Traffic Accidents.—EARL A. ANDERSON and O. F. HAAS.—This article deals with the seriousness of accidents on streets of American cities. Loss of life in traffic accidents is twice as great as in railway accidents and equal to over half the total industrial loss. The annual personal and property loss is approximately $1,000,000,000. Curves show the traffic accidents by years, months and also by hours. This survey was made to obtain some definite measure of the value which should be attributed to the proper illumination of streets as a factor in the prevention of traffic accidents.—*Transactions I. E. S.*, Nov. 20, 1921.

Generation, Transmission and Distribution

Reaction of High-Capacity Lines Upon Alternators.—J. LABOURET.—Aluminum conductors are being used frequently now for long and high-capacity trunk lines. The diameter of these cables is much greater than that of a copper cable of equal resistance, which results in a much higher electric capacity of the line. For this reason certain phenomena negligible in a copper line become of great importance with the use of aluminum. The author describes a case where the overvoltage due to connecting a 145-km., three-phase, 65,000-volt aluminum line to the generators amounted to as much as 430 per cent of the normal generator voltage. A vector-diagram explanation is given.—*Revue Générale de l'Electricité*, Dec. 17, 1921.

Heat Balance of the Connors Creek Plant of the Detroit Edison Company.—C. H. BERRY and F. E. MORETON.—Heat balance is considered from two viewpoints, (1) heat-absorbing and heat-developing capacities of the station and (2) the thermal balance sheet which records the ultimate disposition of all the heat developed. Auxiliary apparatus is briefly described, ideal operating conditions are discussed, and actual results are presented. Alternating current for auxiliaries is available from either of two buses—(a) the "system service" bus, fed through a transformer from the main bus, or (b) the "house service" bus, fed by three 1,000-kw. turbo-generators. Direct-current auxiliaries are connected with a single-ring bus that is fed from four sources—(a) two 1,500-kw. steam-driven direct-current generators; (b) three 500-kw. induction motor-generator sets driven from the house-service alternating-current bus; (c) two 1,500-kw. synchronous motor-generator sets driven from the main station bus, and (d) a storage battery of 1,500 amp.-hr. capacity. Diagrams show the arrangement of auxiliary exhaust steam and feed-water heating apparatus and curves indicate steam consumption of the main and house-service turbines, computed cost of power under various steam consumptions and boiler-feed temperatures and amount of water that can be heated by the house-turbine exhaust. A very complete thermal balance sheet for the month of April, 1921, is included as a part of this article.—*Mechanical Engineering*, January, 1922.



ARRANGEMENT OF AUXILIARY ELECTRICAL SYSTEM, CONNORS CREEK PLANT

Pulverized Coal as Fuel in the United States.—Refers to the records of a test made by John Anderson, chief engineer of the Milwaukee Electric Railway & Light Company, and to comments by T. W. Thompson, engineer of the Detroit Edison Company.—*Engineer (London)*, Dec. 16, 1921.

Traction

Final Report on the Electrification of Railways.—This report of the advisory committee of the British Ministry of Transport presents the conclusions arrived at after thoroughly studying the operation of various systems of railway electrification and the extent and character of engineering regulations desirable to facilitate continuous travel over connecting railway lines. The principal recommendations of the investigation are not limited to British practice but are of international application. These are: (1) That three-phase alternating current be the standard system of power generation; (2) that direct current be the standard system of power distribution; (3) that 1,500 volts, a multiple or submultiple be the standard distribution potential; (4)

third-rail, the overhead wire, or both, to be the standard distribution conductor.—*General Electric Review*, January, 1922.

Installations, Systems and Appliances

Recent Developments in Accumulator Electric Trucks. —RAYMOND J. MITCHELL.—To attain the practically universal application of electric trucks it will be necessary to devise special types of such machines to meet the demand of all industrial services. This tendency is being realized by the designers, who are beginning to deal with the peculiarities of each industry in turn. Various types are reviewed, such as are being used in paper mills, for handling bricks, machine-shop parts, furnace charging, tiering and lifting trucks.—*Electrician* (*London*), Dec. 30, 1921.

Electrically Driven Plows.—A. DELAMARRE.—Two different types of electrically driven plows have been recently built and tested by two French concerns, this article being a description of the equipment and a report on its performance. A small plowing set, built by Douilhet, consists of two little trailers each with a 13-hp. motor-driven cable drum holding 500 m. of 6-mm. steel cable. The two trailers are placed alongside of the field. Two stationary pulleys, anchored in the ground, lead the cable ends to the plow, which goes to and fro across the field. After each furrow the pulleys have to be reset, and after each 30 m. of furrows their anchorage has to be changed. A light self-turning plow is used. A large plowing set has two heavy trailers, each with two cable drums and one 60-hp. motor. Two permanent anchor posts are provided, and both trailers move the width of one furrow after each cross-plowing. The small set will plow one, the large set three hectares per day, at an approximate cost of 96 francs and 80 francs per hectare respectively. The cost of the smaller set is about 25,000 francs, and that of the larger set 100,000 francs.—*Revue Générale de l'Electricité*, Dec. 17, 1921.

Electric Drive of Steel Rolling Mills.—A discussion of the use of the Ilgner system for reversing mills. With very simple speed regulation and possibility of reversing the mill motor and of limiting the kilowatts demanded from the supply, this system gives a very excellent solution of the problem. For limiting the supply load to an amount equal to the average load necessary for rolling, the primary motor of the flywheel set is fitted with an automatic slip-regulating device. This article is continued from the last issue.—*A. S. E. A. Egen Tidning*, November-December, 1921.

Electrophysics and Magnetism

Some Effects of the Distributed Capacity Between Inductance Coils and the Ground.—GREGORY BREIT.—A study of the conditions which must exist when resonance is present on inductance coils—*Scientific Paper of the Bureau of Standards*, No. 427.

Behavior of Electricity in Ionized Gases.—W. M. THORNTON.—A study of the ionization of gases and the action of electricity in ionized gases. The article covers radiation, electrical ignition, Diesel-engine ignition, ignition of coal-mine gases, ignition by hot wire, electric arcs, arcs in vacuum tubes, arc rectifiers, vacuum-tube discharge, ozone, nitrogen from air, smoke deposition and atmospheric electricity.—*Journal of the Institution of* (*British*) *Electrical Engineers*, December, 1921.

Certain Types of Electric Discharge.—D. N. MALLIK and A. B. DAS.—A series of experiments made to study the behavior of electric discharge under gradually decreasing pressure in tubes of ordinary pattern, with electrodes consisting of thin rods, to verify the various theoretical deductions previously made on this type of tube.—*Philosophical Magazine* (*London*), January, 1922.

Units, Measurements and Instruments

Balanced-Vane Electroscope as a Means of Detecting High-Tension Potential on Underground Cables.—W. J. MCILVANE.—This instrument effectively detects any voltage above 500. It consists of an ordinary electroscope with a vane of aluminum ¼ in. wide and 5½ in. long (6.35 mm. x 13.9 cm.), mounted on an axis slightly above its center of gravity so that the ordinary position of the vane is vertical. It works satisfactorily under almost any sort of weather conditions.—*N. E. L. A. Bulletin*, January, 1922.

Telegraphy, Telephony and Signals

Telephonic Transmission Through Submarine Cables. —A. ROSEN.—A discussion of the nature of telephone transmission problems and the importance of the attenuation constant. The effect of varying the line constants is discussed and summarized in a table, and the improvement obtained by the addition of inductance in the form of loading is illustrated. Tables are given of the coil-loaded and continuously loaded cables that have been laid. The introduction of telephone repeaters necessitates a smooth impedance frequency curve for the cable, and this is more readily obtained with continuous loading. A comparison is made of the two methods now used in loading telephone submarine cable, showing that the balance of advantage is on the side of the continuously loaded cable.—*Journal of the Institution of* (*British*) *Electrical Engineers*, December, 1921.

Investigation of Transmitting Aërial Resistances.—T. L. ECKERSLEY.—Severe loss of wireless radiation waves due to energy being absorbed by earth is prevented by screening the earth with wires parallel to the horizontal part of an L-type aërial insulated from the ground. Results of tests to accomplish this are given. A screen used at Clifden, England, reduced the power for sending to one-sixth.—*Electrician* (*London*), Dec. 23, 1921.

Miscellaneous

Electricity Supply in London and the Home Counties. —A report for the unification of electricity supply in Greater London. A method for the linking up of the various plants in the immediate vicinity of London so that the present generating capacity may be used to the best advantage.—*Engineer* (*London*), Dec. 23, 1921.

Report of the Water-Power Resources Committee.—Résumé of the final report of the committee appointed by the President of the Board of Trade in 1918 to inquire into the water-power resources of the United Kingdom. The recommendations fall under two main heads, first, the general control of water supply, and, second, the control of water for power purposes. The committee considers that in Great Britain about 210,000 kw. could be developed continuously from potential water powers at economical rates. An interesting proposal provides for the reversion to the state, after a period which would normally be 100 years, of all licenses or rights granted in respect to water-power developments.—*Engineer* (*London*), Dec. 16, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Conference Called on Uniform Crossing Specifications

AT THE request of the American Electric Railway Association, a conference has been called by the American Engineering Standards Committee for March 2 in New York to decide whether there shall be uniform specifications for the crossing of overhead wires, and to dispose, if possible, of certain differences of opinion in regard to those parts of the National Electrical Safety Code which deal with overhead lines. The code has already been submitted to the committee for approval.

The following has been planned for the agenda of the conference:

1. Shall there be a set of national specifications for crossings between overhead electric wire lines and railways and between different wire lines?
2. If so, what should be its relation to Part 2 of the National Electrical Safety Code, "Rules for the installation and maintenance of overhead and underground electrical supply and signal lines"?
3. Can disposition be made of the differences of opinion on Part 2 of the National Electrical Safety Code by (a) approving the present edition, (b) revising the present edition through a sectional committee of the American Engineering Standards Committee?
4. What procedure shall be recommended for carrying out the conclusions reached by the conference?

Indianapolis Light & Heat Company Expands to Meet Demand

IMPROVEMENTS to the equipment of the Indianapolis Light & Heat Company, made necessary by the rapid growth of home building and business in Indianapolis, which will cost when completed approximately $2,000,000, are well under way and will be finished in a few months. According to Thomas A. Wynne, vice-president and general manager of the company, the improvements have been made necessary by the increased demand for energy from the company's commercial, industrial and domestic consumers.

"Our company has had to fight and fight hard," Mr. Wynne said, "to provide the facilities for the normal growth of Indianapolis. With improvements already completed, however, we feel that we have an excess capacity to meet the needs of the city for some time to come. When business becomes more stabilized our company feels that Indianapolis will enter the most rapid period of growth of her history."

A new 5,000-kw. substation has just been placed in service in West Indianapolis, and the company is building two more. One, to be known as the Brightwood substation, will be at Massachusetts Avenue and Sherman Drive. This substation also will have a rating of 5,000 kw. Still another substation of the same size is being started at Beech Grove. With these three new substations the company will be operating thirteen, six for direct-current and seven for alternating-current service.

An 18,000-kw. turbo-generator was recently placed in service at the company's Mill Street station. Four 800-hp. boilers and a new stack were also placed in operation, and a 10,000-kw. "step-up" transformer station was installed.

A large extension is being erected at the Kentucky Avenue station and an 800-hp. boiler has been installed there. The new structure at the Kentucky Avenue station will accommodate a large turbo-generator similar to the one just installed at the Mills Street plant. With the completion of work under way several million pounds of wire will have been added to the company's overhead system.

Capitalization of Premiums Disapproved by Massachusetts Commission

CAPITALIZATION of premiums paid in upon stocks of gas and electric companies was disapproved by the Massachusetts Department of Public Utilities in an exhaustive report filed last week with the Legislature. A comprehensive study of the entire problem of capitalization was ordered by legislation passed in 1921 after a long campaign on behalf of this policy. The commission unanimously recommends that the provisions of the 1920 bond law be made permanent, allowing the board to fix the rate of interest and in some cases the issue price and provisions for amortization of discount, and that the commission be authorized to permit issue of stock below par in certain cases and to allow the use of other pars than 100. Regarding the capitalization of premiums, the commission does not favor it for the following reasons: First, because stock holdings have changed so greatly in late years that its benefits would seldom accrue to persons alleged to have suffered wrongs from the present law; second, because such a step would operate unequally among different companies; third, if premiums alone and not surpluses are capitalized, in effect those companies which paid large dividends and thus created a higher market value for their stock will be rewarded instead of those companies which preferred to follow the more conservative policy of putting a greater proportion of earnings into their plants.

A valuation of these companies is not now considered desirable by the commission in discussing rate bases, particularly as affected by decisions of the Supreme Court of the United States in states having standards of utility finance different from those of Massachusetts. The cost and complexity of an appraisal and the changing conditions of the present would render of little use a valuation of these companies at this time. A majority of the commission recommends that the present premium law be repealed, permitting future issues at not less than par but with regulation of dividends by the commission for such period as it may deem necessary. This, it is said in the majority opinion, signed by Chairman Attwill and Commissioners Wells and Ellis, would encourage the distribution of stock among small local investors. The report reviews at great length the legislation of Massachusetts bearing upon gas and electric utility capitalization. Gas and electric companies with a combined capitalization of nearly $200,000,000 are concerned in the report.

Announcements of April 1 Coal Wage Cuts Appear

ALMOST all trace of doubt as to a national strike by coal miners in less than two months was removed last week when the bituminous operators of the Pittsburgh district, southern Ohio and Indiana announced substantial reductions in wages to take effect April 1, the date on which the old contract expires. Officials of the unions as quickly as the reductions were announced stated that a lower wage scale could not be accepted.

The Pittsburgh district cut will bring a scale approximately that of April 16, 1917. A reduction of from 31 to 46⅔ per cent is proposed by the southern Ohio operators and one of 30 per cent by the Indiana operators. All new wage scales embody the abolition of the "check-off."

An announcement has been made by Secretary Hoover that there will be no reduction in freight rates on coal until after April 1.

Manufacturers' Council Reorganizes and Broadens Its Scope

A REORGANIZATION of the Electrical Manufacturers' Council under revised constitution and bylaws was completed at a meeting of the Council held at the Hotel Astor, New York, on Jan. 26 and 27. S. L. Nicholson, chairman of the council, announced that the new constitution and bylaws have been approved by the three member bodies, the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club.

A number of changes result from the approval of the new arrangement. The functions of the council as the co-ordinating organization representing the three bodies in matters of common interest are broadened and enlarged. Instead of the old basis of representation through four delegates from each member body the three boards of governors, comprising a total of thirty-five members, become the council.

One of the most important changes is the formation of an advisory board composed of five representative men of the industry who are not council members. This board will act in an advisory capacity to the council. The following were appointed members of this board: E. W. Rice, Jr., president General Electric Company; E. M. Herr, president Westinghouse Electric & Manufacturing Company; A. W. Berresford, vice-president Cutler-Hammer Manufacturing Company; J. C. Hobart, president Triumph Electric Company, and B. E. Salisbury, president Pass & Seymour.

An executive committee was named with authority to act for the council between meetings. The standing committees of the council were reappointed, except in one or two cases where the work assigned to such committees had been carried to completion under the old organization. Some of the committees, however, were enlarged in membership and a number of new committees were created.

Officers were elected as follows: Chairman, S. L. Nicholson, assistant to vice-president Wetsinghouse Electric & Manufacturing Company; vice-chairman, Le Roy Clark, president Safety Insulated Wire & Cable Company; treasurer, J. W. Perry, manager electrical department H. W. Johns-Manville Company. Thomas M. Debevoise was appointed legal counsel and Frederic Nicholas executive secretary.

A full presentation was made of the work which committees of the council are undertaking with the Department of Commerce at the request of Secretary Hoover. These committees are appointed as sub-committees of the public policy committee. Le Roy Clark, chairman of the public policy committee, gave an outline of the persônnel and division of activities of the sub-committees which are co-operating with the Department of Commerce in matters pertaining to the various bureaus of the department whose work is of interest to the electrical manufacturing industry. He was followed by Clarence L. Collens, 2d, who spoke as chairman of the committee to handle matters pertaining to the Bureau of the Census; C. E. Skinner, chairman of the committee on the Bureau of Standards, and Joseph McElroy, 3d, chairman of the committee to handle export and import statistics.

In connection with the meeting a dinner was held at the Hotel Astor on the evening of Jan. 26. Addresses were made on matters of interest to the electrical manufacturing industry. Those who spoke were E. W. Rice, Jr., on "Standardization," E. M. Herr on "Co-operation with other Branches of the Electrical Industry," L. A. Osborne on "Economic Problems of Industry," Thomas M. Debevoise on "Legislative Matters of Interest to the Industry," and A. W. Berresford and C. L. Collens, 2d, on "Organization of the Electrical Manufacturing Industry." S. L. Nicholson, chairman of the council, was toastmaster.

Non-Par Preferred Stock Financing by Pennsylvania Power & Light

FOR reducing floating debt and other corporate purposes, including the cost of additional construction, the Pennsylvania Power & Light Company, an Electric Bond & Share property, has sold to a syndicate of bankers a block of around 60,000 shares of non-par 7 per cent cumulative preferred stock. This is offered at $96 a share.

This company, which was organized a year and a half ago as a result of the merger of a number of properties in the industrial region of eastern Pennsylvania and also in the coal region in the western part of the state, has had an exceptionally prosperous year in spite of the industrial depression. Its gross revenue grew from $8,354,723 in 1920 to $9,760,261 in 1921, while its net revenue advanced from $2,541,383 to $3,076,262.

A 66,000-volt two-circuit tower line is now being built from Harwood to Wilkes-Barre, and work is about to commence on a single-circuit wood-pole line from Sunbury to Shamokin. There is already a line between these two latter places, but it is felt that the new line will feed this region better. The company also has plans under way to build another line from Hauto to Siegfried.

Australian Utility Comes Into American Money Market

THE Melbourne (Australia) Electric Supply Company, Ltd., has sold to American bankers a new issue of $2,500,000 of twenty-five-year 7½ per cent general-mortgage sinking-fund gold bonds, series A, which are now being offered to American investors at 101, yielding 7.4 per cent.

Gross revenue of the company has grown from $1,441,264 in 1917 to $2,768,586 in 1921. In the same period net applicable to interest has increased from $710,909 to $1,053,678. Interest charges in the meantime have increased from $144,666 to $207,051.

Licensing of All Electrical Workers and Utilities Proposed in Virginia

STATE licensing of electric light and power companies and all individuals and firms engaged in electrical operation, maintenance and installation where 110 volts and over is involved is provided for in a bill recently introduced in the Virginia Senate. Under the terms of the bill there would be a state board of electrical examiners representing fire underwriters, city inspection departments, electrical engineers, electrical contractors and journeymen electricians. The board is authorized to draw up a set of rules and regulations which shall be in conformity with the National Electrical Code and the National Electrical Safety Code.

Five Technical Sessions Arranged for the A. I. E. E. Midwinter Meeting

AN UNUSUALLY large attendance at the tenth annual midwinter convention of the American Institute of Electrical Engineers, to be held, as already announced, in the Engineering Societies Building, New York, on Feb. 15, 16 and 17, is anticipated owing to the fact that this will be the first convention to be held under the ruling of the board of directors reducing the general technical meetings of the Institute to four each year. Beginning with Wednesday afternoon, Feb. 15, five technical sessions will be held for the presentation of papers. The Thursday evening session will be devoted to the bestowal of the Edison medal upon Cummings C. Chesney and to a lecture by Dr. W. D. Bancroft on "Colloids." Friday afternoon has been left open for members to make inspection trips.

Following is the program of the technical sessions:

WEDNESDAY, FEB. 15

Afternoon.—"Printing Telegraph Systems Applied to the Handling of Commercial and Railroad Telegraph Traffic," by A. H. Reider; "Modern Developments in Submarine Telegraph Cable Operation," by J. W. Milnor; "The Key West-Havana Submarine Telephone Cable System," by W. H. Martin, G. A. Anderegg and B. W. Kendall.

Evening.—"Condenser Discharge Through General Gas Circuit," by C. P. Steinmetz; "Questionnaire on Lightning-Arrester Practice," by F. L. Hunt (from the 1921 annual report of the protective devices committee); "Deviations from Standard Practice in Lightning Arresters," by E. E. F. Creighton.

THURSDAY, FEB. 16

Morning.—"The Petersen Earth Coil," by R. N. Conwell and R. D. Evans; "Effect of Moisture on Thermal Conductivity of Soils Surrounding Cables," by G. B. Shanklin; "Five Hundred Tests on the Dielectric Strength of Oil," by J. L. R. Hayden and W. M. Eddy; "An Analytical Investigation of the Causes of Flashing of Synchronous Converters," by E. B. Shand.

Afternoon.—"The Use of Superimposed Emfs. and Fluxes in the Solution of Alternating-Current Problems," by V. Karapetoff; "Wave Form and Amplification of Corona Discharge," by J. B. Whitehead and N. Inouye; "Questions on the Economic Value of the Overhead Grounded Wire," by E. E. F. Creighton; "Prevention of Transient Voltage in Windings," by J. Murray Weed.

FRIDAY, FEB. 17

Morning.—"The 'Indumore,'" by V. Karapetoff; "Heating of Railway Motors in Service and on Test Floor Runs," by G. E. Luke. The following papers will be presented by title only: "Skin Effect and Proximity Effect in Tubular Conductors," by Herbert B. Dwight; "Heat Losses in Stranded Armature Conductors," by Waldo V. Lyon; "Current Locus of Single-Phase Induction Motors," by J. K. Kostko; "Polyphase Commutator Machines," by A. B. Field.

Launch Engineering Firm with Contracts Valued at $7,500,000

THE Public Service Corporation of New Jersey through a newly incorporated subsidiary, the Public Service Production Company, branched out Feb. 1 into an entirely new field of activity, entering into competition with the country's largest engineering and construction organizations. Already contracts valued at $7,500,000 have been booked for the coming year.

Fundamentally, the new member of the Public Service family will be an engineering and construction concern, and under its charter it can do everything along these lines, including designing, construction and maintenance of all kinds for public utilities and industrial plants, electrification of steam-railroad properties, repair of equipment, reorganization of utility or industrial plants, paving of roads, efficiency tests and reports, valuation studies and financing.

It is so organized that it will in no wise interfere with the present activities of the operating companies of the Public Service Corporation—gas, electric and electric railway—and is not the character of enterprise that comes under the control of the State Board of Public Utility Commissioners. The operating and distribution departments of the Public Service Electric Company will be retained in that company under Farley Osgood, vice-president and general manager.

Filing of the charter of the newly organized company came unexpectedly, although it was known that long before the war the company had in mind such a broadening of its activities. The papers of incorporation show that $5,000,000 of preferred stock will be issued, paying 8 per cent cumulative dividends. There will also be issued 50,000 shares of common stock of no par value.

The three incorporators are Thomas N. McCarter, president of the Public Service Corporation and its subsidiaries; Edmund W. Wakelee, vice-president, and Percy S. Young. Mr. McCarter holds 400 shares and the other two 300 shares each. It was also announced that the Public Service Corporation will itself own the rest of the common stock.

Nathaniel A. Carle, chief engineer of the Public Service Electric Company, becomes vice-president and general manager of the new company and takes with him his entire department. The chief engineer is E. B. Meyer, formerly assistant chief engineer of the Public Service Electric Company. Headquarters will be in the Public Service Terminal, Newark, N. J.

Colorado River Commissioners Favor Development of River as Whole

THE Colorado River Commission has adjourned to meet again about March 15 at Phoenix, Ariz., where the public hearings will be held. Several different plans for the equitable distribution of the water in the basin between the seven states were presented by the members of the commission. There was a four days' discussion of these different plants, and it was considered desirable that the different state representatives should consult their state officials before further discussion.

The commissioners were unanimous upon the urgent necessity of undertaking the construction of the large control dam at some point in the Colorado Canyon and that the development of the river should be undertaken as a whole in order that its value should be best preserved to the entire people of the seven states.

N. F. P. A. Will Consider Changes in 660-Watt Rule of Electrical Code

THE electrical committee of the National Fire Protection Association, which has charge of the revision of the National Electrical Code, will meet in November of this year to consider reports of standing sub-committees covering changes in the current issue of the code for the 1923 edition. One change which has been urged by an important national body affects the so-called 660-watt rule, which limits the current load on the ultimate branch circuit.

Investigation of this subject will be carried on jointly by the standing sub-committees on wiring systems and standards and on devices and materials. A. Penn Denton, Seventeenth and Oak Streets, Kansas City, Mo., and A. R. Small, 207 East Ohio Street, Chicago, are the respective chairmen of these committees.

Indiana Commission Approves Merger of Indiana Electric Utilities

THE Indiana Electric Corporation, which is a merger of seven electric utilities of the state, was authorized on Jan. 26 by the Public Service Commission to issue $17,496,000 in securities to purchase properties. The action of the commission constitutes approval of the merger plan and financial transactions outlined by the company. Because of the size of the company and the amount of money involved, its application was bitterly contested before the commission by some of the cities affected.

The companies which will enter into the merger are the Merchants' Heat & Light Company, Indianapolis; the Elkhart Gas & Fuel Company, Valparaiso Lighting Company, Indiana Railways & Light Company, Kokomo; Wabash Valley Electric Company, Putnam Electric Company and Cayuga Electric Company. The first three companies are already owned by the corporation. The Joseph R. Brewer interests are behind the merger. The petition of the company, which asked for approval of securities amounting to $18,496,000, was the second to come before the commission. A previous petition, asking approval of the issuance of $21,000,000 in securities, was denied.

The $17,496,000 in securities authorized by the commission is distributed as follows: Bonds, $13,296,000: notes, $700,000; preferred stock, $1,500,000, and common stock, $2,000,000. A total of $2,250,000 of the bonds is to be refunded by the sale of preferred stock. The value of the properties, as found for the purpose of purchase and sale, is $17,500,000. This valuation includes physical property, $16,000,000: working capital, $600,000, and going value, $900,000.

Members of the commission said that it was stipulated that the values found in the order are not to be considered in any rate case. The commission announced that a central power plant of the company is to be erected in the coal fields along the Wabash River.

Congress Gets New Muscle Shoals Ford Offer

SECRETARY OF WAR WEEKS sent to Congress on Thursday the new Muscle Shoals offer of Henry Ford. Prior to sending the offer to Congress Secretary Weeks took the matter up with President Harding. In his letter of transmittal to Congress Secretary Weeks analyzes the offer in great detail, commenting on certain points, but he makes no recommendation for the acceptance or rejection of the offer.

In the new offer by Mr. Ford there are numerous differences from the old offer of July 8 last. The rental under the first offer was deemed inadequate by the War Department, and a modification is made by which Mr. Ford agrees to undertake the construction and completion of the work at actual cost and without profit and when completed and ready for operation to pay the United States as annual rental of the property an amount equal to 4 per cent of the total cost of such construction.

A more favorable amortization proposal is contained in the new offer. By the first offer the most the government would realize by the amortization payments would be $48,000,000, while under the new offer the minimum is $49,071,935 on a 4 per cent interest basis and the maximum is $213,134,690 should the interest basis be 6 per cent.

A new renewal clause is offered whereby there is no attempt to control the policy of Congress beyond the initial hundred-year period.

Mr. Ford now offers to make necessary renewals and repairs at his own expense.

A new paragraph contains a provision for termination of the lease in case of default, this provision being substantially the same as a provision of the water-power act. There is, however, no provision for penalty for not carrying out the contract.

At the conclusion of his letter of transmittal Secretary Weeks summed up the offer and made certain suggestions as follows:

> In the event that Mr. Ford's proposal is accepted, the government must make new appropriations amounting to $40,000,000 to $50,000,000, of which Mr. Ford will have the benefit for approximately a hundred years at 4 per cent. The company is, of course, bound to keep Nitrate Plant No. 2 in a condition to produce explosive, which, as a matter of preparedness, is of great value to the government, as, no doubt, a plant fully organized and in production would be available far sooner than one maintained merely in standby. Nevertheless Mr. Ford is offering but $5,000,000 for the title to the two nitrate plants, the Waco quarry, the Gorgas-Warrior steam plant, transmission lines and appurtenances. That you may better understand the value of the property for which Mr. Ford is offering this $5,000,000 I am attaching to this letter, as Exhibit A, a brief statement

prepared by the Chief of Ordnance showing the cost and estimated salvage value of these properties. From the table contained in this statement it will be seen that these properties cost the United States approximately $85,000,000 and that as scrap they are estimated to be worth $8,812,000. However, the last column of the table in Exhibit A indicates that the Chief of Ordnance believes the War Department can dispose of the property for $16,272,000. Mr. Ford is bound by his proposal to operate Nitrate Plant No. 2, but there is no legal obstacle to prevent his disposing of the other properties to which he gets title. Should he be able to obtain what the Chief of Ordnance estimates that the government can secure for the various items, namely, $3,000,000 for the Warrior plants, which have an installation of 40,000 hp., and $600,000 for Nitrate Plant No. 1, and dispose of the Warrior-Muscle Shoals transmission line, as a transmission line and not as scrap, for $675,000, and should he obtain $357,000 for the Waco quarry, he would have left the Nitrate Plant No. 2 with its 80,000-hp. steam plant at a cost to him of less than $400,000. The interest on the proceeds of such possible sales would amount to a very large sum during the term of the proposed contract. The present revenue from rental of the power plant at Nitrate Plant No. 2 is a minimum of $120,000 per annum, with a possibility that, in event of operation, it may run to $260,000. The cost of maintenance of Nitrate Plant No. 2 was approximately $200,000 during the fiscal year 1921. The total horsepower developed by the three steam plants to which Mr. Ford will get title is 125,000, which practically doubles the all-season or primary horsepower to be developed at Dam No. 2. (Approximately 500,000 of the horsepower that is to be developed at Dam No. 2 will not be available 365 days in the year.)

Inasmuch as I am without authority in law to accept Mr. Ford's offer or dispose of the property as a whole, either by sale or by lease, it is peculiarly the province of Congress to weigh the considerations which will pass to the respective parties to the proposed arrangement, and to determine whether or not the advantage to the government in having Nitrate Plant No. 2 maintained in readiness for the manufacture of explosives and in actual production of fertilizer, together with the improvement to navigation, is of sufficient importance to justify the proposed departure from the present policy of the law in regard to dealing with the water-power resources of the nation and to warrant leasing to Mr. Ford government property for so long a period at the rental proposed.

SECRETARY WEEKS' SUGGESTED MODIFICATIONS

If Mr. Ford's proposal be accepted by Congress, I suggest that there should be certain modifications made to safeguard the government's interest. As heretofore stated, there should be some assurance that the contracts made by his proposed company will be carried out.

I also suggest that the cost of acquiring the lands and flowage rights necessary for Dam No. 3 should be included in the sum upon which Mr. Ford is to pay 4 per cent interest as rent. The omission of the cost of these lands from this computation is more serious than would be the omission of the provision for a sinking fund, for the annual interest at 4 per cent on the cost of such lands and rights, if used for that purpose, would amortize a sum much larger than that provided for in paragraph 10 of Mr. Ford's proposal.

In case the proposed company sells any or all power developed at either or both of these dams, it should be required to do so under terms and conditions imposed by the Federal Power Commission or the Public Service Commission of Alabama in the manner required of other power companies.

I believe it would be better policy to limit the contract to a term of fifty years to conform to the established policy of the federal government as set out in the water-power act. In my opinion a contract such as that proposed for a period of one hundred years is not a wise general policy in view of the unknown possibilities surrounding water-power developments and the probability of changes which may be made, especially in the transmission of power.

While paragraphs 4 and 8 of the present proposal provide that Mr. Ford's company is to pay to the United States annually the sum of $35,000 on Dam. No. 2 and $20,000 on Dam No. 3 for repairs, maintenance and operation of the dams, gates and locks, Congress may well consider whether it would be more desirable to have Mr. Ford maintain the property and omit these payments.

If Mr. Ford's proposal be not accepted, it is my opinion that Dam No. 2 (Wilson Dam) should be completed by the government and that the power requirements for commercial purposes, the benefits to navigation, as well as the possible needs of the government, would warrant this expenditure. If this were done, the government may itself undertake to sell the product to the best advantage. In such case the amount of the government's present proposed investment would be very materially reduced, because Dam No. 3, costing from $18,000,000 to $25,000,000, would not be built. At Dam. No. 2 it would not be necessary to make the full installation of power plant until the market should require such installation. This partial installation would effect a saving of present investment in at least the sum of $3,000,000, leaving, according to the Chief of Engineer's estimate, not to exceed $22,000,000 to be invested by the government at this time, instead of $40,000,000 to $50,000,000. The analysis made by the Chief of Engineers (hereto attached as Exhibit B) shows a loss in excess of $15,000,000 due to delay in the receipt of returns from rentals. Such a large loss would hardly be justified in case the investment is to ultimately bear but 4 per cent interest if there were not other considerations which are beneficial to both the government and the people of that vicinity.

At this time, when there is a large amount of non-employment, it is not without importance to consider the advantage to the nation of the employment of the large amount of labor required in undertaking this development. I therefore urge that Congress give early consideration to this matter not only to settle a controverted question but to furnish employment on a large scale.

Methods of Improving Factory Power Generating Conditions Discussed

OPPORTUNITIES for improving industrial-plant power-generating conditions constituted the chief subject of discussion before a joint meeting of the New York Section of the A. I. E. E. and the Metropolitan Section of the A. S. M. E. on Jan. 27 Two papers were presented, namely, "Power in Industrial Plants," by John S. Griggs, Jr., and "Steam-Electric Power for the Industries," by Harold Goodwin, Jr. More intelligent operation of existing equipment and factory distribution systems and the installation of new and modern apparatus were suggested by Mr. Griggs as the means of effecting possible savings. Mr. Goodwin's paper was based on the recent superpower report, it being pointed out that only a small saving in coal can be effected by improving operation in plants of 500 hp.

In the discussion it was brought out that the inefficiencies of industrial plants are due chiefly to complicated layouts, disinterested managements and lack of proper knowledge on the part of the engineering staff. Power factor was blamed for some of the ills of industrial plants, a case being cited where a power factor of 50 per cent was increased to 92 per cent with very beneficial results by eliminating overmotoring. The expense of keeping operating records attracted considerable attention. The opinion was expressed that it more than offsets the savings possible in plants of 200 hp. and less. In such plants greater economy could be effected by designing the plants as simply as possible. Stress was also laid on the minimum number of instruments that can be used to obtain intelligent records of operation. A suggestion was made that greater economy could be obtained in small plants by grouping them under some technical advisory staff.

Meter Committee of N. E. L. A. to Hold Open Meeting at Springfield, Ill.

AN OPEN meeting of the national meter committee of the National Electric Light Association to be held in the Sangamo Electric Company's assembly room, Springfield, Ill., on Wednesday, Feb. 15, is announced by the chairman, W. L. Wadsworth. This is the second of a series of open meetings which the meter committee is planning to hold in the different geographic divisions of the N. E. L. A. An invitation is extended to all interested.

The program will include a general talk by R. C. Lanphier, vice-president and general manager of the Sangamo Electric Company, and discussions on the care and inspection of jewels and use of oil on meter bearings, by F. C. Holtz, chief engineer Sangamo Electric Company; the testing of instrument transformers in service, by C. E. Brown, Commonwealth Edison Company, and the care and maintenance of testing equipment, by William A. Fogler, Philadelphia Electric Company. There will also be a tour of inspection through the Sangamo Electric Company's factory.

Motor-Operated Valves Closed Under Severe Conditions

SEVERAL domestic types and two foreign makes of electrically operated steam valves were tested at the Essex station of the Public Service Electric Company of New Jersey last Saturday afternoon to ascertain what further modifications, if any, may be necessary in the construction of valves to insure their closing properly when operating under relatively high pressure and discharging to atmosphere. While data in considerable quantities still have to be interpreted and the valves must undergo internal examination the tests were outwardly satisfactory, since all of the valves closed.

Both gate and globe valves were tested, most of them being of the 10-in. size. The gate valves closed in forty-seven to fifty-five seconds with a boiler pressure approximating 225 lb. and a superheat about 150 deg. Fahr. One high-speed test was conducted with a 10-in. valve in which the closing time was reduced to twenty-seven seconds. Steam discharged at the rate of 308,000 lb. to 340,000 lb. per hour with the 10-in. gate valves open.

More details regarding the tests will be presented later. The investigation was conducted under the auspices of the prime movers committee of the N. E. L. A. Technical Section, of which N. A. Carle is chairman. The actual conduct of the tests was carried out by Peter P. Dean, who was the manufacturer of the motor-operated equipment used. Numerous central-station engineers were present.

Another set of tests will be conducted in three or four months if sufficient requests for additional data obtainable with the facilities at hand are made.

January Yield Down to 6.28 per Cent on New Financing

DURING the month of January the total amount of stocks and bonds of electric light and power public utilities offered investors was $51,182,500. This figure represents a decrease of more than $15,000,000 under December and an increase of more than $10,000,000 over January of last year. While the tendency toward long-term securities is still evident, three short-term issues appear in the accompanying tabulation, two of which were offered by the Edison Electric Illuminating Company of Boston. The rate of return yielded the investor was low, being 6.28, as compared with 6.64 for the month of December and 6.33 for the month of November. The largest single offering of the month was the Boston Edison issue of $12,000,000.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Edison Electric Illuminating Co. of Boston	$4,000,000	One-year	Coupon gold notes	To retire notes and floating debt incurred for increases in plants and facilities	5½	5 50	100
	12 000,000	Three-year	Coupon gold notes		5½	5 80	99.15
Nebraska Power Co	200,000	Twenty-seven year	First mortgage bonds		6	6 08	99
Indiana Hydro-Electric Co	1,250,000	Thirty-year	First mortgage sinking-fund gold bonds, series A		7	7.20	97½
Federal Light & Traction Co	2,590,000	Thirty-year	Stamped first lien gold bonds	To retire debentures falling due, to fund current indebtedness and to increase working capital	6	6 75	91¼
Galveston-Houston Electric Co	1,700,000	Three-year	Secured gold notes		7	7 15	99¼
Pacific Gas & Electric Co	10,000,000	Twenty-year	First and refunding mortgage gold bonds, series B, non-callable	To retire notes	6	6 05	99¼
Public Service Corp. of New Jersey	3,122 000		Perpetual interest-bearing certificates		6	6⅔	90
Wisconsin-Minnesota Light & Power Company	1,930,000	Twenty-five-year	General and refunding mortgage gold bonds, series A	To reimburse company for expenditures made for additions and improvements and to provide in part for further additions and improvements	7	7 10	99
Southern Illinois Light & Power Co	1,200,000	Twenty-year	First lien and refunding sinking fund gold bonds, series A	To provide part of the cost of the enlargements and extensions made and to be made	7	7 25	97½
San Joaquin Light & Power Corp	3,000,000		Cumulative prior preferred stock	To retire floating debt	7	7.10	98½
	5,000,000		Prior preferred cumulative stock	To refund bonds falling due. To pay for additional improvements and betterments. To provide additional working capital	7	7 11	98
Philadelphia Electric Co	4,000,000		Cumulative preferred stock	Additions and improvements	8	8 00	Par (25)
Roswell Public Service Co	315,000	Sixteen-year	First mortgage gold bonds		6	7 50	86½
Cambridge Electric Light Co	450,000		Capital stock				
West Missouri Power Co	425,000	Fifteen-year	First mortgage sinking fund gold bonds, series A		8	8 00	Par
Total	$51,182,500						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Kansas System Now Serving Eighteen New Towns.—The recent completion of 75 miles of pole line as part of a contract entered into by electric utilities in Kansas has made it possible to serve eighteen additional towns with energy purchased from the Hutchinson plant.

Metric System May Be Submitted to Chamber of Commerce Referendum.—Whether or not the Chamber of Commerce of the United States shall conduct a metric system referendum will be determined at the meeting of the National Council of the chamber which will be held in Washington on Feb. 8 and 9.

New York Edison Company to Hold Industrial Truck Meeting.—For next Thursday, Feb. 9, the New York Edison Company announces an "industrial truck meeting" to be held at 130 East Fifteenth Street at 8 p.m. Illustrated addresses on the advantages of the electric commercial vehicle will be made by T. Kennard Thomson, Capt. John F. Kelly, Jr., C. H. Clare and H. C. Yost.

A. S. M. E. Begins Publication of Semi-Monthly Newspaper.—The first number of the *A. S. M. E. News*, which is to be issued semi-monthly by the American Society of Mechanical Engineers, has appeared. It is a four-column, six-page sheet, 15 in. x 10½ in., which will carry information regarding the activities of the society, its local sections and professional divisions. C. E. Davies is managing editor.

Rate Reductions East and West.—The United Illuminating Company, serving New Haven and Bridgeport, Conn., has reduced its lighting rate from 8½ cents to 8 cents a kilowatt-hour. The Lawrence (Mass.) Gas Company has cut its electric rate from 13 cents to 12½ cents a kilowatt-hour. The Southern California Edison Company of Los Angeles has reduced its lighting rate from 9 cents to 8 cents, benefiting 160,000 consumers. All these reductions were voluntary.

New Orleans Company Prosecutes "Meter Jumpers."—The New Orleans Railway & Light Company has filed fifteen affidavits against alleged "meter jumpers" and further actions are expected. The company is proceeding under an act passed by the Legislature at its last session which imposed a fine of from $10 to $100, imprisonment up to three months, or both, upon any one convicted of having used fraudulent devices to prevent the proper recording by the meters of the actual amount of gas, water or electrical energy used.

Vancouver to Save Daylight.—An initiative bylaw establishing daylight saving time in Vancouver, British Columbia, was carried by a close vote in a recent election.

The Rankine Centenary.—British engineers have recently held a belated celebration of the centenary of the birth at Edinburgh of W. J. Macquorn Rankine, whose natal day was July 5, 1920, and who died in 1872. Rankine, who occupied the chair of engineering in the Glasgow University for seventeen years, contributed 158 papers to scientific and technical societies. His most important contributions, it is held, were to thermodynamics, and he was the first to determine the thermodynamic efficiency of an ideal steam engine, being the inventor of the Rankine cycle.

Attractive Electric Sign Guides Travelers at Civic Center.—An unusually effective sign erected in the center of the town whose name it displays is in service at Hudson, Mass., energy being supplied by the local light and power department as a part of the street-lighting output. The sign is triangular in shape, 21 in. high, 73 in. long, and is mounted 14 ft. above the street on a pole carrying two 1,000-cp. lamps on a bracket at its top, these lamps being 30 ft. above the roadway. Six 40-watt lamps are mounted inside the sign, which burns from dusk to daylight.

Plans for the Development of the Rhone.—Plans have been elaborated for the utilization of hydro-electric power from the Rhone according to the terms of the law voted by the French Senate on May 25, 1921. The two principal features of this project are, first, the proposal to utilize the river to the utmost, from the triple point of view of (a) hydro-electric power, (b) irrigation and (c) navigation, and, second, the creation by single incorporation of public and private enterprises benefiting by use of the river, with the state coming in as guarantor of the debentures and, after a certain time and up to a certain maximum, as sharer in the profits. No less than eighteen power stations are, according to the plans, to be erected along the 326 miles of the Rhone's course from the Swiss frontier to the Mediterranean. The total energy of this river at mean water has been calculated at 1,800,000 hp. It is estimated that the enterprise will take from twenty-five to thirty years to complete, at a cost of 3,400,000,000 francs.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Power Club.—The annual meeting of the Power Club will be held at Hot Springs, Va., on June 5, 6 and 7.

Engineering Society of Buffalo.—With a membership of 600, the Engineering Society of Buffalo has established permanent club quarters in the Iroquois Hotel.

American Society for Testing Materials Sets Date of Summer Meeting.—The twenty-fifth annual meeting of the American Society for Testing Materials will be held on June 26-July 1 at Atlantic City, N. J.

Electric Club of Chicago.—Officers of this club have been elected for 1922 as follows: President, W. G. Luscombe; first vice-president, E. W. Donoho; second vice-president, Paul W. Koch; secretary, J. W. Collins; treasurer, Otis L. Johnson.

February Section Meetings of the A. I. and S. E. E.—These meetings of the sections of the Association of Iron and Steel Electrical Engineers are scheduled for February: Philadelphia, Feb. 4, "Efficient Burning of Fuel and Use of Waste Gases in the Industrial Plant," by W. W. Pettibone, assistant chief engineer Bethlehem Steel Company, Lebanon, Pa.; Cleveland, Feb. 13, "Gaseous Fuels and Their Use in Iron and Steel Plants," by H. T. Watts, steam engineer Otis Steel Company, Cleveland; Birmingham, Feb. 25, "Operation of Frequency Changes," by L. M. Smith, assistant chief electrical engineer Tennessee Coal, Iron & Railroad Company. The Pittsburgh Section will discuss departmental organization at its Feb. 18 meeting.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meeting—Los Angeles, Feb. 13.

A. I. and S. E. E. Section Meetings—Philadelphia, Feb. 4; Cleveland, Feb. 13; Pittsburgh, Feb. 18; Birmingham, Feb. 25.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

American Physical Society—New York, Feb. 25.

Prime Movers Committee, N. E. L. A.—Pittsburgh, Feb. 27-28.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago March 15-16.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Extravagant Fees and Salaries for Small Company.—The Wisconsin Railroad Commission has expressed the opinion that a total labor and salary expense of more than $3,240 a year for a utility which purchases its energy and has only 162 customers is entirely too large. This sum is made up of $125 monthly for the manager and secretary, $125 monthly for a lineman and $20 monthly for directors' fees. If these expenses continue at this amount, the commission says, a portion of them should be considered as part of the return on the investment.

Invasion of Territory Authorized Where Established Company Had Refused Service. — The Seneca River Power Company of Baldwinsville, N. Y., having refused to extend its lines to serve eleven rural residents, these residents applied to the Jordan Electric Light & Power Company for service, but were again refused. They then obtained a franchise from the town and themselves built a line, over which the Jordan company agreed at first to send its energy but, after doing so for a short time, gave notice of discontinuance because the Seneca company asserted that it was violating the Seneca company's franchise rights. The Public Service Commission being appealed to has ordered the Jordan company to continue service under the conditions now existing.

Discriminatory Rates Unproductive of Revenue.—In adjusting rates for the Cottage Grove Electric Company the Public Service Commission of Oregon pointed out grave errors made in applying the existing schedule, observing: "It was estimated at the time of filing the present rate schedule that increased revenues would be the immediate result. This, however, was not the case, due primarily to an apparent lack of knowledge in constructing rate schedules for electric utilities. For example, under the present schedule the largest consumer of lights received a decrease in rates that required the entire increase of seventeen average light users to balance the deficit created. In other words, the small consumer's rate was increased 50 per cent, while the rate to the larger user was decreased by approximately the same percentage. Consequently the utility, through the application of the higher schedule, did not receive the relief sought, nor were the rates contained therein so balanced as to encourage future development, nor in fact retain the company's present customers."

Discrimination Against Lighting Consumers Condemned. — In prescribing a rate schedule to meet complaints against the Chasm Power Company, serving Chateaugay, N. Y., the New York Public Service Commission condemned the company's previous rates, saying: "It is evident that the burden of the rates charged is not fairly distributed and that the rates are discriminatory and ill-adjusted. While the quality and kind of power furnished are not the same in each class, yet it would seem that the larger power users are buying power at a price which pays no profit to the company and leaves the burden entirely on the lighting consumers. To fairly distribute the burden of payment of this revenue, it is necessary that the lighting consumers shall not be discriminated against. Our tabulations show that power users have been paying less for energy than it cost the company to produce it."

Commission Allows 10 per Cent Increase in Lieu of Service Charge.—The Public Service Commission of Missouri has handed down a ruling authorizing the Springfield Gas & Electric Company to reimburse itself for losses sustained through elimination of a service charge by making a flat rate increase of 10 per cent in its charge for gas. At a time when the price of coal, oil and coke went soaring the company, denied an increase in rates, sought to establish a service charge for each customer. This was frowned on by the commission. The company asked for a rehearing, which was only recently granted. At this rehearing the company presented facts and figures showing that its rate of return was under 6 per cent and might fall as low as 5.1 per cent. The commission ruled that the company was entitled to a return of at least 7.58 per cent, which the 10 per cent increase would give.

Valuation During Period of Fluctuating Costs.—The Public Service Commission of New Hampshire in fixing a rate base for the Franklin Light & Power Company made these observations: "It would seem unreasonable to mark up or down the valuations of all of our electric and other plants to correspond to the fluctuations in the cost of materials and labor, especially in such abnormal times as these. A permanent change in values may fairly be considered, but there is a pretty general feeling that money prudently invested should be reasonably secure against sudden or other reduction in values, and, of course, it would be equally objectionable to raise values to match fluctuations in cost of materials or construction. It is only fair where additions and extensions have been made to meet urgent public needs to allow the actual cost as a capital investment, even though the expenditures were made at a time when labor and materials were abnormally high. In general, the money prudently invested is very important evidence in determining fair value."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Meter Charge Not Subject to Penalty or Discriminatory.—The collection of a monthly uniform charge for meters, it is held by the Supreme Court of Rhode Island (Rivelli vs. Providence Gas Company), is an equal distribution of the burdens incident to the manufacture and distribution of gas which should be borne by all customers irrespective of the quantity used and does not come within the penalty provided for the collection of a larger sum than the meter shows to be due; nor is it discriminatory. (115 At. 461.)

Vested Rights in Watercourses.—In Yates vs. Newton suit was brought to compel the State Engineer of Utah to rescind two grants of water rights (one for irrigation and one for power purposes) in which the plaintiffs claimed they had acquired a vested interest. These rights were situated in a ravine of such physical conformation that it was thought possible a further supply of water could be brought about, and the Supreme Court of Utah, while sustaining the rights of the plaintiffs, held that a state grant so conditioned as not to interfere with these rights was not to be set aside. (202, Pac. 208.)

Damages Allowed Against Electric Companies for Destruction of Grain.—Damages in the amount of $50,000 have been allowed by the District Court of Appeal against the San Joaquin (Cal.) Light & Power Corporation and the Midland Counties Public Service Corporation in favor of two farmers, Fabray and Vanderburch, because of the destruction of standing grain alleged to have been set on fire through the careless use of blowtorches in the hands of linemen working for the two companies. (For a cognate decision of the California Supreme Court see ELECTRICAL WORLD, Aug. 7, 1920, p. 304.)

Duty of Utmost Protection to Linemen.—It has been held by the St. Louis Court of Appeals in Hudson vs. Union Electric Light & Power Company that in an action for injuries to a telephone lineman from an electric shock caused by contact between a dead strand wire from which he was removing cable rings and a live wire the defendant company's failure to insulate or take other precautions to prevent the escape of current from its wire was a proximate cause of plaintiff's injury and that the trial court did not err in refusing to direct a verdict for defendant. A verdict for $3,500 was held not excessive, injury being permanent. (234 S. W. 370.)

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*The left-hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System

Men of the Industry

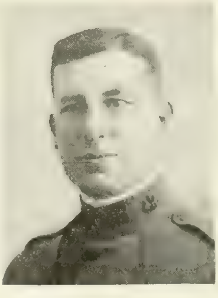
Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

W. Rawson Collier, who has been associated with the Georgia Railway & Power Company for the past seventeen years in a wide range of engineering and executive capacities, has resigned to accept an important executive position with the Central Hudson Gas & Electric Company of Poughkeepsie, N. Y. Mr. Collier is well known among electrical engineers and executives in the South, and the transfer of his activities and interests is keenly felt in that section of the country. Mr. Collier was graduated from the Massachusetts Institute of Technology in 1900 and entered into engineering practice immediately as mill construction engineer with M. W. McRae, consulting engineer, Atlanta. From 1901 to 1904 he was connected with the firm of Collier & Brown, consulting engineers, in charge of the design and construction of more than a dozen large municipal lighting and industrial plants throughout the South. In 1904 Mr. Collier became chief engineer of the B-R Electric Company, electrical jobber and contractor, and from 1905 to 1907 was engaged as an electrical engineer with the Georgia Railway & Electric Company in plant construction and high-tension railway work. He became connected with the Electric Manufacturing Equipment Company in 1907 as factory manager. In 1908 he returned to the service of the Georgia Railway & Electric Company as contract agent. This position he held until his promotion to be sales manager of the company in 1912. During four months of 1918 Mr. Collier served as Georgia representative of the priority committee of the War Industries Board. During the fall of 1919 he served as fuel administrator in charge of public utility fuel consumption in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee and Louisiana. Mr. Collier was appointed sales and operating manager of the Georgia Railway & Power Company in 1919, and a year later was promoted to the position of general sales manager of the company, including all former subsidiary companies which were absorbed. Mr. Collier is a fellow of the American Institute of Electrical Engineers and is active in a dozen other national and sectional public service associations.

W. R. COLLIER

Dr. A. S. McAllister was married on Jan. 28 to Miss Homé Catharine Stephens of Philadelphia. Dr. McAllister was editor of the ELECTRICAL WORLD from 1913 to 1915 and is now a member of the staff of the Bureau of Standards detailed as a special liaison officer stationed in New York for cooperative work with the American Engineering Standards Committee.

Major Louis B. Bender, Signal Corps, has recently been transferred from duty at Fort Monroe, Va., where he was technical adviser to the Coast Artillery Board, to the office of the Chief Signal Officer at Washington, D. C., where he will be in charge of the engineering and research division, succeeding Major J. O. Mauborgne, Signal Corps. In this capacity he is administering the Signal Corps program for development of improved types of electrical communication apparatus for the army. An important part of that program at the present time is the development of the line of radio-telephone sets for airplane use. Major Bender is a graduate of the Kansas State College and the Massachusettes Institute of Technology. He is an associate of the American Institute of Electrical Engineers and brings to his new assignment a varied experience of twelve years of technical work in the army preceded by five years in communication utilities.



MAJOR L. B. BENDER

Charles A. Collier has been appointed general sales manager of the Georgia Railway & Power Company, succeeding his brother, W. Rawson Collier. Mr. Collier brings to his new position a wide experience in public utility work and a thorough understanding of power salesmanship. He was born in Atlanta in 1888 and was graduated from the Georgia School of Technology in 1909. He immediately entered the employ of the Georgia Railway & Electric Company as inspector of wiring and motors and was promoted to the position of industrial power sales engineer in 1910. Mr. Collier took over the duties of power sales engineer for large industries in 1911 and during his tenure of this position made some important investigations of customers' power installations in the interest of improvements in operating efficiency. In 1912 he was made assistant to the contract agent of the parent company, the Georgia Railway & Power Company, his special duties being further studies of customers' power installations, especially of industrial plants. He was promoted to be assistant to the sales manager in 1914 and in 1919 was appointed assistant to the operating and sales manager. His duties of assistant to the general sales manager were taken over in 1920, and he now succeeds to the position of general sales manager. Mr. Collier has been actively identified with the affairs of the Southeastern Section of the National Electric Light Association and with local association work in Atlanta.

C. A. COLLIER

Allen H. Forbes, instructor in electrical engineering at Yale for the past three years, has resigned and accepted a position with Pennsylvania State College at State College, Pa., in the department of electrical engineering.

W. C. Starkey, who recently resigned from the Ohio Brass Company, where he was chief engineer, to become associated with the Stevenson Gear Company as vice-president and engineering director, has been engaged in electrical engineering work since he was graduated from Purdue in 1903. His first year out of college was spent with the Townsend Reed Company, which was building the interurban line from Indianapolis to Lafayette. On completion of this work he took the apprenticeship course of the Westinghouse Electric & Manufacturing Company. He was graduated into the engineering department and was first engaged on development of a small-type motor and finally had charge of the engineering of all air-type circuit breakers. In the spring of 1906 Mr. Starkey first became associated with the Ohio Brass Company as production engineer. Two years later he left to take the superintendency of the company now known as the Eureka Copper Company, but in 1910 was called back to the Ohio Brass Company and in a short time was made chief engineer. During this time he has had charge of all patent matters and in particular has had supervision of the Buck-Hewlett patent suit, which has just been decided in favor of the Ohio Brass Company in the United States Circuit Court of Appeals. Mr. Starkey has taken out a number of patents, among them being patents for trolley retrievers and extruded metal ears.

W. C. STARKEY

C. F. Goodwin has been appointed manager of New York district sales for the Sprague Electric Company. Mr. Goodwin has had wide experience in the electrical industry in both the manufacturing and operating ends. He was employed in the testing department of the General Electric Company at Lynn, Mass., in 1905, spending two years there and leaving to enter the service of the New York Edison Company in the operating department. He became connected with the operating department of the Hudson & Manhattan Railroad Company in 1909 and remained there two years. He resigned from his position there to become construction engineer for the Sprague company. He was transferred to the sales department in 1912 and a year later was made printing-press expert for the sales department.

George H. Mueller has become associated with the Pawling & Harnischfeger Company, Milwaukee, manufacturer of electric cranes, machine tools and excavating machinery, as general sales manager. He is a graduate of Purdue and Cornell universities and has had considerable experience in engineering and sales work.

Atlee B. Saurman has been appointed general sales manager of the Standard Underground Cable Company, with headquarters in Pittsburgh. Mr. Saurman has been with this company for more than twenty years. During this period he served for several years as manager of the Boston office, for twelve years as manager of the Pacific Coast department with headquarters at San Francisco, while for the past seven years he has been manager of the Southeastern sales department with headquarters at Philadelphia.

Eric A. Lof has been decorated with the Royal Order of Vasa by the King of Sweden in recognition of various services to the Swedish government. Mr. Lof is an industrial engineer and specialist in the power and mining engineering department of the General Electric Company. He spent several months in Europe last year for the International General Electric Company, partly in connection with the power transmission and railway electrification project which is being planned by the Swedish government. Mr. Lof was born in Sweden and came to the United States in 1902. He has been connected with the Schenectady works of the General Electric Company since 1909. He is well known through his many contributions to the technical press, his lectures on various subjects and as the author of several technical books.

E. A. LOF

H. A. Campe, formerly manager of the domestic service section, has been appointed manager of the small motor appliance section of the industrial department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. Campe succeeds V. M. Beeler, who has been transferred to the Springfield (Mass.) office of the Westinghouse company. Mr. Campe was graduated as an electrical engineer with the degree of bachelor of science from Pennsylvania State College in 1902. He immediately entered the employ of the Westinghouse company and took up the apprenticeship course. He has since been employed for a number of years in the sales and service department. Mr. Campe is well known among engineers, having been president of the Society of Motion Picture Engineers.

H. A. CAMPE

Edward Kerschner has been appointed manager of the Southeastern sales department of the Standard Underground Cable Company, headquarters of which have been moved from Philadelphia to Washington, D. C. Mr. Kerschner was connected with the Philadelphia and Pittsburgh offices of the company for many years and has been manager of the Washington office since its opening.

Obituary

E. V. D. Johnson, who was general manager of the former Northern California Power Company for fifteen years, died Jan. 4 at Healdsburg, Cal. Mr. Johnson was born in Indiana in 1877 and was graduated from the Naval Academy, at Annapolis, Md. In 1901 he became manager of the Northern California Power Company, which at that time had a total installed generating rating of only 2,000 hp. When Mr. Johnson retired in 1915 because of ill health, the company had a total of six generating stations, with an aggregate generator capacity of 54,000 hp.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Electric Passenger Vehicle Manufacturers Optimistic

THOUGH the production of electric passenger vehicles has fallen off considerably from the peak reached in 1918, those manufacturers left in the field express themselves as optimistic. It was felt in the earlier days of the industry that the main drawback to this type of automobile was the expense of battery renewal. This has been overcome by the development of a battery guaranteed for 8,000 miles or two years' service. Another former source of expense to owners, the driving motor, has been simplified and requires little attention. Inasmuch as the flat operating cost of an electric vehicle is lower on the average than that of a gas car, manufacturers are confident that the industry will again reach the record production of 1918, which is given as approximately 7,000 cars.

A chart prepared by the Automobile Bureau of the New York Edison Company shows the total number of electric passenger automobiles in use in 1920 as 16,641. Of these Chicago has the largest number, 4,500, or 27 per cent of the total. Cleveland also has a large number, 2,500 cars, or 15 per cent of the total, being licensed there. The remainder are scattered through various other cities in small percentages.

Advance in prices was slight and recent reductions have brought the level close to that of 1910. A four-passenger car selling now at $2,985 sold at $3,400 a year ago and as low as $2,650 in 1915, while in 1910 it sold at $2,800.

Japanese Electrical Exports in 1918 and 1919 Principally to Far East

ELECTRICAL apparatus and supplies exported from Japan during 1918 and 1919 amounted to far less than those sold to foreign customers during the same period by the United States. This fact is disclosed by figures obtained by the United States Bureau of Foreign and Domestic Commerce from the Electrical Bureau, Department of Communications, Tokyo, Japan. The total of electrical exports from Japan in 1918 was $7,995,053, while those from the United States amounted to $59,982,526. In the following year Japanese electrical manufacturers sold $6,022,374 worth of their products abroad, while the United States exported $89,089,711 worth. There must be taken into account the fact that the difference in output between the two countries is equally large, but the figures do show that Japanese competition except in the Far East was not serious in the years considered.

The tabulation for 1918 shows exports by commodities and by countries. The shipments to the United States evidently were negligible as they are not shown. During that year the Japanese were particularly strong in China, Kwangtung Province, Australia and British India, with smaller amounts consigned to Dutch East India, South Africa, Great Britain and France. Japan's most important customer that year was Australia, to which were shipped goods to the value of $1,805,854. Motors, generators and parts, copper wire and insulated wire were exported in the largest amounts in 1918.

PRINCIPAL COUNTRIES TO WHICH ELECTRICAL MACHINERY WAS EXPORTED FROM JAPAN IN 1919

Countries	Quantities (Lb.)	Value
China	2,337,766	$1,422,718
Kwantung Province	2,530,133	1,560,803
Hongkong	325,200	134,096
British India	262,000	164,006
Straits Settlements	220,233	84,744
Dutch East India	3,245,466	1,049,841
Asiatic Russia	619,333	531,401
United States of America	7,466	5,982
Chile	145,333	63,807
Argentina	404,400	187,435
Australia	1,596,133	732,794
New Zealand	202,133	83,747
Total	11,895,596	$6,022,374

The information available for 1919 does not include data on commodities, giving only the quantities and values of the total electrical goods sent to each country. As in the previous year, China, Kwangtung Province and Australia proved good buyers, but Dutch East India took the place of British India, being third on the list. This was undoubtedly due to the return of the British electrical manufacturer to peace-time industry. Exports to the United States amounted to only $5,982.

Deliveries Growing Longer on Radio Telephone Receiving Sets

POPULAR demand for the small radio-telephone receiving sets has grown so large in the short time manufacturers have been pushing their sale that deliveries now average forty-five days. Only two months ago jobbers and dealers were able to obtain stocks in three days to one week. A number of dealers and a few jobbers hesitated to order large stocks at that time because demand had only begun to show its head. The result is that, though all these establishments now realize the necessity and desirability of installing radio departments, it will be some time before they will be able to do so under conditions such as the present. Many jobbers are booked for all the sets they will be able to obtain for several months

DETAILED EXPORTS TO PRINCIPAL COUNTRIES FROM JAPAN OF PRINCIPAL KINDS OF ELECTRICAL MACHINERY, ETC., IN 1918

Kind	China	British India	Australia	Kwantung Province	Dutch East India	Great Britain	France	South Africa
Motors, generators and parts	$453,515	$64,927	$139,991	$648,811	$129,643	$15,575	$120,665	$40,752
Transformers	8,297	....	....	81,258	....		....	....
Switchboards and parts	5,379	9,440	2,389	6,307	285	....	....	47
Switches	12,767	18,942	4,826	5,552	34	814	1,575	801
Electrometers, etc.	7,526	....	....	4,965	....	....	.	....
Lighting apparatus	40,669	10,852	15,971	13,355	1,833	28,907	.	1,438
Batteries and parts	11,652	588	....	7,807	....	..	....	..
Copper wire	283,027	914,630	300,533	205,279	135,306	13,616	78,157	77,902
Insulated electric wires	654,255	672,586	1,238,933	310,252	510,943	315,731	5,140	106,567
Insulators and insulating tubes	60,633	9,919	3,211	70,943	12,094	....	10	231
Totals	$1,534,720	$1,701,884	$1,805,854	$1,354,529	$790,138	$374,643	$205,547	$227,738
Grand total	$7,995,053							

and are canceling further orders because of the very indefinite deliveries they must quote.

The sudden rush of orders caught manufacturers napping also. Within two to three months, according to an officer of the Radio Corporation of America, which handles sales for the largest manufacturers, these manufacturers have increased their production to thirty times its former amount. In these plants the radio departments are alone in working to full capacity on night and day shifts. One company is said to be 200,000 sets behind orders.

Demand so far is heavier around Chicago and in the Middle West generally and on the Atlantic seaboard, mainly because of the broadcasting stations situated in these regions and because of the very favorable publicity given by the daily press, many papers having started radio sections. However, the desire of the public to have a share in the advantages of the radio telephone is spreading with almost unbelievable rapidity to all parts of the country, and even though demand should simmer down to normal in the East and Middle West, it should be some time before deliveries from manufacturers approach normal. Some fear that the saturation point is a matter of two or three years at the present rate, but manufacturers point to the example of the phonograph manufacturers, who stimulate sales yearly by bringing out new and improved models.

One of the troubles experienced by many dealers and quite a few jobbers has been the lack of salesmen with a working knowledge of radio and the radio telephone. Until recently the purchasers of radio supplies were either experienced amateurs or those studying radio, and the only thing demanded of the salesman was ability to sell the goods. Now the retail customer is, as a rule, some one entirely without knowledge of radio or of electricity, and the salesman must be able to explain the operation of a receiving or sending apparatus, to suggest a way of erecting aërials and hooking them up, and to answer questions on troubles that develop later. In cases where the dealer has only a small store and is his own salesman the difficulty is magnified. Jobbers are contending with this by establishing radio courses for dealers and salesmen.

"Pittsburgh Plus" Under Federal Trade Commission Fire

WESTERN and Southern manufacturers have reopened their fight before the Federal Trade Commission on the system of basing steel prices on the Pittsburgh mill price plus the freight rate to destination, even though the steel was actually made in Gary, Birmingham or Cleveland. The first hearing before the commission was held in Milwaukee Jan. 30 before John W. Bennet, trial examiner. The witnesses included heads of independent structural-steel, drop-forging and other plants. The manufacturers opposing the system claim that they are forced to pay an "imaginary" freight charge between Pittsburgh and their plants, which makes it impossible for them to ship their goods back into Eastern markets and compete with Eastern manufacturers. Counsel for the United States Steel Corporation and its subsidiaries will try to prove that the system attacked no longer exists. The American Steel & Wire Company, a subsidiary, has just changed its base from Pittsburgh to Cleveland.

Electric Sheet Stands Firm in Wavering Steel Market

A FEATURE of the steel market as far as finished products are concerned is the firmness of sheet prices, including quotations on electric sheet. On ordinary sheets producers are charging the regular list and are even said to be charging the published extras. It is reported that one prospective buyer received bids on electric sheet from a number of manufacturers and found them all practically the same. The sheet capacity of the country is engaged at about 48 per cent of nominal capacity. This is virtually all shipped at once as manufacturers are not working for stock.

Growing British Demand for American Electrical Appliances

HOUSING problems and the high cost of domestic labor in Great Britain have brought about a keen interest in household labor-saving devices, and as a result there is a growing and important demand for American domestic electrical appliances, says Consul Coulter at London in a report to the Department of Commerce. While there is thus opened up a large market for household devices, American manufacturers have two factors to contend with in their sales efforts. The first is the obvious one that where a family cannot afford to keep a servant it cannot afford to make a large outlay for electrical devices. The other consideration is the extremely conservative attitude of the English people. At the present time appliance advertising and merchandising in Great Britain is mediocre and lacks the appeal of American advertising. Merchandising methods are antiquated compared with the American system. All this must be changed, the report says, before great success can be expected for electrical devices in the English market.

Metal Market Situation

LITTLE demand from both foreign and domestic consumers has been the feature, if it can be called so, of the copper market for the last month. In spite of this, producers were able to maintain a price of 13⅝ cents per pound until this last week. At that time, however, heavy selling pressure was brought to hear and the market was sold down. Immediately large producers and selling agencies came down to a common level of 13⅝ cents for first-quarter delivery and in some cases even through the first half. Spot in some cases went at as low as 13½ cents, but consumers are so well covered for immediate needs that this price has failed to create a flurry in the market.

The London market also has been sluggish, but hope is still strong for future export business. Electrification of railroads and the development of hydro-electric power facilities will furnish considerable demand. The Copper Export Association is in a very strong position, having today less than 300,000,000 lb. of copper as against about 320,000,000 lb. late in December. The original holdings consisted of 400,000,000 lb., held as collateral for $40,000,000 in notes put out last February, when the situation was worse. With the maturity on Feb. 15 next of $6,000,000 worth of these notes, $14,000,000 of them will have been paid off, leaving due only $26,000,000.

The Anaconda Copper Mining Company has reported a deficit for the nine months ended Sept. 30 of $8,656,547. During a large part of the time covered by the report the mining properties of the company were closed down, and the general opinion in copper circles is that the report for the entire period of 1921 will be better on account of better sales during the fall.

The resumption of mining at Lake Superior—with the Calumet & Hecla companies announcing beginning of operations on April 1—has caused a moderate immigration of former mining workers from the South to the Lake copper country.

NEW YORK METAL MARKET PRICES

	Jan. 24, 1922	Jan. 31, 1922
Copper:	£ s. d.	£ s. d
London, standard spot	64 17 6	64 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13 75	13.50 13 62½
Electrolytic	13 50 13 62½	13 37½
Casting	13 00	12 75 12 87½
Wire, base	15 00 15 25	15.00 15 25
Lead, Am. S. & R. price	4 70	4 70
Antimony	4.45	4.40
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	5 00	4 85-4 90
Tin, straits	31 37½	32 00
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11 00-11.25	11.00-11 25
Brass, heavy	5 00 -5 25	5 00- 5 25
Brass, light	4 50 -4 75	4 50- 4 75
Lead, heavy	4 00 -4 12½	3 50- 3 75
Zinc, old scrap	2.25 -2.37½	2.00- 2 25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

AT LAST the electrical jobbers are reporting increased activity, which is all the more noticeable because of its contrast with conditions during the first three weeks of January. Chicago dealers have reported the January totals to be the best in several years and are beginning to build up stocks. Appliances there are moving better than had been expected. Better merchandising business is noted in St. Louis and a cold snap has boosted air heater sales. A new ruling in Atlanta requiring the use of armored conductor in rewiring of old houses has helped sales of that material there. There have also been numerous inquiries there for floodlighting equipment. In the Northwest general business seems to be marking time, but there have been large orders for transmission and generating equipment, with the prospect that there will be others of even greater importance as spring advances. Building there is being held up by inclement weather. San Francisco jobbers report sales of conduit and wiring materials greater than at any time in the past except during the war emergency. The greater percentage of this is going to Los Angeles and other points in southern California. Retail sales in New England are responding to aggressive campaigning. There have been a few price changes reported, loom taking an additional 10 per cent discount on smaller sizes while outlet boxes are down about 25 per cent.

NEW YORK

Jobbers report that January has been a very satisfactory month, taking all factors into consideration. While no sales records have been broken, the last of the month shows gradually increasing buying of electrical material and the business seems to be decidedly on the upward trend. Except for those few individuals who habitually capitalize a pessimistic attitude, the jobbers of this section appear well pleased with the general business outlook at this time. Wiring supplies are moving somewhat better and orders are coming more frequently, although hand-to-month buying by contractors is still apparent.

A considerable drop in the price of outlet boxes was recorded this week. The discount on boxes in the maximum quantity was increased ten points, which means a reduction of 25 per cent in the price of galvanized boxes and about 28 per cent in the price of black boxes. The price of loom in the 7/32-in. and ¼-in. size has been dropped by an additional 10 per cent discount. Larger sizes are unchanged.

Conduit.—Demand is fair, but orders are mostly for moderate quantities. Jobbers' stocks are ample to meet the present demand. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44 to $46; ¾-in., $57 to $59, and 1-in., $82 to $84 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $49 to $50, $64 to $66 and $91 to $93 for 1,000 ft.

Rubber-Covered Wire.—Conditions in the wire market remain about as last reported, with prices perhaps a shade easier. No. 14 rubber-covered is quoted at $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Demand is spotty and stocks are good.

Flexible Armored Conductor.—This material continues to move very well. Price competition is still in evidence. No 14, two-wire, single-strip, is quoted at $44 to $45 per 1,000 ft. and double-strip at $46 to $47 per 1,000 ft. in that quantity. Stocks are fair.

Outlet Boxes.—The discount on outlet boxes was increased ten points this week. This is a drop in price of about 25 per cent on black boxes and 28 per cent on galvanized boxes. Black boxes formerly took a maximum discount of 65 per cent and galvanized 60 per cent. This discount has been increased to 75 per cent and 65 per cent respectively.

Loom.—New prices on this material have been announced. In 5,000-ft. lots the 7/32-in. size is quoted at $14.85 per 1,000 ft. and the ¼-in. size at $16.20 per 1,000 ft. List prices and discounts on loom in these sizes have both been changed.

Metal Molding.—No change in price has been reported. The three-wire size sells for $5.60 per 100 ft. Demand is light and stocks are small.

Vacuum Cleaners.—Cleaners are moving steadily, and the moderate-priced machines are very popular. One jobber states that, considering the price, vacuum cleaners have almost as good a sale as flatirons.

CHICAGO

Business is recuperating from the after-holiday slump. Although this "comeback" has been slow, dealers feel that it will increase gradually as the year advances. Wiring materials are moving fairly well with no particular demand prominent. The call for safety switches has been pronounced during the week. Heating appliances, washing machines and vacuum cleaners are moving better than might have been expected after the holidays. Dealers report that their stocks, which had been reduced by the holiday trade, are being built up again. One dealer reports January sales of household appliances to have been the best in years; instead of goods being removed from freight cars to storage, they were shipped direct to consumers.

Wire.—Little change in the demand for wiring materials has been noted during the week. While a few jobbers have reported some good sales of rubber-covered wire, sales for the majority of them have been only fair though steady. Rubber-covered No. 14 is still quoted at $6.75 to $6.85 per 1,000 ft. in 5,000-ft. lots. No price change has been announced on either weatherproof or bare wire, and dealers' stocks are good to large.

Flexible Armored Conductor.—The demand for this is continuing fairly steady with dealers' stocks ample for the trade. The single-strip, two-wire No. 14 sells for $45 per 1,000 ft. in 5,000-ft. lots, while the double strip can be had for $46 to $47 per 1,000 ft.

Conduit.—Movement on the ½-in. black pipe has been steady and a few jobbers report some good sales at $45 per 1,000 ft. in 5,000-ft. lots. The new discount card, No. 49, has changed prices very little.

High-Tension Equipment.—The sale of a group of outdoor substations rated at 33,000 volts, 15,000 kw., to a Middle West central-station company was announced by one manufacturer. Inquiries from Bombay, India, for standard equipment to be used on municipal power plants have been reported by another company.

Heating Appliances.—Movement of these goods has picked up again as dealers are gradually replenishing their stocks, depleted during the holiday season. Toasters, irons, grills and air heaters are moving well.

Lamp Cord.—Fair activity continues with stocks in good shape. Silk cord sales have slowed up, but the cotton moves much better. No. 18 twisted cotton in 5,000-ft. lots is sold for $18 per 1,000 ft. The same size in the parallel silk is $27 per 1,000 ft.

Washers and Cleaners.—Movement of both washers and cleaners has been satisfactory, considering the time of the year. Dealers are getting their stocks back in good working order again.

Dry Cells.—A few good sales have been reported, but most of the orders are for small quantities. No price changes have occurred since the regular cell sells for 31 cents in barrel lots.

Radio.—The news service offered by the broadcasting station has stimulated the sale of radio equipment so that in many cases stocks are low.

BOSTON

Business continues to develop unevenly throughout New England, with a gratifying improvement in building operations, slightly better sales in the paper industry, well-sustained outputs in the textile and leather fields, and quite satisfactory mercantile activities. Central-station outputs are holding up remarkably well and showing some local gains. Contractor-dealers are busy in many localities and some schoolhouse wiring is being placed. Jobbers' stocks are well liquidated, but owing to light demand buying is cautious in most lines. Slight improvements are noted in some electrical manufacturing circles, though business is now being obtained on close margins of profit and widespread dissatisfaction with taxation laws combined with unsettled conditions both abroad and at home are handicaps to rapid recovery. Retail electrical sales are responding to aggressive campaigning backed by real service, and in some parts of Maine appliance sales are active.

Sockets.—Light sales are reported, with stocks easily meeting demand. One of the larger jobbers has set the case-lot price of pull sockets at 33 cents net on the ground that the former lower price allowed little or no profit on a warehousing basis.

Portable Lamps.—These outfits are moving better than might be expected at this season. Vigorous sales methods are yielding fruit, and while some price cutting is undoubtedly a factor in the market, purchases on a quality basis are showing up well.

Motors.—Pick-up sales are all that are evident this week, but a continual absorption of small motors into scattered industries is under way.

Wire.—Small-order business dominates the market. Prices are firm among the leading houses, rubber-covered No. 14 moving slowly at $6.75 per 1,000 ft. in 1,000-ft. lots. Weatherproof sales are dull.

Washing Machines.—Considerable improvement is apparent in sales, though hard personal efforts are required to win orders. Interest of the public in labor-saving devices for the home has remained alive through the recent severe depression, and with conditions somewhat better, the movement of even the higher-cost devices is responding.

Fixtures.—Here and there business is looking better, and interest in public building equipment is showing new vitality. Very large stocks are available for selections, and yet the revival in building work is likely to reduce these considerably during the next few months.

Flexible Armored Conductor.—Moderate sales only are reported and stocks are sufficient for current needs. Prices are fairly steady, No. 14 in 5,000-ft. lots moving around $48 to $50 per 1,000 ft.

Outlet Boxes.—Tendencies toward weaker prices are reported on both galvanized and black boxes. Current demand is light.

Appliances.—The lighter appliances for table and boudoir service are moving fairly well in some parts of the Northeast, as a result of energetic sales efforts. Vacuum cleaners are showing a little better than lately on sales reports, and hollow ware maintains a surprising popularity.

ATLANTA

Slight signs of renewed activity have begun to manifest themselves, one of the largest manufacturers reporting that there is a tendency on the part of the trade to commence restocking in a moderate measure in the more popular lines, while inquiries from engineering firms for quotations are becoming more evident. The final working plans for improvements to waterworks and pumping station under the bond issue of Atlanta are ready and in the hands of bidders, with prospects that the preliminaries will be wound up shortly and actual work commenced. The Board of Education, in a preliminary announcement, states that it will undertake the construction of thirty new schools as soon as architects can complete plans for same. Building permits continue to show up remarkably well, the permits for residences in Atlanta up to Jan. 20 exceeding in number those for any similar period in the city's history.

Armored Conductor.—A new ruling in Atlanta requiring all new work in old houses to be done with armored conductor has caused a sharp increase in orders. The rest of the territory is taking but a small portion. Local stocks are in good shape with quotations at $54 on two-wire, No. 14, in lots of 5,000 ft. and under.

Bell-Ringing Transformers.—This specialty continues to gain in popularity as it becomes better known, though the demand for the cheaper article continues in excess of that for the larger types.

Floodlighting Equipment.—Inquiries from railway yards and docks are much in evidence and a number of satisfactory orders have been received from these sources in the past few days.

"White Way" Lighting Equipment.—Considerable activity is to be noted in this line, a great many of the small municipalities actively entering into the installation of better street-lighting equipment. Factory shipments are fairly satisfactory in all standard types.

Meters.—The 5-amp. and 10-amp., two-wire and three-wire types continue very active, there being a noticeable increase in the orders for the 10-amp. size. Local stocks in the aggregate are good with factory shipments prompt.

Lamps.—Standard varieties continue their normal seasonal movement, but manufacturers' advertisements have stimulated the sale of the miniature type.

Insulators.—The past few weeks have seen a marked slump in the sale of this line, a number of jobbing firms having placed large stocks on the market at prices below the cost of replacement. The glass type continues to lead in the volume of sales.

Battery-Charging Outfits.—The automobile and garage business has not improved sufficiently to take any worthwhile quantity of this article, while the large number of second-hand machines is likewise interfering with sales.

Printing-Press Machines.—This line continues quite active, several large orders having been received in the past few days. The single-phase up to 5 hp. and three-phase for larger sizes in 220 volts are the most popular sellers.

ST. LOUIS

An "after-inventory" improvement in business was felt by electrical jobbers here last week, especially in merchandising wares. Dealer stocks were low after the holidays, and they are placing orders in good volume, chiefly for flatirons and air heaters, the demand for the latter being accentuated by the advent of the first cold weather of the season. Initial orders for fans are being placed, and a good business in that line is expected, as carry-overs from last season were as a rule very light. The inventories found jobbers' stocks of appliances low as well, and they are consequently building up their stocks in a conservative manner.

Greater activity on the part of industrial concerns is becoming apparent, there being a fair amount of motor business last week. The greater percentage of the sales, though, was to out-of-town buyers. Construction work is still quiet, owing to the continued inability of the contractors and men to arrive at a wage adjustment, though the painters have signified their willingness to accept lower wages.

A good sign of improving business is the rate at which the railroads in this section continue buying new equipment to take care of expected heavier traffic. Last week the Burlington announced the appropriation of $15,000,000 for this purpose, to be used in purchasing cars for both freight and passenger traffic, and other roads have ordered passenger equipment and rails. A number of the roads are reporting increased shipment of merchandise in less-than-carload lots, consisting largely of commodities used in ordinary living, indicating a more general disposition on the part of the public to buy. Jobbers likewise report some improvement in the railroads' demand for electrical goods.

Loom.—Prices were made about 10 per cent lower during the week and the revised quotations range as follows: $\frac{7}{32}$-in., $14.75 to $15; $\frac{1}{4}$-in., $15.75 to $16.20; all prices being for

1,000 ft., in 5,000-ft. lots. Stocks vary from conservative to slightly heavy, and the demand has been dull.

Air Heaters.—Quiet business has prevailed until this week, when the first real cold weather of the season appeared. Dealers' stocks were low, but the jobbers in general had sufficient supply to take care of the requirements. There has been some interchange to meet the demand.

Fans.—Indications are that a good fan business will be had this coming season. Dealers' and jobbers' stocks were low at the conclusion of the last season, and there will be good buying all along the line. Lower prices are expected to stimulate buying on the part of the public in the better grades. Dealers and jobbers are placing their orders, which are on a normal basis.

Flatirons.—The holiday trade brought stocks to a low point and replacement orders are being booked for attractive amounts. The demand of the public continues steady and strong.

Fuses.—An increasing demand is experienced for plug fuses coming in cartons or on cards. The clear window type is selling for $2.75 per 100 in standard-package lots. Cartridge fuses maintain steady sales. The non-indicating type is quoted as follows: 1-amp. to 30-amp., $4.60 per 100; 31-amp., to 60-amp. $6.90 per 100. Stocks are well in line with the requirements.

SALT LAKE CITY—DENVER

Gold and silver mining are expected to show marked improvement in 1922, according to the mining interests of Denver and Salt Lake City. The opening up of new properties and several old properties closed during the war indicates a definite revival of the industry. Tungsten mining is also said to be on a decidedly better basis. The coal market during several months has been good and most mines have been kept running on a six-day-week production basis. Labor troubles in several important fields have forced practical suspension pending adjustments between employers and employees. That the stiffening of the wool market, amounting in many cases to 50 per cent, is not a temporary flurry is shown in the fact that present stocks are low and that tariff protection in the near future seems certain. Enthusiastic live-stock shows are either in progress or in preparation at several live-stock centers of the Intermountain country, notably at Denver and Salt Lake City.

Pole-Line Hardware.—The market is very inactive. Orders are only occasional and usually small. There have been several small declines in price, with every indication that other changes will follow before the market is in any way settled. Construction work, excepting necessary repairs, is virtually nil.

Motors.—Few sales are recorded. The present demand is limited to motors of fractional horsepower. Stocks on jobbers' shelves are not excessive.

Washers.—The market is stagnant, with jobbers well stocked to handle the business that is looked forward to with the opening of spring. In some cases the standard cylinder-type machines are back to a pre-war basis in price. In the dolly type so many mechanical improvements are offered in the new models that fair price comparisons are as a rule impossible.

SAN FRANCISCO

Electrical contractors who are chiefly engaged in the wiring game are very sanguine over prospects for a good year. Electrical dealers are finding their business somewhat slower than last year at this time. Some constructive work is being done so that districts now in a temporary state of saturation are expected to become productive again.

Conduit.—Half-inch black conduit is now selling in quantities up to carload at about $6 per 100 ft., and galvanized and sherardized conduit in the same size at $6.50 per 100 ft. An approximate allowance of 5 per cent is made for carload quantities and in sizes other than ½-in. Approximately 5 per cent is added for quantities of less than 10,000 ft. Conduit business is excellent. It is stated that, with the exception of orders for war emergencies, demand is now running higher than ever before. Demand in the San Francisco Bay district is a little lower than normal, but southern California and especially Los Angeles are more than bringing up the average. In San Francisco and Oakland the fire limits are confined to a certain business and residential portion, but in such southern cities as Los Angeles and Pasadena they are coterminous with the county limits.

Boxes and Covers.—A recent drop of 10 per cent is reported so that galvanized boxes in package lots now carry a discount of approximately 45 per cent with an extra 10 per cent in lots of 1,000. The demand is very good and local stocks are well maintained.

Flexible Non-metallic Conduit.—The 7/32-in. flexible non-metallic conduit is selling for approximately $17 per 1,000 ft. in coils like other roughing-in material. The demand is great, with stocks making a rapid turnover.

Wiring Material.—A marked rapidity of turnover is reported by manufacturers who accumulated during the dull season of last year stocks which were much larger than justified at that time. Hand-to-mouth buying, except in certain special sizes, has been effectually upset by the consumer. One Los Angeles firm making a specialty of house wiring is reported to have wired as many as 4,000 outlets in November, and several firms there are averaging 2,000 outlets per month. On the other hand, many contractor-dealers have shown disinclination to seek this class of work, with the result that many of their former wiremen are now managing small firms which seek this business on a close margin.

SEATTLE—SPOKANE—PORTLAND

General business continues to mark time. Temporarily unfavorable weather conditions which have been quite general throughout the Northwest have delayed the starting of building operations somewhat and also apparently have had a tendency to slow down sales generally. Lumber production for the week ending Jan. 21 was 19 per cent below normal. New business was 7 per cent below production and shipments 6 per cent in excess of production. Manufacturers report that, although business is slow at the present time, inquiries are more active in the industrial lines than for some time past. The Oregon Electric Railway Company has placed orders with manufacturers for equipment for seven automatic substations to replace present manual equipment.

The California-Oregon Power Company is preparing to install at its Copco plant a 10,000-kva. generator which was purchased some time ago. The Portland Railway has purchased $1,000,000 worth of relays, oil switches and other equipment. This company is also proceeding with work on its 25,000-kw. hydro-electric development on the Upper Clackamas River. A new power line is to be built into the famous Wenatchee Valley apple district in Washington which will give this district an ample supply of power.

Larger stocks are now being carried by Spokane jobbers than at any time in the last eight years, according to prominent jobbers. It is also reported that business is better and the prospects are brighter than at any time during the last twelve to eighteen months. Portland and Seattle jobbers report business rather poor for the past week, due probably to unfavorable weather conditions with the consequent slowing up of building operations.

Conduit.—Demand is fairly good in some sections and poor in others. An improved market is predicted for the spring as the building program gradually gets under way. A reduction in prices of conduit has just been made by Portland jobbers. Seattle and Portland quotations respectively follow: ½-in. black, $6.95 and $6.70 per 100 ft.; galvanized, $7.50 and $7.25 per 100 ft.; ¾-in. black, $9.65 and $9.30, and galvanized, $10.35 and $10 per 100 ft. in 10,000-ft. lots.

Outlet Boxes.—Demand is fairly active with the 4-in. octagonals and squares, the most popular sizes and shapes. Four-inch octagonals are quoted at $17.75 per 100 in lots of less than 100.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Luminous Unit Now Brascolite Company

The Brascolite Company is the new title of the company formerly known as the Luminous Unit Company, 2615 Washington Avenue, St. Louis, Mo. The company manufactures lighting fixtures and glassware and its best-known product for a number of years has gone under the trade name of "Brascolite." The intention in the change is to identify the company more closely with its product and to make the name easier to remember by the trade. There is no change in the corporation organization or policies.

Conant Company Appoints Distributers

The Conant Machine Company, manufacturer of electric and other power-driven loading equipment, Concord Junction, Mass., has appointed the following distributers in the southern territory: The Fairbanks Company, Birmingham, Ala.; Henry H. Meyer Company, Baltimore, Md.; Lewter H. Hobbs, Inc., Norfolk, Va., and Raleigh Iron Works Company, Raleigh, N. C.

East Jersey Pipe and Riter-Conley Manufacturing Arrangement

The East Jersey Pipe Company, Paterson, N. J., has completed an arrangement with the Riter-Conley Company, Pittsburgh, whereby the latter company will manufacture in the Pittsburgh district "Lock-Bar" steel pipe, the rights to which have been exclusive to the East Jersey Pipe Company. This is announced as a step forward in manufacturing policy as it will permit considerable saving in freight rates and economy in manufacturing. The sale of this product will continue to be exclusively in the hands of the East Jersey Pipe Company.

Boston Manufacturer Changes Name

The Eastern Electric Manufacturing Company, 410 Dorchester Avenue, South Boston, Mass., has changed its name to the Westgard Electric Company with the same headquarters. O. Westgard, president, informed the ELECTRICAL WORLD recently that the outlook for better business is more promising and that the increased amount of construction now evident is being reflected in a better volume of orders for the company's product. This concern manufactures the "OK Unbreakable" stamped-steel outlet plate and is now prepared to undertake other stamping work. Mr. Westgard stated that it had been decided to market the company's product through a New York sales representative and that announcement will soon be made as to his name and location.

Robbins & Myers Appoint New England Agents

The Wetmore - Savage Company, Boston, has been appointed exclusive agent for New England for the products of the Robbins & Myers Company, Springfield, Ohio, and will distribute these products from 75 Pearl Street, Boston. Resale control is included in the agreement. The Robbins & Myers Company closes its New England district office in Boston in transferring this exclusive agency to the Wetmore-Savage Company, which has represented these manufacturers for some years in the motor field.

Apex Company Starts New Sales Contest

The Apex Electrical Distributing Company, Cleveland, has started another sales contest for retail and wholesale salesmen with cash prizes totaling $50,000 to be distributed at the end of the contest to the winners in various parts of the country. The contest will close on May 9. The company also has announced that it will insure the lives of all of the members of its "National 100 per Cent Salesmanship Club" for $500 and will gradually increase this amount to $1,000. The winners in the sales contests carried on by the company are admitted to membership in this club.

Combustion Engineering Makes Agency Change

The Combustion Engineering Corporation, Combustion Engineering Building, New York, has announced an arrangement by which the George J. Hagan Company, Pittsburgh, will discontinue representation of the former company in that district. The Hagan company, however, is to retain the exclusive agency for the type H stoker of the Combustion Engineering Corporation for use in its own industrial furnaces. The New York company has opened its own office in the First National Bank Building, Pittsburgh, and will soon open another in Cleveland. Both will be in charge of W. C. Stripe, former manager of the Philadelphia office.

Geier Company Queries Dealers on Appliances Prices

A questionnaire has been sent to all the dealers of the P. A. Geier Company, Cleveland, manufacturer of vacuum cleaners, asking them their opinion on the present level of prices. The questionnaire desires to know whether the present price of the "Royal" cleaner is right, whether the price should be changed and to what amount, by what percentage the dealer's sales would be increased if the price were reduced by a certain percentage, something about the dealer's methods of selling, and his opinion about the price situation as a whole. In the January issue of *Royal Breezes*, the company's house organ, which accompanies the questionnaire, there is a discussion of how price reductions are apt to affect retail business and profits. The statement is made that if manufacturers can see their way clear to make a cut in price a good portion of this saving should be used in national advertising and the remaining portion should be given to distributers and dealers to afford them an extra margin to take care of "trade-in" vacuum cleaners. By reducing retail prices, the editorial continues, the jobbers' and dealers' margin and the salesmen's commissions would have to be cut down, and to make a profit sales costs would have to be cut, with a probable falling off in sales on that account. In its announcement to its dealers the Geier company asserts its belief that whatever is best for the dealer is best for the company and its desire to frame its policy according to their needs.

Edison Lamp Increases Production

The Edison Lamp Works of the General Electric Company, Fort Wayne, Ind., which for the last several months have operated only four and a half days a week, are now operating full time. J. W. Anspach, superintendent of the plant, stated this week to a representative of ELECTRICAL WORLD that there will be no change in the number of employees working at the plant, but that it has been considered advisable to increase the hours to full time. For several months the plant had felt the slump in business, and the number and the hours of the employees had been slightly reduced.

Monroe Corporation Expands Jobbing Activities

The Monroe Lamp & Equipment Corporation, 314 West Fourteenth Street, New York, which formerly dealt only in Packard "Mazda" lamps, is now doing a general jobbing business in electrical supplies. The company will handle the products of the National Metal Molding Company, Thomas & Betts, Indiana Insulated Wire Company, R. B. Corey Company, Edwards & Company, W. A. Bonnell, Garland Manufacturing Company, Emerson Electric Manufacturing Company, Economy Fuse & Manufacturing Company and Duplex Lighting Works. The increase in the electrical supply business of the company has made it necessary to increase the sales force, and M. J. Egan, who for the past twenty years has been connected with the jobbing business in this territory with F. W. L. Fullerton, Inc., Stanley & Patterson and the Western Electric Company, is now with the Monroe Company. J. J. Hagan, formerly vice-president of the company, has resigned to take up his duties as Assistant Commissioner of Public Works, New York City. His successor will be announced soon. C. W. Culkin remains as president and J. M. McCunn as treasurer of the company.

C. A. Cotton, Inc., Formed at Boston

C. A. Cotton, long prominent in the New England motor trade, has organized C. A. Cotton, Inc., 100 Pearl Street, Boston, and has been appointed New England representative of the Northwestern Manufacturing Company, Milwaukee, manufacturer of motors and generators, and of the Baldor Electric Company, St. Louis, Mo., producer of single-phase motors. Mr. Cotton is president and George R. Walworth treasurer of the new company. Mr. Cotton has just returned to Boston from a ten-day trip through the Middle West and said to a representative of the ELECTRICAL WORLD this week that the outlook is encouraging for better business in the electrical field.

Work Completed on Western Electric Extensions

Extensions to the Hawthorne plant of the Western Electric Company at Chicago have been completed. The buildings comprising the addition are estimated to have cost $2,000,000, and in them will be installed machinery valued at $1,500,000. The new structures add about ten acres to the plant's floor space, which now totals 3,376,000 sq.ft. The addition consists of three six-story shops and a four-story warehouse. The gross floor area of the latter is 105,000 sq.ft. All are of the most modern brick construction with structural-steel frames on concrete foundations. The construction took eighteen months from the breaking of the ground to the announcement of readiness for service.

Only about a year ago the Western Electric Company completed several other buildings at Hawthorne, valued at $1,700,000, and installed $1,600,000 worth of machinery. At the present time the plant facilities are being used mainly for the manufacture of telephone equipment, and owing to the receipt of very large orders for this material the full capacity of the plant is being utilized.

To provide for additional packing materials needed for the increase in production on account of the new manufacturing buildings, plans are being considered for the erection of a new packing material factory.

Outlook Bright, Says Electric Furnace Company

The marked improvement of business in the last few months of 1921 will probably continue in increasing volume in 1922, according to the view expressed by the Electric Furnace Company, Salem, Ohio, in an editorial in its January house organ. The company bases its opinion upon the improved financial situation, as reflected in the statement of the Federal Reserve Bank, showing the best reserve ratio since 1917 and a rediscount rate of 4½ per cent, within one-half of 1 per cent of the lowest rate since the organization of that institution.

"This, in turn," the company continues, "has reacted favorably on the market price of bonds and the value of the better known industrial stocks. Some of the factors that were expected to add to the volume of business in 1921 have as yet not materialized. Among these is heavy buying by the railroads, and the longer this is delayed the greater must be their orders when they do come to market. There is little doubt that railroad business in 1922 will be very large. The building industry is still far behind requirements, the iron and steel industry is showing signs of recovery, copper mining is being resumed, and foreign exchange rates are improving. All these are signs of better business this year. There has been an increased volume of inquiries for our products from both domestic and foreign sources during the last few weeks, indicating a desire on the part of industrials to buy new equipment and modernize their plants."

December shipments of the electric furnaces manufactured by the company were good and went to foreign destinations as well as domestic. Two furnaces went to Mexico and one to Canada, the rest being consigned to points within the United States. Though 1921 sales were not so heavy as those in 1920, a good total was reached in both the non-ferrous and the heat-treating and annealing field. The export department of the company showed an increase of 40 per cent in number of units installed over the figure for the previous year.

Lewis Electric Building New Plant

The Lewis Electric Company, Minerva, Ohio, manufacturer of switches and control equipment, is erecting a new factory at Minerva to take care of increased business. The building, according to J. C. Lewis, president, will be of steel construction, two stories high and about 60 ft. by 200 ft. The completion of the new plant will add about 23,000 sq.ft. to the manufacturing facilities of the company. The plant will be equipped to take care of a large production of a full line of industrial and commercial steel-inclosed safety switches. Included in the equipment of the addition is a complete power plant as well as a modern enameling and finishing plant.

The Holtzer Cabot Company has closed its St. Louis office and has transferred S. E. Klunder, formerly its representative there, to the Chicago office.

The Standard Underground Cable Company has transferred the headquarters of its Southeastern sales department from Philadelphia to Washington, D. C. Edward Kerschner is manager. The Atlanta (Ga.) suboffice of the company will be continued under the management of J. A. Peacock as formerly.

The Sun-Ray Manufacturing Company, maker of heating pads, Oshkosh, Wis., has appointed Robert E. Rae, 38 Murray Street, New York City, as Eastern representative. The F. K. Simons Electric Company, Fuller Building, Philadelphia, has been made distributing agent for southeastern Pennsylvania, Maryland, West Virginia and Virginia. R. S. Wakefield, 222 Interurban Building, Dallas, Tex., is sales representative for the South Central States.

Kaufman & Albert, sales agents in the lighting fixture and glassware fields, have opened an office and showroom at 605 Broadway, New York City, and are representing several manufacturers of these products. A sales staff has been organized for the purpose of calling on the trade.

The Ruberoid Company, 95 Madison Avenue, New York City, successor to the Standard Paint Company, is now marketing No. 2 "P & B" electrical compound under the label "Ruberoid P & B rapid asphalt paint." The "P & B" designation will ultimately be dropped.

The Ideal Commutator Dresser Company, 3229-31 Sheffield Avenue, Chicago, has announced the establishment of a district office at 1905 Tribune Building, 154 Nassau Street, New York City. R. W. Becker is district sales manager.

The George H. Wahn Company, Boston, has been appointed distributer for New England through Fitts-Morse, Inc., of the fixture material manufactured by the Crescent Brass Products Company, Cleveland.

The Butler Automotive Steel Company is the new name of the Butler-Edwards Electric Company, Easton, Pa. The company, originally formed for the manufacture of fan motors, lightning arresters, electric dental engines and telephone ringing machines, has discontinued the manufacture of all these with the exception of the telephone-ringing machines and will manufacture automobile parts.

The Lapp Insulator Company, Inc., Leroy, N. Y., manufacturer of high-voltage insulators and electric power transmission appliances, has appointed the following district representatives: J. W. Fraser & Company, Commercial National Bank Building, Charlotte, N. C.; F. W. Jennings & Company, 805 Ford Building, Detroit, and J. E. Sumpter Company, 310 Security Building, Minneapolis.

Foreign Trade Notes

PROPOSED HYDRO ELECTRIC DEVELOPMENT IN INDIA. Investigations have been made of eleven sites in the Travancore State, according to *Electrical Industries*, in connection with a proposed hydro-electric project. It is proposed to construct a masonry dam to impound water in a lake 4 miles square with a fall of nearly 1,000 ft. in connection with the Kallar project. The management is to be handed over to a reliable private company on a small charge per unit of supply by the state. A committee has been appointed by the government of Bengal to carry out a hydro-electric survey of the province. The survey is to be confined in the first instance to the Hill Tippera area around Comilla and Chittagong.

ELECTRIFICATION PLAN IN SWEDEN PROGRESSING. The first section of a high-tension transmission line which is designed to pass through the center of Sweden from north to south has just been completed and is now in operation. This section connects the high-voltage station at Trollhättan Falls, in central Sweden to the city of Vasteras, one of the most important manufacturing centers in Sweden. The large waterfalls of north and central Sweden will be utilized to furnish electricity for the great central transmission line when completed. This line is intended not only to supply electricity to operate the trains in Sweden, but also to furnish energy to operate the large industrial plants of the country.

ELECTROLYTIC PLANT FOR HOBART, TASMANIA.—The Waterloo Chemical Works, Sydney, Australia, is negotiating for a factory site on the water front at Hobart, according to *Commerce Reports*, where it purposes to establish a plant for the electrolytic manufacture of pigments from scrap iron. The company, it is stated, will remove its works from Sydney to Hobart to take advantage of the cheap hydro-electric power, of which 500 hp. will ultimately be required. The initial output will be 10 tons weekly but larger works are contemplated.

New Apparatus and Publications

FUSES, BOXES, ETC. — The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, has issued a new catalog, containing ninety-six pages and 445 illustrations, covering its electrical protective materials and conduit fittings.

WIRE.—The Copper Clad Steel Company, Braddock, P. O. Rankin, Pa., is distributing two leaflets, one entitled "Technical Data and Tables on Aristos 'Copperweld' Signal Wire" and the other "Technical Data and Tables on Aristos 'Copperweld' Wire for Series Lighting Circuits."

PUMPS.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, is distributing bulletin W-605, entitled "Worthington Instruction Book for Type VH, Class B, BBS, OS, Centrifugal Pumps." This catalog contains seventy-two pages and contains data on the erection and installation of centrifugal pumps.

MOTOR BEARINGS. — Circular reprint No. 104, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes in detail babbitting motor bearings.

STRAINERS. — The Elliott Company, Pittsburgh, Pa., is distributing bulletin A (1922 edition) covering its different types of twin strainers.

WIRE PRODUCTS. — The Acme Wire Company, New Haven, Conn., has issued a general trade catalog entitled "Acme Wire Products," covering "Acme" magnet wire and coil windings.

ROTARY CANOPY SWITCH.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has recently developed a new rotary canopy switch.

STEREOPTICON.—The Autopticon Corporation, 192 Market Street, Newark, N. J., is distributing a four-page leaflet describing the "Autopticon" for automatic stereopticon slide service for advertisers, lecturers and educators.

HAIR DRYER.—An electric hair dryer, the "Star," with all the switches in the handle, has been placed on the market by the Fitzgerald Manufacturing Company, Torrington, Conn.

STEEL HANGER.—The Dodge Sales & Engineering Company, Mishawaka, Ind., have recently developed a pressed steel hanger for general-purpose use.

GRAPHIC INSTRUMENTS.—The Esterline Company, Indianapolis, Ind., is distributing bulletin 122, calling attention to the use of its graphic instruments in industrial plants.

STANDARDS IN THE PUMP INDUSTRY.—"Trade Standards in the Pump Industry" is the title of a booklet recently published by the Hydraulic Society, 50 Church Street, New York City.

FACTORY LIGHTING.—Bulletin No. 42, just issued by the National Lamp Works of the General Electric Company, covers factory lighting designs and is a practical handbook for the installer of lighting equipment.

WASHING TABLETS.—The Liberty Washing Tablet Corporation, 96 Prospect Avenue, Brooklyn, N. Y., has issued a booklet entitled "I've Thrown Away My Washboard," which gives information on the correct use of washing tablets with electric clothes washers.

REFRIGERATORS.—The Frigidaire Corporation, Dayton, Ohio, has issued a new booklet on electric refrigerators for the home.

CYCLONE BLOWER.—The Corte Engineering Company, consulting and sales engineers, 3112 Woolworth Building, New York City, is distributing a leaflet covering the "Emery" four-cyclone blower, manufactured by Charles W. Emery & Sons, Philadelphia.

ELECTRIC TRUCKS. — The Lansden Company, Inc., Danbury, Conn., is distributing an illustrated catalog covering the different types of the "Lansden" electric commercial vehicles.

WATERWHEELS — Bulletin No. 17, issued by the Pelton Water Wheel Company, Nineteenth and Harrison Streets, San Francisco, describes and illustrates its different types of waterwheels (impulse turbines) and reaction turbines.

COOLING APPARATUS.—The B. F. Sturtevant Company, Hyde Park, Boston, Mass., is distributing bulletin No. 246, describing the "Sturtevant" generator cooling apparatus.

CIRCUIT BREAKER.—"'U-Re-Lite,' the Circuit Breaker in the Steel Box," is the title of a booklet distributed by the Cutter Company, Philadelphia, covering the "U-Re-Lite" circuit breaker.

New Incorporations

THE BIG WALNUT ELECTRIC COMPANY, Sunbury, Ohio, has been incorporated with a capital stock of $25,000 by Rudolph Burrer, Earl O. Burrer, Robert P. Anderson, David M. Cupp and Parker P. Burrer.

THE GLADBROOK-SALEM ELECTRIC COMPANY, Gladbrook, Iowa, has been incorporated with a capital stock of $50,000. The officers of the company are Fred Gethmann, president, and Joseph Mathern, vice-president.

THE WESTERN POWER COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $50,000 by Charles R. Arbaugh and James A. Shearer.

THE CO-OPERATIVE ELECTRIC COMPANY, Cincinnati, Ohio, has been incorporated with a capital stock of $10,000 by Jacob R. Koch, Anthony L. Harris, J. G. Esselman, Jr., Frederick Closs and Benedix Rosenbaum.

A. A. ZIMMERMAN, INC., 557 Bergenline Avenue, West New York, N. J., has been incorporated by Arthur S. Zimmerman, Charles F. Echentille, West Hoboken, and Sigmund Bronstein. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical supplies, etc.

THE STANDARD ELECTRIC COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture electrical and mechanical devices. The incorporators are T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington, Del.

THE WONDER ELECTRICAL MANUFACTURING COMPANY, Portland, Ore., has been incorporated with a capital stock of $25,000 by John W. Henry, Stephen T. Downey and Austin J. Neylon.

THE ELGIN (ILL.) WATER, LIGHT & POWER COMPANY has been incorporated with a capital stock of $225,000 by Eugene Clifford, George B. Dunne and Henry T. Hendersth, all of Chicago.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 10, 1922)

1,402,797. MACHINE ELEMENT; Joseph Roschach, Campgaw, N. J. App. filed April 7, 1917. Selective position finder composed of field and movable magnets.

1,402,802. SWITCH FOR MAGNETIC CHUCKS; Frank L. Simmons, Woonsocket, R. I. App. filed March 14, 1918. Waterproof and pole changing.

1,402,832. INDUCTION FURNACE; John L. Brown, Catonsville, Md. App. filed Dec. 22, 1920. Conical coil of fusible metal melted by direct connection and metal in crucible reduced by induction.

1,402,860. ELECTRIC CORD ANCHORAGE; Howard E. Hoover, Chicago, Ill. App. filed May 1, 1918. Vacuum sweeper cord fastened to handle.

1,402,870. DYNAMO-ELECTRIC MACHINE; Preston H. Kuhn, El Paso, Tex. App. filed Oct. 16, 1917. Rotor wherein certain coils are automatically cut out.

1,402,873. ELECTRIC WATER HEATER; Joseph Ledwinka, Philadelphia, Pa. App. filed April 17, 1919. Transformer including in secondary a tube of conducting material through which water flows.

1,402,875. POWER-DEVELOPING APPARATUS; Edgar W. McCallister, Pittsburgh, Pa. App. filed Aug. 8, 1919. Ship propulsion by two combustion engines whereby speed can be varied without decreasing efficiency.

1,402,884. MANIFOLD HEATER; Louis L. Parrish, Minneapolis, Minn. App. filed Dec. 29, 1919. By electric coil.

1,402,889. ELECTRIC HEATING ELEMENT; George Potstada, Oakland, Cal. App. filed Sept. 21, 1920. Flat spiral coil.

1,402,905. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed Oct. 18, 1913. Automatically disconnects lines.

1,402,931. METHOD AND APPARATUS FOR THE PRODUCTION AND UTILIZATION OF ELECTRIC CURRENTS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 18, 1915. Relates to production of electric pulses of definite time period and the generation therefrom of alternating currents of practically any definite time period.

1,402,932. METHOD OF REPRODUCING VARIATIONS IN AN ELECTRIC CIRCUIT; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed Nov. 19, 1915. Varied by controlling the amount of electrical energy supplied from source by circuit.

1,402,933. METHOD OF AND APPARATUS FOR CONTROLLING ELECTRIC CURRENT; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed July 6, 1916. By action of a magnetic field on an electrode in a vacuum gas or vapor device.

1,402,936. AUTOMATIC TELEPHONE SYSTEM; Harry H. Ide, La Grange, Ill. App. filed June 18, 1917. Machine switching.

1,402,956. ELECTRIC CELL; Peter P. Politowski, Chicago, Ill. App. filed Feb. 14, 1920. Storage battery.

1,402,986. ELECTROLYTIC CELL AND METHOD OF OPERATING THE SAME; Hugh H. Wilkie, Chicago, Ill. App. filed April 13, 1918. Precipitates metallic oxides.

1,402,991. CARRIER TELEGRAPH CIRCUIT; Herman A. Affel, Brooklyn, N. Y. App. filed Oct. 21, 1920. Carrier signals translated into carrier frequencies for transmission.

1,402,999. LAMP-SOCKET CONNECTION; Herman H. Ashinger, South Bend, Ind. App. filed Dec. 18, 1918. Lamp socket detachable from base.

1,403,025. OZONE MACHINE; Arthur P. Haase, Chicago, Ill. App. filed April 14, 1921. A separable dielectric and electrode.

1,403,034. LINEMAN'S BLANKET; Charles A. Kingsbury, Chicago, Ill. App. filed Nov. 17, 1919. Rubber reinforced with fabric.

1,403,048. THEATER SEAT INDICATING APPARATUS; Ralph H. Mecorney, St. Albans, Vt. App. filed Oct. 1, 1919. Rack to show unsold seats.

1,403,06[illegible]. CORRECTION DEVICE FOR REPEATER COMPASSES; Elmer A. Sperry, Brooklyn, N. Y. App. filed May 17, 1917. For correcting the readings of gyroscopic compasses.

1,40[illegible],06[illegible]. RECOVERY OF ZINC BY ELECTROLYSIS; David Avery, Melbourne, Australia. App. filed March 16, 1920. Removing chlorine from zinc-bearing solution to prevent corrosion of electrodes.

1,403,078. ELECTRIC ARC LAMP; John A. Heany, New York, N. Y. App. filed June 11, 1917. Operating on low wattages.

1,403,079. ELECTRIC ARC LAMP; John A. Heany, New York, N. Y. App. filed June 11, 1917. Operating on low wattages.

1,403,102. ELECTRIC WATER HEATER; Frank C. Perkins, Buffalo, N. Y. App. filed July 5, 1918. Water used as heating element.

1,403,107. ELECTRIC POCKET LAMP; Otto Pletscher, Albisrieden, Switzerland. App. filed Oct. 27, 1917. Spring-driven generator inclosed.

1,403,119. THERAPEUTIC LAMP; Paul E. Johnson, Chicago, Ill. App. filed June 9, 1920. Combination of incandescent and mercury-vapor lamps to obtain any wave length.

1,403,136. ELECTRIC OVEN; Elsie Terry, St. Louis, Mo. App. filed Aug. 12, 1920. Constructed of metal, cork and asbestos.

1,403,137. SPEED-REGULATING SYSTEM; Louis W. Thompson, Schenectady, N. Y. App. filed Nov. 26, 1920. Speed of direct-current motor maintained constant on variable loads.

1,403,150. SIGNAL FOR MOTOR VEHICLES; George B. Ewart and Harlan R. Milligan, Pittsburgh, Pa. App. filed March 20, 1919. Rear-end light.

1,403,172. CONTROL OF ELECTRIC MACHINES; Fred H. Kroger, Brooklyn, N. Y. App. filed July 3, 1916. For regulating air gap of high-frequency alternators.

1,403,179. STATOR; William A. Marschke and Fredrich W. Marschke, Indianapolis, Ind. App. filed April 7, 1919. Removable stator magnetic unit.

1,403,185. ELECTRIC CONNECTION; Edwin S. Mix, Rochester, N. Y. App. filed Jan. 24, 1917. For connecting conductors at right angles.

1,403,216. AUTOMATIC ELECTRIC POWER AND LIGHT SYSTEM; Louis B. Williams, Dayton, Ohio. App. filed Feb. 19, 1917. For use in isolated stations.

1,403,230. METALLIC ARC WELDING; Jack Churchward, New York, N. Y. App. filed Feb. 12, 1920. Metal to be deposited is supplied from the electrode itself.

1,403,231. ELECTRICAL CONNECTION; Alexander Churchward, New York, N. Y. App. filed June 19, 1920. For widely dissimilar resistances.

1,403,292. METHOD AND APPARATUS FOR PERCUSSIVE WELDING; Lewis W. Chubb, Edgewood Park, Pa. App. filed March 23, 1920.

1,403,298. CONNECTOR; Charles A. Deuscher, New York, N. Y. App. filed Oct. 2, 1920. Non-soldered connection for resistance unit.

1,403,305. MAGNET CORE AND METHOD OF MAKING THE SAME; Gustaf W. Elmen, Leonia, N. J. App. filed Dec. 21, 1920. Composed of finely divided magnetic material, each particle insulated.

1,403,330. ELECTRIC HEATER; Edwin N. Lightfoot, New York, N. Y. App. filed April 9, 1920. Used in press blocks of printing presses.

1,403,331. ELECTRIC HEATER; Edwin N. Lightfoot, New York, N. Y. App. filed April 9, 1920. Terminal mounting for flat units.

1,403,342. MOTOR CONTROLLER; Niels L. Mortensen, Milwaukee, Wis. App. filed April 30, 1920. Master controller for motors with definite cycle relation.

1403,352. CONDUIT AND METHOD OF INSTALLING SAME; William W. Smythe, Jr., Chicago, Ill. App. filed Feb. 16, 1917. Split conduit covered with cement.

1403,355. SYSTEM OF CONTROL; Norman W. Storer, Pittsburgh, Pa. App. filed May 16, 1916. Batteries charged by regeneration of railway motors.

1403,356. STARTING SYSTEM FOR AUTOMOBILES; Horace V. S. Taylor, Pittsburgh, Pa. App. filed June 4, 1915. Moving motor armature longitudinally.

1403,380. ELECTRODE FOR USE IN DEPOSITING MOLTEN METAL AND PROCESS OR METHOD OF MAKING SAME; William H. Boorne, London, England. App. filed Sept. 27, 1920. By means of electric arc.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

LOWELL, MASS.—Plans have been prepared for the construction of a hydro-electric generating plant at the Boott Mills, to cost about $35,000. Arthur T. Safford, 66 Broadway, is engineer.

WEBSTER, MASS.—At the annual town meeting to be held in March the proposal to install an ornamental light system in the business section of Webster and to place wires of the Webster & Southbridge Gas & Electric Company on Main Street underground will be submitted to the voters.

SPRINGDALE, CONN. — Inquiries have been sent out by the Stamford Rolling Mills Company for complete oil-engine power equipment with electric generators for its two mills at Stamford and Springdale. The capacity of each power house will be about 2,500 hp. C. F. Hunter is purchasing agent.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 14, for furnishing 9,100 ft. of electric cable for the Brooklyn Navy Yard. (Schedule 9388.)

BROOKLYN, N. Y.—The Brooklyn Edison Company has filed a petition with the Public Service Commission for permission to raise additional funds to the amount of $10,000,000. Part of the proceeds will be used for construction of a new electric power plant.

GRANVILLE, N. Y. — The Granville Electric & Gas Company has filed notice of increase in capital from $150,000 to $300,000.

HUDSON, N. Y.—The Upper Hudson Electric & Railroad Company, Hudson, is considering the erection of distribution lines to furnish electricity for lighting in Windham, Hensonville and Maplecrest.

MIDDLETOWN, N. Y. — The Orange County Public Service Corporation has been acquired by interests headed by Lionel Hagenaers and R. R. Livingston, who will become president and vice-president respectively of the company. Tentative plans are under consideration for extensions and improvements in the system.

NEW YORK, N. Y.—The New York Edison Company will take bids early in February for the erection of its new one-story substation, 50 ft. x 100 ft., at Park Avenue and 188th Street, to cost about $75,000. William Whitehill, Forty-first Street and Sixth Avenue, is architect.

PORT WASHINGTON, L. I.—The Nassau Light & Power Company is planning to rebuild its local substation, damaged by fire Jan. 23.

ROCKVILLE CENTER, L. I.—The Village Council is planning for extensions and improvements to the municipal electric light plant to cost about $50,000.

BRIDGETON, N. J.—An electric plant will be constructed by the Cumberland Glass Company in connection with its new plant on Laurel Street, to cost about $1,500,000.

LONG BRANCH, N. J.—Bids will be received by the Board of Commissioners until Feb. 7 for the installation of ornamental lamps on Ocean and Long Branch Avenues. Elmer F. Lawyer is city clerk.

NEWARK, N. J. — The Department of Parks and Public Property, City Hall, is considering preliminary plans for the construction of a new power plant to be used in connection with the municipal market building, now in course of erection. It will cost in excess of $100,000. Frank Grad, 245 Springfield Avenue, and George B. Hooper, 116 Market Street, are architects.

WILDWOOD, N. J.—The City Commissioners are considering the installation of a municipal electric lighting system in Wildwood.

CARLISLE, PA.—Plans will be placed under way at once for the installation of the new ornamental standards and underground-wiring system in the business district. About $16,400 has been raised to install the system. Chairman Starner, Carlisle Electric Light Committee, is in charge.

MORRISVILLE, PA.—The Council is considering improvements to the street-lighting system.

PHILADELPHIA, PA.—The Philadelphia Electric Company is reported to have purchased property at Main Street and Green Lane on which it proposes to build a new distributing plant.

PHILADELPHIA, PA.—The Philadelphia Electric Company has arranged for the sale of $4,000,000 in capital stock, part of proceeds to be used for additions to the main generating plant in the city, including equipment.

SALISBURY, MD.—The Eastern Shore Gas & Electric Company has appropriated $500,000 for plant extensions and improvements during the next twenty-four months, of which about $300,000 will be expended in the present year and $200,000 in 1923.

EASTON, MD.—The Council has authorized the installation of an automatic fire-alarm system. Plans will be prepared at once.

BLUEFIELD, W. VA.—The Appalachian Power Company has commenced the construction of an addition to its electric generating plant in the vicinity of Glen Jean, W. Va. The equipment will be installed under the direction of Vielé, Blackwell & Buck, 49 Wall Street, New York, consulting engineers.

MARTINSVILLE, VA.—Ground has been broken by the American Furniture Company for the erection of a one-story power house to cost about $50,000.

North Central States

CALUMET, MICH.—The Gratiot Mining Company is preparing plans for the construction of a new power house at its local properties.

FENTON, MICH.—The City Council has approved the purchase of property of the Fenton Mills Company, to be used in connection with a municipal hydro-electric power plant.

GRAND RAPIDS, MICH.—The Consumers' Power Company is preparing plans for the construction of a new hydro-electric plant on the Muskegon River, near Rogers, Mich., with initial capacity of about 6,500 kw., to replace the station recently destroyed by fire.

UNION CITY, MICH.—Plans have been completed for the construction of a municipal hydro-electric power plant to cost about $150,000, for which bids will soon be asked. Holland, Akerman & Holland, 106 East Liberty Street, Ann Arbor, Mich., are engineers.

CLEVELAND, OHIO.—Resolutions have been adopted authorizing the installation of an ornamental lighting system on East Fifty-fifth Street between St. Clair Avenue and Broadway, and electric lamps on East 144th Street south of Kinsman Road, Bartlett Avenue from East 131st to East 140th Street, East 169th and 171st Streets from Lake Shore Boulevard to Ozark Avenue, and on 174th Street from Lake Shore Boulevard to Grovewood Avenue. A resolution providing for the installation of an ornamental lighting system along Broadway, S. E., from East Thirty-fourth Street to Miles Avenue, S. E., to cost about $130,000, has passed its first reading in the Council.

HAMILTON, OHIO.—Preliminary surveys are under way by the Froehlich & Emery Engineering Company, Second National Bank Building, Toledo, preparatory to rebuilding the municipal electric light plant or erecting a new one. The cost of the plant reconstructed is estimated at $650,000.

INDIANAPOLIS, IND. — The proposed new power plant to be constructed by the Indiana Electric Corporation on the Wabash River in Vigo County is estimated to cost close to $6,000,000, including transmission system. A petition for authority to proceed with the work is before the Public Service Commission.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company, 48 Monument Place, has broken ground for the erection of a one-story power plant at West and Kentucky Avenues, 60 ft. x 90 ft., to cost about $43,000. Charles C. Ferry is president.

LA PORTE, IND.—In a report submitted to the Board of Public Works by Dabney H. Maury, consulting engineer, Chicago, Ill., relative to the cost of a proposed municipal power plant for operation of the Kankakee pumping station, the erection of a new station is recommended. The cost of the proposed power plant and pumping station is placed at $80,000.

SEYMOUR, IND.—Fire on Jan. 23 destroyed the power house and other portions of the woodworking plant of the Keene Manufacturing Company. The loss estimated at about $30,000.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company has been granted permission by the Public Service Commission to issue $300,000 in capital stock, the proceeds to be used in part for proposed extensions to power plant and system.

TERRE HAUTE, IND.—The Little Giant Coal Mining Company is reported to be planning to rebuild its power house, recently damaged by fire.

CHICAGO, ILL.—The Commonwealth Edison Company, 72 West Adams Street, has filed plans for the construction of a new one-story substation at 5547 Lowe Avenue. The company has arranged for an increase in capital from $60,000,000 to $80,000,000.

CHICAGO, ILL.—The Illinois Central Railroad Company, 135 East Eleventh Place, has presented a statement to the Illinois Commerce Commission announcing that plans are being arranged for the electrification of the road in the south side district of the city and that work will be started within a few months.

CHICAGO, ILL.—The Birk Brothers Brewing Company, 1325 Webster Avenue, has awarded a contract for the erection of a one-story power house addition. G. L. Lehle, 3810 Broadway, is engineer.

PEORIA, ILL.—The City Council is considering the installation of an ornamental lighting system on Court Street and on sections of other streets in Peoria.

VERONA, WIS.—Bids will be received Feb. 10 by the Dane County Board of Supervisors, Madison, for a new power plant and boiler house, 40 ft. x 98 ft., with a 125-ft. stack, conveyors, stokers, etc., to cost about $30,000, for the county insane asylum and almshouse. Thomas W. Wilson, 512 West Wilson Street, Madison, is chairman. Allan D. Conover is state architect.

HIBBING, MINN.—Bids will be received by D. D. Haley, secretary, Water and Light Commission, until July 31, for equipment for the municipal power plant, to cost about $50,000. C. Foster, Hibbing, is superintendent of plant.

COLUMBIA, MO.—Bids, it is reported, will be received soon by the board of trustees of the University of Missouri, for the construction of a one-story and basement power plant, 50 ft. x 200 ft., to cost about $250,000, complete. James P. Jamieson, Security Building, St. Louis, is architect.

JEFFERSON CITY, MO.—The Board of Trustees, Lincoln University, has authorized plans prepared for a new electric power plant to be erected in connection with a number of other buildings at the institution. E. C. Janssen, 1301 Chemical Building, St. Louis, is architect.

KANSAS CITY, MO.—The American Gasoline Company, Third and Blue River Streets, has filed plans for the erection of a new electrically operated pumping plant, to cost about $65,000.

KANSAS CITY, MO.—An electric power plant and considerable electrical equipment will be installed in the new ice-manufacturing and cold-storage plant to be erected at Third and Locust Streets by the Kansas City Cold Storage & Warehouse Company, recently organized, consisting of two eight-story units, 135 ft. x 300 ft., to cost about $5,000,000 with machinery. A third unit of the same size will be erected at a later date.

ST. LOUIS, MO.—The Southern Illinois Light & Power Company, Central National Bank Building, has disposed of a bond issue of $1,200,000, the proceeds to be used for additions to power plants, line construction, etc. William A. Baehr is president.

ANDALE, KAN.—The Council is having plans completed and will call for bids late in February for the construction of a transmission line from Wichita, Kan., to Andale, by way of Maize and Colwich, about 20 miles, for local light and power service. The Ruckel Engineering Company, Interurban Building, Hutchinson, Kan., is consulting engineer.

Southern States

CHARLOTTE, N. C.—The City Council is considering the installation of a new lighting system in Charlotte.

MARION, S. C.—Bonds to the amount of $5,000 has been voted for the installation of an electric lighting system in Marion.

MOUNT HOLLY, N. C.—The construction of an electric railway line from Mount Holly to Blowing Rock is being promoted by the Blue Ridge Development Company. W. T. Shipp is general manager.

ORLANDO, FLA.—At an election to be held Feb. 21 the proposal to issue $975,000 in bonds for the purchase, rehabilitation and extension of the plant of the Orlando Water & Light Company will be submitted to the voters.

HURRICANE MILLS, TENN.—The Hurricane Light & Power Company, E. T. Stanfield, Waverly, is planning to purchase a site on which to build a dam and a power plant of 6,000-hp. capacity. The total cost is estimated at $460,000. The plans also provide for the erection of 36 miles of transmission lines connecting Hurricane Mills, Waverly, McEwen, Tennessee City and Dickson. Bids, it is reported, will be asked for construction and machinery in about thirty days.

HOUSTON, MISS.—The municipal electric light and water plant has been leased by D. W. Tabb and D. A. Box. Improvements, it is understood, will be made to the plant.

BASTROP, LA.—At an election to be held Feb. 28 the proposal to issue $45,000 in bonds for the construction of a combined electric light, power and water plant will be submitted to the voters.

NEW ROADS, LA.—Bids, it is reported, will be asked early in March by Swanson-McGraw, Inc., engineers, 705 Fruit Building, New Orleans, for remodeling the electric light and water plant in New Roads.

CARTER, OKLA.—The Council is considering recommendations submitted by V. V. Long & Company, 1300 Colcord Building, Oklahoma City, Okla., for the construction of a transmission line and electric distributing system, to cost about $26,000. J. C. Mitchell is town clerk.

ENID, OKLA.—The City Council is considering the establishment of a municipal electric lighting plant.

FAIRFAX, OKLA.—Contract has been awarded for extensions to the municipal electric light, water and sewer systems to the Ajax Construction Company, Oklahoma City. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are consulting engineers. E. C. Quigley is clerk.

HOBART, OKLA.—The Common Council has commissioned V. V. Long & Company, 1300 Colcord Building, Oklahoma City, Okla., to prepare plans for municipal electric power plant. J. C. Huie is town clerk.

LOCUST GROVE, OKLA.—Bonds to the amount of $20,000 have been voted for the erection of a high-tensions transmission line from Locust Grove to connect with the power plant at Pryor. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are consulting engineers.

RAMONA, OKLA.—At an election held recently in Ramona it was voted to abandon the municipal electric light plant and secure electricity from the power plant in Sand Springs.

SAND SPRINGS, OKLA.—Surveys are being made by Charles Page, Sand Springs, for the erection of a high-tension transmission line to connect with the towns of Barndall, Pershing, Wynona, Nelagoney and Pawhuska.

WOODWARD, OKLA.—The City Council has taken bids for two 350-kw. generating units for the municipal power plant and will soon award contract for installation with auxiliary equipment. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are engineers.

CORPUS CHRISTI, TEX.—Work is under way on the rehabilitation of the power plant of the Corpus Christi Railway & Light Company. When completed the plant will furnish electricity in other towns, including Robstown, Bishop, Mingsville and Taft. E. H. Eldridge is the general manager of the plant.

CURRIE, TEX.—The Currie Electric Light Company will install new equipment at its plant. Plans are under way for the installation of an ornamental street-lighting system in certain portions of the town.

GALVESTON, TEX.—The Galveston-Houston Electric Company is disposing of a note issue of $1,700,000, part of the proceeds to be used for plant and system improvements.

HILLSBORO, TEX.—The Town Council is planning to rebuild the municipal electric light plant, destroyed by fire Jan. 23.

LIVINGSTON, TEX.—At an election to be held Feb. 11 the proposal to issue $30,000 in bonds for purchasing a site and the construction of a municipal electric light and power plant will be submitted to the voters.

Pacific and Mountain States

BAKERSFIELD, CAL.—The Kern County officials are considering the construction of a general hospital, juvenile detention home and custodial for aged indigents, estimated to cost about $300,000, with an additional $100,000 for equipment. Power, water and sewage systems will be installed.

CLOVIS, CAL.—The Board of Trustees has engaged H. W. Stitt, electrical engineer, Fresno, to prepare plans for laying pipe around the business blocks of Clovis for wires for the ornamental lighting system and a pipe for the fire-alarm system.

HERMOSA BEACH, CAL.—The Council is considering a petition of property owners for the installation of an ornamental street-lighting system on Pier Avenue, from Hermosa Avenue to the city limits.

LOS ANGELES, CAL.—The City Council has authorized the installation of a lighting system on Hayworth Avenue between Selma and Sunset Boulevard.

SACRAMENTO, CAL.—The city engineering department is preparing plans for the installation of an ornamental street-lighting system on certain portions of Third Avenue and Thirty-fifth Street. Albert Givan is city engineer.

SACRAMENTO, CAL.—The Carmichael Utility District, organized for the purpose of providing electricity for light, heat and power for residences and farms in the district, is considering issuing $25,000 or $30,000 in bonds.

SAN LEANDRO, CAL.—The Trustees have ordered the installation of electroliers on Estudillo Avenue from East Fourteenth Street to Santa Rosa Avenue.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association has preliminary plans under way for the construction of a dam and hydro-electric plant, with an initial capacity of 5,000 hp., at Mormon Flat on the Salt River, in the vicinity of Mersa.

Canada

FREDERICTON, N. B.—Bonds to the amount of $1,890,000 have been sold by the provincial government, the proceeds to be used for hydro-electric development and permanent highways.

HAMILTON, ONT.—The Hamilton Hidro-Electric System, it is reported, will start work immediately on the east and distributing station, to cost, with equipment, about $100,000.

KITCHENER, ONT.—The engineering department of the Hydro-Electric Power Commission of Ontario is considering the installation of more adequate switching equipment at the Kitchener power station.

TORONTO, ONT.—A report submitted to the Property Committee by the Property Commissioner contained three propositions relative to a proposed new street-lighting system for the city, except in the downtown district. The first scheme calls for the replacement of some 46,000 100-watt tungsten lamps with 100-watt nitrogen lamps; the second and third schemes provide for replacing 3,012 100-watt tungsten lamps with either 100-watt or 200-watt nitrogen lamps on Queen, King, College, Carlton, Dundas, North Yonge and Bathurst Streets and St. Helen's Avenue.

UXBRIDGE, ONT.—The Hydro-Electric Power Commission of Ontario is considering extension to the high-tension line to Greenbank and building a station at that point and the erection of two 4,000-volt lines to Uxbridge and Port Perry.

MONTREAL, QUE.—The Montreal Light, Heat & Power Consolidated has plans under consideration for cables for its underground conduit system as extended into new territory and for ordinary extensions and reinforcements to its gas and electric distribution systems. Herbert S. Holt is president.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary. H. C. Bristol, Calderwood, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 143 Liberty St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Midwinter convention, New York City, Feb. 15-17.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, M. M. Kelly, 29 West 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

BRITISH COLUMBIA ELECTRICAL CO-OPERATIVE ASSOCIATION. Field Manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

ELECTRIC POWER CLUB. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

ELECTRICAL SAFETY CONFERENCE. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 111 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 165 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

GREAT LAKES GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill. Meeting, Chicago, March 15-16.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

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Electrical World

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Are We Content with This?

OUT of the Division of Building and Housing in the Department of Commerce have come some interesting figures that paint a vivid picture of the part that the electrical industry is playing in the building of a house. They present the astonishing fact that the plumbing industry is doing three times as good a job as we are.

These figures are based on a survey of a very large number of six-room houses spread over the entire country. They show in what proportion the money spent for a home today is divided between carpenters, plumbers, and so on:

		Per Cent		Per Cent
Carpenters	Frame house	49.6	Brick house	32.2
Bricklayers	Frame house	6.2	Brick house	21.5
Hod carriers	Frame house	2.2	Brick house	6.7
Plasterers	Frame house	7.9	Brick house	8.8
Plumbers	Frame house	8.7	Brick house	7.6
Electricians	Frame house	2.6	Brick house	2.5
Painters	Frame house	10.0	Brick house	6.3
Common laborers	Frame house	6.3	Brick house	9.9
All others	Frame house	6.5	Brick house	4.5

These statistics cover labor only. The figures for material, though not released, have been compiled and show an almost exact comparison with labor in so far as the plumbing and the electrical installations are concerned.

THE reason is plain. For the plumbing industry for years has persistently sold the idea of quality and luxury in the bathroom and persuaded the home builder that this equipment must be installed complete in the beginning. So effectively has the plumber emphasized the style feature of modern sanitary bathroom equipment that the people have accepted his contention that the character of the bathroom sets the standard of the house. We all believe it. What a tribute to the power of this common purpose!

So the plumber sells us pipe and fittings and installs them and then equips our houses complete with the most luxurious type of bathroom furnishings that we can possibly afford, while the electrical man has been content to put in a skimped skeleton of wiring and a minimum of lighting fixtures; and as he leaves he says: "Some day when you decide to buy a clothes washer, remember me!" And so the plumber and the painter and the plasterer each gets three times as much out of that job as the entire electrical industry.

WHOSE fault is it? It is our fault—manufacturers, jobbers, central-station companies, as well as contractor-dealers. Where are our salesmen when this home is planned and built? Electric clothes washers, ironing machines, dishwashers and refrigerators, and the wiring and the outlets to connect them, can be figured into the original building estimates and financed then as easily as porcelain tubs and shower baths.

We do not lack the courage or the skill. But we have fallen short lamentably in vision and in common purpose. The question is, shall we continue to be satisfied with 2.5 per cent?

Philip Torchio

An electrical engineer and economist to whose original researches can be traced much of the development in high-tension cable practice.

IT WAS not so many years ago that every large city had its unsightly maze of overhead wires. In placing the wires underground the engineers were confronted with an entirely new set of problems. For the solution of many of the problems and for numerous developments in cable practice the industry is indebted to Philip Torchio, chief electrical engineer of the New York Edison Company. During almost all of his professional life Mr. Torchio has followed high-tension cable work intensively, particularly in the matter of insulation. He was a pioneer in the investigation of dielectric losses in high-tension cable insulation, having emphasized the importance of this matter as far back as 1902. In 1909 he developed "reinforced rubber," a new type of insulating covering for high-tension cables, which has since come into wide use for overhead cables. In connection with the installation of 24,000-volt cables in 1914 he developed an oil-filled cable joint which has eliminated joint failures where previously the system was severely affected. Other important cable insulation studies which he he has made relate to the ionization of rubber and fibrous insulation in non-lead-covered cables and to dielectric losses of insulating oils for cable impregnation. Incidental to his study of insulating material he has made a valuable contribution to the art through his studies on the life of insulation as affected by temperature and time and the effects on insulation of the expansion and contraction of insulated copper subjected to wide ranges of temperature. He has made valuable investigations of the dissipation of heat from electric cables in subways. It should also be mentioned in connection with his cable work that he is credited with the introduction into the United States of the sector type of three-phase cable now so extensively used in large power systems. Another field in which Mr. Torchio has done considerable original work of importance, because of its wide application, is the design, construction and use of protective reactors for large systems.

In addition to being a technician of unusual ability, Mr. Torchio has made a name for himself as an economist. It is not surprising, therefore, to find him one of the earliest proponents, if not the earliest, of the superpower system idea. It was twenty years ago that he first called attention to the value of interstation ties between plants of different companies. Again in 1911 he contributed a comprehensive exposition of the value of superpower plant interconnections, and in 1920 he contributed to the symposium on the "Economic Supply of Electric Power" which resulted in the indorsement by the A. I. E. E. of an Atlantic seaboard superpower investigation.

A great many other contributions have been made to the electrical art by Mr. Torchio. Among them are the development of thin-plate storage batteries for central station standby service, original investigations going back as far as 1902 of the application of relays on power systems to obtain selectivity of operation, introduction of the practice of single rating for steam turbines, early investigations of the relative merits of 25 cycles and 60 cycles, and co-operation with manufacturers in the introduction of novel arrangements and in the development of the design of high-tension oil switches, large rotary converters, low-tension switch gear and various original protective devices.

Mr. Torchio is an Italian by birth, having been born Aug. 2, 1868, at Vercana, in the Province of Como. He studied mechanical engineering at the Royal Polytechnic of Milan, and during his last year there he also took the special course of electrical engineering at the Carlo Erba Institute, a course limited to a small number of students chosen in order of merit from the graduating class of mechanical engineers. Upon graduation in 1893 he came to the United States and was employed by the Sprague Electric Elevator Company as draftsman, later being chief draftsman. Since 1895 he has been employed by the New York Edison Company. Mr. Torchio is a member of a number of engineering societies and has served on numerous committees. Mr. Torchio is a writer of unusual merit, and the literature of the industry as a result has been enriched by his many original contributions.

Editorial Comment

Electrical World, February 11, 1922

Volume 79

Number 6

The Arms Conference and the Senate

MEN and women of America must not permit themselves to undervalue the practical results of the President's conference on the limitation of armaments. Many weeks have passed since the whole world thrilled to the momentous proposal made by Secretary Hughes at the first meeting, and our minds have turned to other things. Nevertheless, the several treaties which the conference has evolved probably stand as the greatest single achievement in the cause of peace in the history of man.

In one gathering of these chosen men of the nations the ruinous international competition in naval superarmaments has been stopped, lifting a crushing burden from the hearts and shoulders of humanity, and the war cloud in the East has been blown away. The fact that submarines and other lesser craft have not been definitely curbed is a disappointment because the people of the world desired it so much. But it in no degree reflects upon the splendid realization of the even greater purposes for which the conference was held.

The treaties now go to the Senate, and the country waits with a fair degree of patience but with no little anxiety. Other great ideals remain unsatisfied. Other pressing work of the same magnitude must soon be done. For land armaments must also be limited. There must soon be held an economic conference, in which not only the representatives of political government, but those of industry, of finance, of agriculture, of labor and of business must be brought together to unravel the tangle of the world's economic affairs. But unless the United States Senate ratifies these new treaties promptly and upholds the administration in the spirit of America, we need not hope again within this generation to exercise a leadership in world affairs.

Henry Ford Teaches a Much-Needed Lesson

HENRY FORD knows a lot about automobiles—of that there is no doubt. But there are many things about which Ford knows precious little, and one of those is water power. We must admit, however, that when it comes to focusing attention on water power (Muscle Shoals, for instance) and dramatizing its possibilities our hats go off to Ford. He certainly has fired the imagination of the farmers and the people of the South, so that they cry with one voice, "Give Muscle Shoals to Ford at any price and under any conditions!" In this respect he has shown the electrical industry how to capitalize an opportunity for service, an art in which the industry has proved itself to be woefully lacking and in which Ford excels. Isn't it time that the lesson were learned? If the industry is ever going to fulfill its destiny and harness for the service of man not only the Tennessee, the St. Lawrence and the Columbia, but all the other usable watercourses, it must display greater optimism, enterprise and initiative and show greater faith in the country and its advancement. The nation wants its water powers developed. It would prefer that the job be done by electric public utilities, because the power would then be available to all at rates fixed by the state. But if the utilities are not alive to the opportunities, the public is willing that others, less skilled but more willing, undertake the task. This is the threat of the Ford offer. Shall it go unheeded?

Shall Rates Be Reduced or Property Maintained?

FOR some years, owing to conditions too numerous to mention, electric light and power companies of the country have been leading a precarious existence. That they were able to exist at all in many instances was nothing short of marvelous. What with interconnections and overloads and enforced economies, supplemented here and there by slight increases in rates, the electric utilities have, as a whole, come with flying colors through one of the most trying periods the industry has ever faced. But there is an end to this sort of thing, and such of the utilities as have shown earnings have in many cases earned them only at the expense of maintenance or through drastic curtailments in personnel or extensions. The utilities certainly have not gone forward and as a consequence are at this time in no position to handle any great increase in load. In view of these circumstances it is decidedly unreasonable for any one to suggest a general reduction in rates, because, in the first place, increases in domestic rates were not generally granted and, in the second place, the utilities must have a chance to put their equipment in first-class condition and to build up their organizations again. Such reductions as have been made in the cost of coal and other commodities are not large enough to affect the retail rate appreciably, and the commissions can be relied on to safeguard the interests of the general public. However, the utilities cannot disregard the trend toward lower prices nor the obligation to grant these where rates have previously been increased and where the conditions warrant reductions. But it is imperative that the property be maintained in excellent condition. Service comes first.

The Increasing Menace of Tax-Exempt Securities

IF PROOF were needed of the increasing attractiveness of municipal bonds because of their tax-exempt features, it is given in the showing made by such bonds in 1921. The demand for municipal securities last year was unprecedented, being in excess of two billion dollars, of which $1,203,000,000 represented long-term bonds. This is almost 75 per cent greater than the previous record of $691,500,000, established in 1919, and shows that business men are now turning to investments formerly considered ideal only for widows and orphans. It is a sad commentary on the justice of our tax laws when a man with a large taxable income is inhibited from encouraging and succoring the trade and industry of the nation because investments in corporation bonds do not yield as large a net income as investments in municipal bonds. Such a manifestation of selfishness and short-sightedness on the part of legislatures cannot but react to the detriment of the state and the municipality. On the other hand, public utility securities, while not in such great demand as those of municipalities, are faring much better than those of railroads and industrial companies. During 1921 the public utilities sold securities totaling $675,000,000, compared with $496,000,000 in 1920 and $462,000,000 in 1919, while the railroads of the country put out $655,000,000 last year, as compared with $378,000,000 and $208,000,000 in 1920 and 1919. The industrials during the same periods are credited with $435,000,000, $1,062,000,000 and $880,000,000 respectively.

It is, of course, but natural that public utility securities, possessing both stability and convertibility, should gain in favor as commodity and labor costs are reduced, since the utilities are not appreciably affected by general business conditions; but it is essential to the well-being of the country that its industries and railroads also shall be able to finance their wants. Removal of tax exemption from all bonds ought to cause money to gravitate naturally to industrials as well as to the utilities without handicapping municipalities. In fact, an amendment to the Constitution making this possible is to the interest of good government. Municipalities which can raise money easily are confronted with the temptation to spend it freely, thus adding to taxes. The country is now overburdened with taxes, and a check on municipal and government extravagance would be a blessing rather than a cause for regret.

The Industry Must Not Be Handicapped for Want of Men

ELEVEN per cent fewer freshmen are enrolled in electrical engineering courses in American colleges this year than last, according to figures which appear elsewhere in this issue. The sophomore class also is smaller. The total enrollment, on the other hand, is larger, but that is easily explained by the fact that the present junior and senior classes are abnormally large owing to the record-breaking entering classes which were reported by nearly all colleges immediately subsequent to the war.

Here, then, is something for the industry to think about. Entering classes this year for general collegiate work were record-breaking. Many colleges turned away men, in some instances almost as many as the total registration in all four classes. Why, then, are there fewer first-year men in electrical engineering? Is the reason an economic one? Are there too many electrical engineers already? Aren't salaries high enough? Is the opportunity limited? Is the industry generally willing to absorb men fresh from college or does it demand experience?

These questions must be answered. If we as an industry find that the reason for this lower first-year registration is an economic one such as is suggested by these questions, then we must act at once and apply the remedy. On the other hand, there is the possibility that as an industry we have never convincingly commended our profession to the young man. How many boys of the high-school age have any conception of the possibilities and opportunities that there are in the electrical industry? Why would it not be a good idea for electrical men in every community to impart this idea to the boys in high school and to their parents?

In any event an industry such as ours, one that is growing by leaps and bounds in every direction, one that is opening new fields of application all the time, must not be handicapped by the lack of technically trained young men. In the hands of these young men lies the future of the industry.

Field Tests at 280,000 Volts Apparently Justify Anticipations

THE proposal to adopt 220 kv. as the standard voltage for superpower systems has a certain unique character in that there has been a marked unanimity of opinion that no serious difficulties would be met in operation at this voltage. Whenever an advance in engineering methods is seriously proposed and reaches the point of probable adoption, however, the first steps almost invariably are the alteration of existing installations and equipment for placing the proposed new methods under trial. That such experiments are already under way is evidenced by the account which we present in this issue of experiments by the Southern California Edison Company to convert lines now operating at 150 kv. to operation at 220 kv. The experiments have been made on 27 miles of line set aside for the purpose, and the voltage has been carried to 280 kv. The particular objects in view were to ascertain the feasibility of using existing towers and insulators and a study of the magnitude of corona loss, charging current and the possibility of insulator flashovers. While limited in duration, the tests have nevertheless covered a rather wide range of weather conditions, and the results are very promising in their indication of the possibilities of a relatively simple modification of existing lines to meet the new conditions.

The original insulation consisted of nine 10-in. cap-and-pin suspension units. In the experiments shield rings were installed at the bottom of all strings and 280 kv. applied to the line. There resulted only one case of flashover under rainy conditions. It is concluded therefore that the number of insulator units should be increased to eleven, and that with this change reasonable reliability as regards flashover will be reached. The line already has a conductor spacing of 17 ft., and it was found that clearly marked corona did not set in until a value of 241 kv. was reached, the losses at 220 kv. being negligible. At 278 kv. in dry weather and heavy fog the loss varied from 15 kw. to 45 kw. per mile. It is stated that the observed losses correspond closely to those calculated from Peek's formula. Measurements of the charging currents are reported as agreeing with calculated values to within about 7 per cent, the measured value being higher. This is attributed to the presence of adjacent lines, overhead and ground wire, and increase in capacity due to corona.

The results indicate that this line will possess one feature that has been suggested as having possible value against overvoltage disturbances, namely, the appearance of considerable corona loss at a relatively small increase of voltage above normal value. Since corona is accompanied by energy loss, it will tend to relieve accumulated charges and steep wave fronts. The experiments also suggest a question as to the method of determining the actual values of voltage reached on the high-tension side of the transformers. Presumably the voltage measurements are made on the low-voltage side. It is well known that considerable errors may occur in this method of measurement with high values of voltage. In the present experiments conclusions are based on differences in voltage of the order of 10 per cent. Consequently, unless the voltage determinations are known to be accurate there is obvious possibility of erroneous conclusions. The experiments in question undoubtedly constitute important evidence as to the value of the recent types of guard rings and indicate that the predictions of satisfactory operation at 220 kv. are probably well founded.

The Responsibility for Distribution

FOR many years the producer and the consumer have been complaining of the amount of money that is absorbed by the middleman. The farmer, for example, is getting too little for his crop and the householder is paying too much for his food, and both of them blame the warehouse and commission man. But clearly it is not all his fault, since it lies within the power of the farmer and the householder to sell to and buy from the right kind of a middleman and to refuse to do business with any one who fails to render fair economic service in the necessary process of distribution. For distribution is not the problem and the responsibility of the middleman alone. The producer and consumer are intimately concerned and have a very definite obligation.

In the electrical industry there is a similar anxiety and uncertainty. Men are asking if our system of distribution is breaking down. The jobber is being criticised because he is involved in a situation that is costing him his prosperity. But it must be remembered that it is not the problem of the jobber alone, because the manufacturer, the central-station company, the contractor and dealer all share responsibility in the common obligation to industry and to the people.

Electrical materials and appliances must be distributed—out from the factories and on to the consumer. And if our present system is inefficient or ineffective or unprosperous, it is a serious matter for us all. It will not do, therefore, for any class of electrical men merely to look on and shrug their shoulders, saying, "This is no affair of ours." As long as the electrical jobber is in trouble, the entire electrical industry is involved, and this fact might as well be recognized. And it is time to put the question, "What is going to be done about it?"

Present conditions are due neither to witchcraft nor to accident. Definite causes have brought definite effects, and the sensible, profitable thing for the electrical industry to do is to proceed to determine what these blighting causes are and to remove them. Mr. Street in this issue presents what we believe to be the facts which must be faced before this very pressing problem can be solved. And they point very clearly to a definite responsibility in which both those who sell to the jobber and those who buy from him are accountable. We cannot use the jobber and abuse him too. He cannot live for us or for himself unless he prospers as an economic service to our industry.

California Meditating a Doubtful Experiment

WHILE it is prudent at all times to guard against premature and undue alarm, it is also wise to face a situation at its potential worst. The electric utilities of California are threatened with state ownership and the fight is now on. Why California should want state ownership it is difficult to understand. Either the utilities have not lived up to their opportunities or else politicians are hoping to ride to power by awakening and capitalizing the latent populistic ideas of some of the inhabitants. Be that as it may, the fact remains that in a state covered with an interconnected network of transmission lines, where electricity is generated efficiently and economically and where its cost is lower and its use more intense than in any other state in the Union, a state-owned system is seriously considered.

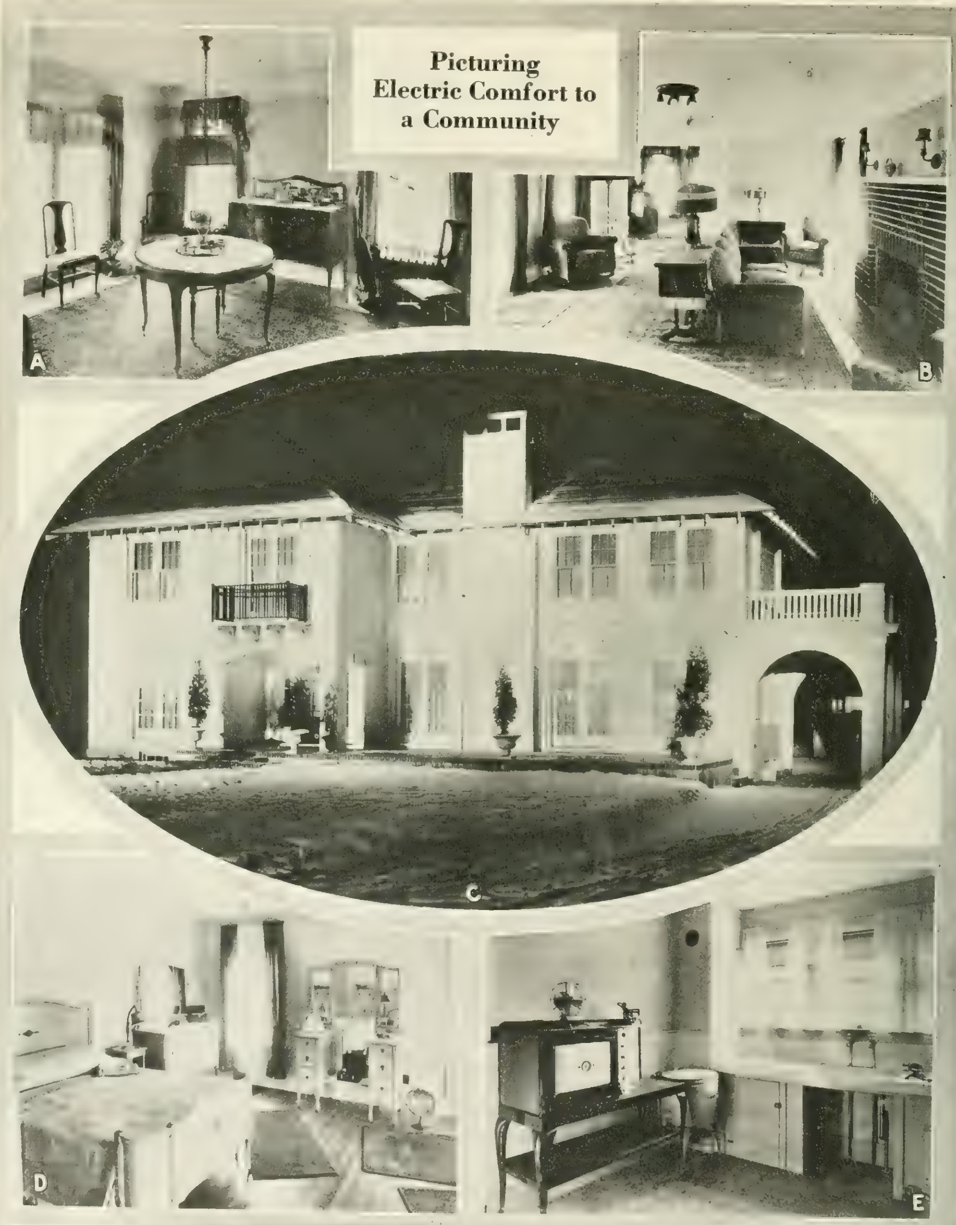
We have been wont to look upon California as a very progressive state, on its electric utilities as enterprising and resourceful, and on its railroad commission as one of the wisest and fairest in the country. To us it is unthinkable that this whole system, which has contributed so much to California's upbuilding and to the welfare of her people, should now be discarded for such an ephemeral, untried and visionary a scheme as that now proposed. Stranger things have happened, however, and if this menace to American institutions, traditions and ideals is to be killed once for all, the people of California must be put in possession of the facts. All the demagogy and wind of political oratory cannot prevail against fact, and unless the people at the Golden Gate have gone mad or become vindictive for some reason or other, they will be guided by fact. On a question of fact the United States government, through its census bureau, has this to say: "California, in which are found the most intensive hydro-electric developments in any state in the Union, ranks among the highest in per capita consumption of power, in addition to being first in the use of current for lighting purposes."

Notwithstanding the very large consumption of high-priced oil by the public utilities of California in 1917, the date of the last census, and the consequent effect on the price of electricity, the census report of that year shows that the average lighting rate for electricity was less on the Pacific Coast than anywhere else in the country and that California's rate for electricity was lower than that of either Washington or Oregon. Having rendered such an excellent account of their stewardship, it is not likely, if the people are in possession of the facts, that private ownership and operation of electric public utilities will be discarded in California for political ownership. We credit California with more wisdom than that.

Need for Data on Industrial Heating

SO MANY special installations have been made by central stations in industrial heating that there is a lack of adequate data in some quarters as to what has been accomplished, what failures have been experienced and what future tendencies in practice may be expected. It is now time to compile available information intelligently, so that further advances may be achieved with minimum loss in time and materials. Perhaps the N. E. L. A. courses that are starting this week will give the industry the necessary impetus.

Picturing Electric Comfort to a Community



THE "home electric" is steadily growing in popularity. Hardly a week passes nowadays without word from some quarter of a new "home electric" exhibit either planned or being demonstrated to the people of some city. And experience is gradually perfecting a standard of excellence in the organization and conduct of these functions that is giving them a constantly increasing influence.

This handsome stucco home has just been entertaining large numbers of people in Utica, N. Y. The home itself is unusually attractive. The electrical equipment presents in full the measure of comfort, convenience and utility that modern electrical equipment brings to the household. The appeal is strong beyond comparison with ordinary selling and the message carries broadly to the community. See page 291.

The Case for the Electrical Jobber

The Growing Sentiment Against the Middleman—His Economic Function in the Electrical Industry Often Not Properly Understood by Other Branches of the Industry or Even by His Own—How and Why It Must Be Protected

By O. D. STREET
General Manager of Distribution, Western Electric Company

THERE is a tremendous interest within the electrical industry just now in the broad subject of distribution. The true, natural economic function of the jobber has not been understood with entire clearness by many manufacturers, by many jobbers themselves and by many central station companies, contractor-dealers and industrial plants to which they sell. Therefore the service which the jobber is rendering has been hampered by many mistaken policies, both of his own making and that of others, which have served to clutter up the free channels of distribution and becloud the vision of the industry. We have asked Mr. Street to present the viewpoint of the electrical jobber in this article with the hope that this kind of straightforward analysis may serve to focus somewhat the thinking of the industry on this subject and perhaps help to correct certain tendencies which are complicating the free functioning of the wholesale processes of the electrical trade. Here are the facts and we have called it, "The Case for the Electrical Jobber."

THE time is well ripe for the electrical jobber to make a comprehensive survey of his position in the electrical field. At the present time we find among jobbers themselves a considerable difference of opinion as to what constitutes a truly economic field of endeavor for their activities. Clearly, therefore, we need a comprehensive survey which will determine the jobber's true status, and that being established, it is essential that a well-defined program shall be adopted—a course of procedure as it were—along which the jobber may work. For he must convince all parties concerned of the validity of his claim, and, once convinced, see that they more generally recognize his functions and aid him in the economical performance of these functions. Although it is not always followed in practice, for the purpose of this discussion we shall argue that the jobber can fairly lay claim only to that field of effort and service the right to which he can establish as sound in principle and sound economically. In other words, the jobber must justify his claim for existence through proving that his claim is economically sound rather than by arguing that he exists and therefore has the right to serve as a middleman and extract from the public a middleman's compensation.

MIDDLEMAN MUST PROVE VALUE OF HIS SERVICE TO THE PUBLIC

Public sentiment in this country is fast getting around to the point where it is going to be necessary for every middleman to prove that he renders a service commensurate with the price he adds to the cost of merchandise. Almost every middleman is considered by the public at large a parasite. Of course, this is not fair, but it comes pretty near representing present general opinion nevertheless. And if the jobbers sincerely believe that they are performing an economic function, it is high time that they take upon themselves the responsibility of educating that particular branch of the public they serve to an appreciation of the quality and value of the service which they render. The electrical jobber, in order to prove his case, must show that the functions he performs in the distribution of supplies result in bringing the supplies to the consumer at lower prices than when distribution is made direct from the manufacturer to the consumer. In other words, he must prove that the charge the jobber makes for his services is more than offset by the savings he effects for the manufacturer and consumer. The jobber himself thinks that he is performing a real economic function, yet many of his customers do not think so, and many manufacturers are also skeptical. Some of the manufacturers apparently give the jobbers an economic ranking of about 25 per cent, and a very few appear to rate his service value at 100 per cent. Some manufacturers believe it is to their advantage, and to the advantage of the public, to sell to the jobber and to no one else. Other manufacturers feel that their interests, at least, are best served by selling to the jobber, as well as direct to the dealer and sometimes direct to the consumer.

The jobber himself believes that the proper method of distributing electrical merchandise is to have it move from manufacturer to jobber to dealer to consumer. At least, those among them who have thought most deeply on the subject think that, in principle, this scheme of distribution is sound. As in the case of most general principles, however, they know that exceptions must occasionally be made, with the manufacturer sometimes going direct to the consumer, even though that means the elimination in that particular instance of the jobber and the dealer.

No manufacturer can be expected to put his full support behind a jobber and clear all his business through him unless the jobber can clearly demonstrate that thereby both the manufacturer and the user will gain—not on each sale necessarily, but by and large. But the kind of jobbers who alone are able to prove this are those who are equipped to render a sales, credit, engineering, advertising and merchandising service of a quality good enough to satisfy the manufacturers, and at a cost cheaper than that at which the manufacturers can perform the services themselves.

JOBBERS AS THE MANUFACTURER'S OUTLET

There are no doubt more than one hundred jobbing houses so equipped at the present time, and there is ample room for many more. However, it requires a large amount of capital to provide and maintain an adequate jobbing establishment of this type, and a large volume of business is needed to enable such an establishment to function profitably. Given the volume, such an establishment can make money, and the volume will be available when manufacturers realize that it will be to their advantage, and the advantage of the public to distribute their products through such channels well up to the 100 per cent mark.

Many jobbers have been lax in not putting themselves in shape to render a full service to the manufacturers, and many of those that are in shape have been lax in not demonstrating to the manufacturers the real value of this kind of complete service. Likewise, they have been lax in not demonstrating to the dealers, contractors and central-station companies that this same brand of service is an indispensable asset to them as well as to the manufacturers.

WHO SHOULD RECEIVE JOBBER'S PRICES

But on top of this a new danger and disturbance has been developed, and it has already reached menacing proportions. Not only the jobbers who are equipped to perform a real economic function in the handling of supplies, but the manufacturers, dealers, contractors and central-station companies as well, if they would study the problem deeply, must most certainly view with alarm the growing tendency to call almost any middleman a jobber and give him a jobber's costs without regard to whether or not he is equipped with sufficient capital or a sufficient organization to warrant the belief that the price he adds to the goods he sells is in fair proportion to the service he renders or is prepared to render to the public he serves.

Since 1913 at least 250 of these new so-called jobbers, to whom jobbers' costs were given by manufacturers, started in business and were still in business in 1920. The aggregate business handled by those middlemen in 1920 exceeded $60,000,000, indicating average annual net sales of about $240,000 per jobber, on which the average jobber in this class earned, or at least received, a gross annual revenue or profit of approximately $43,000. All of them combined in 1920 received 250 times this amount of compensation, or about $11,000,000.

In no other line of business at all comparable with the electrical business can such a condition be found. Perhaps the hardware jobbing business is more comparable with our own than any other, yet practically every new hardware jobber who comes into the wholesale class is one who has been developed from among those establishments which started as retailers. After years of effort they have acquired a sufficient clientèle and sufficient capital to enable them, because of their clientèle, capital, purchasing power and credit rating, to assume the rank of a jobber.

SUCCESSFUL JOBBING REQUIRES CLIENTELE AND CAPITAL

Such an evolution is natural and fair, and the privilege of becoming a hardware jobber is open to all. The requisites are clientèle and capital, and a lot of each. Generally speaking, in the hardware business the manufacturer, jobber and retailer each has his field of usefulness and to a marked degree we see each factor confining his efforts to his chosen field. The result is that there is stability to the business in each and all of its branches.

In the electrical business, however, the large jobbers have always been, and must always be, the ones who, in the final analysis, make it possible for the manufacturer and dealer and contractor to function most economically. But, in spite of this, year after year, and particularly during the post-war period, they have trained dozens of salesmen only to see them resign and go out and start up small competing jobbing businesses on a shoestring, practically all of which, except for the ambitious impulse, has been provided by the manufacturers in the way of consigned stocks, credit balances and long datings.

The manufacturers justify such a practice on the ground that they need more jobbers in order to insure a wider distribution for their products. The manufacturers are no doubt sincere in their belief that this practice and the practice of often selling direct to dealers, contractors and users inure to their benefit. On the other hand, the thinking jobbers know that this sort of practice on the part of the manufacturers hurts them because it is tending rapidly to cut into the jobber's business and is submitting him to an ever stiffer selling resistance. The effect of all this is to diminish the jobber's ability to maintain and develop that sort of an organization which is fundamentally essential to the industry—manufacturer, dealer, contractor and central station—if the business of each and all is to be handled in a manner that will guarantee to the public the best kind of a service at the lowest possible costs.

The electrical jobber's function in the industry is the same as that of a distribution panel in a large electrical installation. Without the panel a very great economic loss would result. The weakest link in the chain of electrical distribution today is the dealer. He with his retail mind and the supplier with his manufacturing mind are too far apart to help each other sufficiently, even if physical distances did not interfere. The jobber can and must understand each, and if he gets the opportunity of maintaining the right kind of an establishment, he will render a service of the greatest possible benefit to each, and to the public as well.

JOBBER'S CATALOG CONSTITUTES A REAL SERVICE

A reasonably complete jobber's catalog of the electrical supplies required more or less regularly by all classes of users in an ordinary industrial community anywhere in the United States would call for the listing of at least 30,000 separate items with at least 6,000 illustrations. It is to the advantage of the buyer in this community to have such a jobber's catalog to refer to when working up his specifications rather than to be obliged to wade through the innumerable catalogs of the manufacturers. And he is helped too by being able to call in the jobber's salesman or the jobber's engineer to help him pick out the items best suited for his particular needs. Consider the time the buyer would waste if he had to write to all the several factories for the information this one jobber's salesman, who represents all the manufacturers, can give him. Consider too how much more it would add to the cost of the material ultimately if the manufacturers had to render this sales service to every individual consumer from their many distant points.

The jobber who is equipped to render a complete service in nearly every instance reduces the purchasing expense of the user and the selling expense of the manufacturer. This saving is effected every time any purchaser in a given community places an order, and the annual saving for the entire community is very great.

The jobber in a typical American community not only must have his complete up-to-date catalog and his trained salesmen, but, behind the salesmen, capable specialized sales engineers, competent credit men and experienced merchandisers. He must also determine which of the 30,000 items in his catalog are most frequently called for by his customers, and he must maintain at all times an ample stock of this material consisting of thousands and thousands of items. Some he can turn over rapidly, others very slowly, but since he is there to serve, he must take the lean with the fat, and carry what the community needs lest jobs shall be held up and an economic waste result.

In the jobbing end of every business—be it groceries, hardware or electrical supplies—a net profit is made on but a small percentage of the articles handled. However, an economic service is performed only when a complete stock is carried, permitting the small items to go out on a ticket with big items, thus reducing the distribution expense of each to the jobber, the purchasing expense of each to the buyer, and the selling expense of each to the manufacturer.

REAL OR IMITATION JOBBERS—WHICH?

An imitation jobber who stocks only the fast-moving items can sometimes undersell the real jobber who carries a complete line, because his total investment is smaller and it turns over faster. It must be obvious, however, to the buyers in a given community that by and large, year in and year out, that jobber who carries a complete stock and who maintains a complete organization is the one entitled to their support. For without access to these complete stocks for all their miscellaneous pick-up requirements jobs would often be held up at considerable cost, or else these buyers would be compelled to add to their own investments by carrying ample stocks of all such materials themselves, when their capital could be more advantageously employed in other ways.

One of these jobbers offers a complete service to the community, the other an incomplete service; one is performing an economic service, the other is not. Which one is needed by the electrical industry and should receive intelligent support?

The jobber who is willing and able to maintain a complete and efficient sales, engineering, credit and merchandising organization, the jobber who is able to buy outright and promptly pay for a complete stock of electrical supplies, the jobber who himself is big enough to conduct his business in a responsible, broad-minded fashion, and possesses a vision that enables him to see and prompts him to support that which is good for the industry in any of its branches. This kind of a jobber, the man who actually performs an economic function, should and will both survive and prosper if Darwin's theory as to the survival of the fittest is as sound as we all believe it to be.

ELECTRICAL INDUSTRY NEEDS THE HELP OF COMPETENT JOBBERS

The electrical industry needs, and needs very much, the service which strong, capable, resourceful and responsible broad-gaged jobbers can render. Two hundred jobbers of the right sort can do far more for the electrical business than two thousand of the incompetent kind. For a complete jobbing service is the one economical service. Split the business up into thousands of parts, and the revenue derived by each part will not permit of the maintenance of adequate stocks or an adequate organization by any part, the service of no part will be complete, and the industry and the public will both suffer.

Pulverized Coal as Power-Plant Fuel Past Trial Stage

Particularly Applicable Where Flexible Furnace Control, Elimination of Banking and Utilization of Waste Fuels Are Important

By E. B. Powell
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PULVERIZED coal in the year 1921 is conceded to have passed finally and unquestionably from the experimental to the class of the commercial steam boiler fuel. There have been no new installations or developments of a radical nature or of particularly striking importance in this year, but results from the 1920 installations have afforded the necessary demonstration to win widespread and virtually universal recognition. Many of the earlier steam boiler installations have continued in thoroughly successful operation, notably those of Milwaukee and Seattle, and have shown eminently satisfactory results. These installations, however, were not designed primarily for pulverized coal, but were adaptations of settings originally constructed for use with some other form of fuel and subject to limitations inherent in previously existing local conditions. For that reason these earlier installations necessarily left much to conjecture. On the other hand, in 1920, boiler plants were constructed which were designed throughout for pulverized coal. These last installations have accordingly been free from the limitations referred to and, incorporating the results of earlier experience, have shown most creditable efficiencies, thoroughly dependable performance and high capacities—though not yet as high as the maximum of the underfeed stoker.

ECONOMIC CONSIDERATIONS WILL DETERMINE FIELD OF USE

The possibilities offered by pulverized coal—continuously high thermal efficiency, flexibility of furnace control, almost complete elimination of banking loss, utilization of otherwise waste fuels—all of which have had ample practical demonstration, must now be seriously considered in the design of any future steam plant of importance. In fact, a number of such plants constructed within the past year, although initially making use of the mechanical stoker, have been designed with a view to the possible ultimate adoption of pulverized coal.

These demonstrated and widely acknowledged advantages of pulverized coal are very great and entirely real. However, it must be kept in mind that economic considerations will still, for the present at least, properly restrict the use of this form of fuel to a comparatively narrow field. Speaking generally, the present scope of pulverized coal may be outlined approximately as follows:

1. For the utilization of those low-grade coals which only with difficulty, if at all, can be handled on existing forms of mechanical stoker, where such coals can be made available at a sufficiently low price. The bulk of the coals ultimately of this class, which include fines from mine and washery waste as well as natural deposits in many parts of the country, may be burned in the pulverized form with relatively high efficiency. In many instances it will be found advantageous first to remove the excess of ash.

2. For combustion of the relatively higher grade coals where such coals are sufficiently high in price

and where on account of the size of the installation and annual load factor any slight improvement in efficiency obtainable by combustion in the pulverized form is of large moment in the operating cost.

These are now the distinct fields for pulverized coal to which economic considerations will normally confine its use. On the other hand, there are other and special conditions, such as would entail heavy banking losses if the mechanical stoker were employed, for which the peculiar characteristics of pulverized coal render it of marked advantage. Further, efforts are constantly devoted toward improvement of design, especially toward simplification of detail and arrangement, so that material broadening of the commercial application of this form of fuel may be looked for at an early date. Meanwhile, for the great number of smaller plants, having available reasonably good grades of coal at moderate price, it is rare that the expense and complication of the pulverizing equipment can be justified, except for very high annual load factors.

MAINTENANCE AND POWER NEED REDUCTION

With the advent of pulverized coal and mechanically atomized fuel oil, it has been possible for engineers, for the first time, to make accurate practical study of the efficiency of combustion and of the furnace proper, as distinct from that of the entire boiler combined. Furnace volumes per unit of boiler heating surface have been increasing very rapidly during the past few years for stoker installations as well as for pulverized coal, and have now reached relatively enormous proportions. However, it is believed that the maximum is about attained, and that with the aid of more nearly definite and complete furnace analysis now possible, the future tendency will be away from excessive furnace dimensions and dependence upon almost haphazard mixing of gases and toward greater efficiency in furnace utilization and greater concentration of combustion. The pioneer work of the Milwaukee Lakeside installation has been of tremendous benefit in this direction. Reduced furnace volumes should make for reduced costs of installation. It should, however, be noted that, at present, stoker furnace volumes are but slightly smaller than those employed with pulverized coal.

The past year's experience has also shown that for certain grades of coal with suitable conditions of furnace the degree of dryness and extreme fineness earlier thought necessary are not really required. In fact, for Eastern bituminous coal and the better grades of Middle Western coal, except where the coal has been washed, the dryer may be relegated to strictly emergency service. In the larger installations using bituminous coal the power consumption of the pulverized coal-handling and preparation plant need not materially exceed that of the corresponding equipment of the stoker-fired plant. However, there is still need for even radical improvement in pulverizer design to reduce both maintenance costs and power requirements. The thoroughly commercial pulverizer for handling the harder grades of anthracite has not yet been fully demonstrated. Furthermore, the type of dryer in common use is not only extremely bulky and cumbersome but is rather difficult to adapt to the requirements either of handling the fines reclaimed from sludge piles or of waste-heat utilization.

These general features and in fact all details of the coal plant—preparation, storage, conveying and feeding systems, burner design, furnace construction, ash collection and disposal—are receiving most careful and intimate study. Much work has been done in the development of the direct-fired system by which the pulverized coal is delivered direct from the preparation mill to the furnace without the intermediary of separate feeders, mechanical conveyors or storage bins. On account of its obvious simplicity this system has much to commend it. The direct-fired system has not yet, however, had sufficiently extended commercial application to warrant an expression as to the extent or value of the present developments.

Experience has shown that not only the volatile constituents of coal, but also the amount and fusibility of the ash, should all be considered in the design of an installation. They can all be taken care of in advance, but without such special provisions it is rare that the results will meet anticipations in either capacity or efficiency. The problem of ash collection and disposal is also altogether real and should receive careful consideration in connection with any installation which may be proposed. It is not, however, regarded as a specially serious problem but merely one which should be carefully considered.

With the added experience from 1920 installations, coupled with the intensive development work under way and the generally widespread study now devoted to the problems of pulverized coal, one can confidently expect material advance in design and further extension of the commercial field.

Maine Fourth in Developed Water Power

WATER-POWER figures recently issued by the Maine Water Power Commission indicate that Maine today stands fourth among the states in the amount of developed water power. Figures furnished by the United States Geological Survey for plants over 100 hp. show that New York and California lead, with slightly over 1,100,000 hp. developed, and Washington follows with 453,556 hp. Maine, counting only plants over 100 hp. in capacity, has a total development of 448,177 hp. Wisconsin, Montana and South Carolina follow with between 320,000 hp. and 350,000 hp. There is a total of 12,796 hp. developed in plants under 100 hp. in capacity, making a total of 460,973 hp. water-power development in Maine.

DEVELOPED AND UNDEVELOPED WATER POWERS OF MAINE

			Total Hp.	
Basin	Developed Power (Installed Hp.)	Undeveloped Power (60 Per Cent of Time), Hp.	Under Present Conditions	Estimated Power with Regulation
Coastal No. 1	1,542	815	2,357	3,000
Coastal No. 2	955	975	1,930	2,000
Coastal No. 3	4,917	711	5,628	6,000
Coastal No. 4	7,852	713	8,565	9,000
Royal	495	68	563	600
St. John	1,910	47,127	49,037	50,000
St. Croix	23,735	10,386	34,121	36,500
Machias	1,713	4,631	6,344	7,000
Union	8,440	5,086	13,526	14,600
Penobscot	112,406	248,744	361,150	400,000
Kennebec	96,702	206,390	303,092	348,000
Androscoggin	143,900	71,300	215,200	221,000
Presumpscot	25,015	2,049	27,064	27,000
Saco	31,391	28,872	60,263	70,800
Totals	460,973	627,867	1,088,840	1,195,500

The undeveloped water powers of Maine are estimated at 627,867 hp., assuming operation for 60 per cent of the time, giving a total possible development under present conditions of 1,088,840 hp. It is estimated, however, that with proper regulation this figure could be increased to 1,195,500 hp.

Registration of New Electrical Students Materially Decreased

"Electrical World" Survey Indicates that the Total Number of Students Is Larger than Last Year, but Freshman and Sophomore Classes Show Large Decrease in Registration as Compared with 1920-1921

THE war-time slump in registration of engineering students was followed by a reaction which brought about a record registration in the falls of 1920 and 1921. That this reaction has now spent its force is shown by a survey just completed by the ELECTRICAL WORLD, of which the results are given below.

TABLE I—POST-GRADUATES, UNDERGRADUATES AND GRADUATES OF ELECTRICAL ENGINEERING COLLEGES 1914 TO 1922

College Year	Freshmen	Sophomores	Juniors	Seniors	Post-Graduates	Total Students	Graduates	Total Graduates to End of Year
				CLASS I COLLEGES				
1914–1915	1,140	819	714	627	98	3,398	667	10,212
1915–1916	1,144	902	722	576	133	3,477	535	10,747
1916–1917	1,050	829	723	587	136	3,325	569	11,316
1917–1918	828	653	568	389	90	2,528	389	11,705
1918–1919	1,047	827	718	257	59	2,908	295	12,000
1919–1920	1,460	1,152	1,003	455	104	4,174	463	12,463
1920–1921	1,887	1,490	1,295	518	119	5,309	440	12,903
1921–1922	1,453	1,275	1,748	673	68	5,217	*571	13,474
				CLASS II COLLEGES				
1914–1915	1,846	1,200	881	689	89	4,705	679	8,020
1915–1916	1,871	1,297	926	703	68	4,865	683	8,703
1916–1917	1,920	1,332	953	696	67	4,968	697	9,400
1917–1918	1,505	1,042	746	433	42	3,768	483	9,883
1918–1919	1,644	1,140	814	388	38	4,024	426	10,309
1919–1920	2,225	1,550	1,113	712	70	5,670	636	10,945
1920–1921	2,863	1,985	1,420	928	92	7,288	879	11,824
1921–1922	2,434	2,084	1,761	1,123	42	7,444	*1,064	12,888
				CLASS III COLLEGES				
1914–1915	581	360	283	240	2	1,466	284	2,918
1915–1916	703	405	442	327	12	1,889	314	3,232
1916–1917	748	517	470	327	12	2,074	302	3,534
1917–1918	654	452	409	327	12	1,854	183	3,717
1918–1919	644	443	404	118	4	1,613	238	3,955
1919–1920	1,182	816	742	272	9	3,021	262	4,217
1920–1921	1,454	1,004	912	272	9	3,651	261	4,478
1921–1922	1,429	1,034	985	335	18	3,801	*322	4,800
				SUMMARY OF ALL COLLEGES				
1914–1915	3,567	2,379	1,878	1,556	189	9,569	1,630	21,150
1915–1916	3,718	2,604	2,090	1,606	213	10,231	1,532	22,682
1916–1917	3,718	2,678	2,146	1,610	215	10,367	1,568	24,250
1917–1918	2,987	2,147	1,723	1,149	144	8,150	1,055	25,305
1918–1919	3,335	2,410	1,936	763	101	8,545	959	26,264
1919–1920	4,867	3,518	2,858	1,439	183	12,865	1,361	27,625
1920–1921	6,204	4,479	3,627	1,718	220	16,248	1,580	29,205
921–1922	5,316	4,393	4,494	2,131	128	16,462	*1,957	*31,162

*Estimate from previous year.

During the period in which the United States took part in the world war several of the smaller colleges closed their engineering courses entirely for lack of students, and the technical departments of many colleges and universities, except in those cases where special government training courses were conducted, were greatly depleted in the session of 1917-1918 and the first part of 1919. Following the discharge of four million young men from the army, the entrance classes of all colleges were flooded, and this record registration applied to nearly all courses.

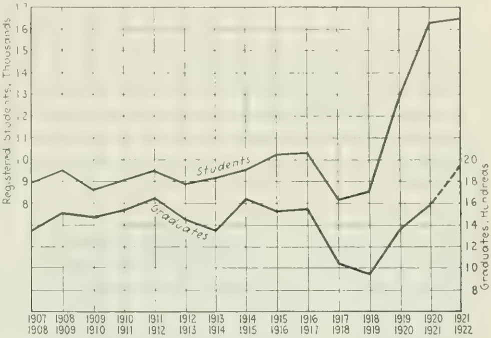


FIG. 1—SIXTEEN YEARS' TOTALS OF ELECTRICAL ENGINEERING STUDENTS AND GRADUATES

This wave of new students continued through the fall of 1920, but with the opening of the present college session an abrupt downward turn is to be noted in the number of new students registering in the electrical engineering colleges. Whether this is the natural recession of the tide which set in after the war or whether it is due to economic causes is a question requiring considerable and extended study.

The ELECTRICAL WORLD survey indicates that there are 16,462 students taking electrical engineering in the present college year. A close study of the accompanying figures indicates that while the total number of registered students this year is 214 in excess of that reported for the 1920-21 college year, yet the total registration in the sophomore and freshman classes is 974, or 9.2 per cent under that for last year. The large entrance class in the fall of 1919, the remaining members of which are now juniors, is sufficient to overcome the decreased registration of sophomores and freshmen, resulting in a slightly increased total registration over last year.

In order that a more comprehensive analysis may be made of the situation, the electrical engineering colleges of the country have been divided into three arbitrary classes or groups, as follows:

Class I—Colleges whose electrical courses have the highest standing, whose teaching equipment is most complete and whose degree is recognized as conferring a certain prestige on the graduate.

Class II—All other colleges whose electrical engineering courses require all the student's time as distinct from those where the student may carry on some other occupation at the same time.

TABLE II—STUDENTS AND GRADUATES OF ELECTRICAL ENGINEERING COLLEGES, 1907 TO 1922.

College Year	1907–1908	1908–1909	1909–1910	1910–1911	1911–1912	1912–1913	1913–1914	1914–1915	1915–1916	1916–1917	1917–1918	1918–1919	1919–1920	1920–1921	1921–1922
Students	8,929	9,651	8,670	9,041	9,515	8,921	9,143	9,569	10,231	10,367	8,150	8,545	12,865	16,248	16,462
Graduates	1,358	1,501	1,473	1,545	1,641	1,442	1,366	1,630	1,532	1,568	1,055	959	1,361	1,580	*1,957

*Estimated from previous years.

Class III—Educational organizations of a trade-school nature having an organized course on electrical subjects in which the instruction is quite elementary from a professional standpoint and as a rule is arranged for evening class work.

The history of attendance and graduation from the electrical engineering colleges and schools of the country is clearly told in Fig. 1. The largest number of graduates in the history of electrical engineering colleges was turned out in the spring of 1915. However, estimates based on the present survey and a study of former years indicate that the number of graduates this coming June will exceed the record of 1915 by about 20 per cent, with a total graduation class of 1,957. Data accumulated by the ELECTRICAL WORLD from past surveys indicate that a total of 31,162 students will have graduated from electrical engineering colleges and schools of the country by June of this year. Some very interesting curves are shown in Fig. 2 indicating the increasing proportionate registration in schools and colleges offering electrical courses of quite elementary type when viewed from the professional standpoint. It is very questionable whether students in this class of schools should not be classed as technically trained electricians rather than as electrical engineers. The number of students attending this class of electrical schools has almost tripled during the past seven years. This large and disproportionate growth as compared with colleges in the other two classes is not, however, believed to indicate any drift away from the colleges offering electrical engineering courses, but rather a greater interest among the electrician class in acquirement of technical training.

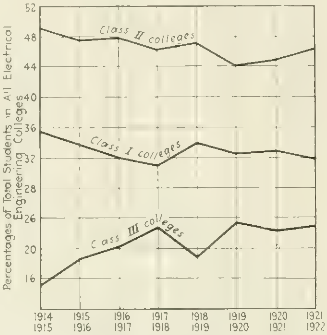


FIG. 2—PERCENTAGE DISTRIBUTION OF ELECTRICAL ENGINEERING STUDENTS AMONG THE THREE CLASSES OF COLLEGES

Cultural studies, such as economics, contract law and finances, are being required more than ever before as an integral part of each student's course in electrical engineering. The extent of these requirements is shown by Table III. The colleges in class I have been slow to make such subjects compulsory, with the exception of economics. Nearly all the colleges and schools of the other two classes, however, require students to take one or more of the so-called cultural studies. However, the reports received indicate that virtually all electrical engineering colleges urge their students to elect one or more of the cultural subjects in addition to their regular engineering course.

On the other hand, summer work as an integral part of the course in electrical engineering is required by 35 per cent of the colleges in class I, whereas only 16.3 per cent and 10 per cent of the colleges and schools in classes II and III respectively require summer work of their students. The returns indicate that the requirement of one or more summers of actual electrical engineering practice by undergraduates is on the increase, especially among the colleges in classes I and II.

TABLE III—GENERAL CULTURAL SUBJECTS AND SUMMER WORK REQUIRED IN VARIOUS CLASSES OF COLLEGES

Percentage of Colleges Requiring Subject as Part of Regular Engineering Curriculum.

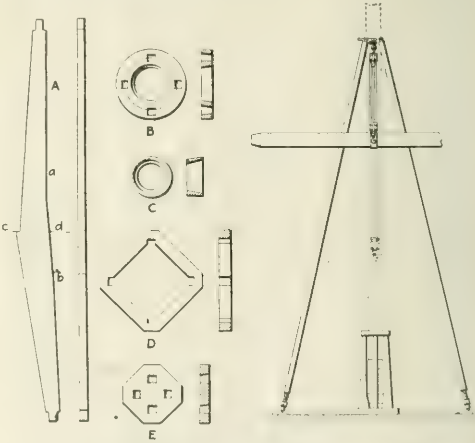
Class of College	English	Economics	Public Speaking	Contract Law	Finances	Journalistic Writing	Summer Work
Class I	0.0	65.0	10.0	40.0	30.0	5.0	35.0
Class II	7.0	83.7	36.4	52.8	27.3	18.2	16.3
Class III	20.0	80.0	30.0	50.0	10.0	10.0	10.0

Concrete Pole Sockets to Prevent Butt Rotting

DETERIORATION of wooden line poles which stand directly in the earth can be only partly avoided by impregnating the wood. A concrete extension for wooden poles has been developed in France, however, by which the pole is held in a socket above the earth's suface, thus avoiding rot, while the holder extends down into the ground to give the necessary strength. The pole socket consists of a number of loose pieces of reinforced concrete, which are kept in stock.

The several pieces are shown in the figure. Four beams *A* are needed for each socket. The lower projecting pieces are put into holes in the bottom plate *E*, and the top ends are kept in place by the ring *B*. The beams are steadied by the clamp *D*, which comes down on the outside, gripping the beams at *d* on the tapered part *ab* on *A*. The pole is held by the ring *B* and the spacing ring *C*, which is conical inside and rests upon projecting parts on the beams, at *c*.

Since in this socket the pole is held in free air above ground, it keeps dry inside and does not decay. An additional advantage with this socket is that it can be used for repairing old pole lines without necessitating the use of new poles. The lower, decayed part of the old pole is removed, while the pole is held in a temporary support. Then a socket is mounted in the hole, and the pole is simply put down into the socket and fastened.



PARTS AND ASSEMBLY OF FRENCH POLE SOCKET

Field Tests at 280,000 Volts on Big Creek Transmission Line

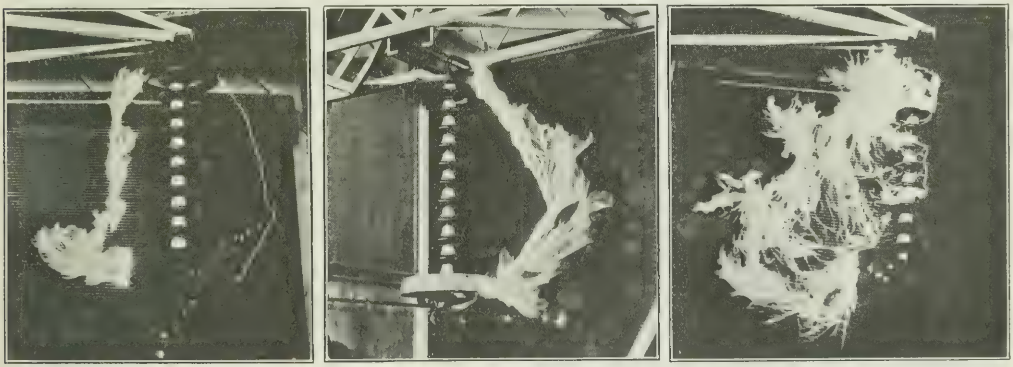
Conducted to Ascertain Feasibility of Using Existing Towers and Standard Insulators, Magnitude of Corona Loss and Charging Current, and Possibilities of Flashover

By **R. J. C. WOOD**
Assistant Electrical Engineer Southern California Edison Company

PREPARATORY to converting the two 241-mile Big Creek lines from 150 kv. to 220 kv., the Southern California Edison Company made extensive field investigations* to determine the feasibility of using existing towers and standard 10-in. suspension insulators, now used on the lines. In addition field tests were made at voltages as high as 280,000 to ascertain corona loss from conductors under actual operating conditions and different weather and to check the charging current against calculated values.

As a result of these field tests and the laboratory experiments which preceded and paralleled them it has been decided to equip the insulators with shielding and grading rings and to increase the number of units from nine to eleven. It is believed that satisfactory operation at 220,000 volts will be possible without any other changes. Undoubtedly minor problems of operation may occur. These will be solved as they arise.

Owing to the fact that only one bank of high-voltage transformers was available for the field test, it was not possible to transmit power, the lines being merely energized. On Sept. 16, 1921, a 7-mile (11-km.) section of line was raised to 275 kv., later an additional 5 miles (8 km.) of line was cut in; two weeks later 19½ miles (31 km.) of line were energized to 280 kv., the reactance of the transformers causing the voltage to increase, together with the charging current of the line. About a month thereafter another 6½ miles (10 km.) of line was added, and at this time it was determined to lower the voltage to 241 kv. to conform more nearly to what will ultimately be the operating voltage of 220 kv.



FIGS. 1, 2 AND 3—DRY AND WET ARC-OVERS OF INSULATORS FOR SOUTHERN CALIFORNIA EDISON LINE

The first shows dry arc-over at 544 kv., 60 cycles, and also a spark over; the second shows arc-over at 533 kv.; the third indicates a wet arc-over at 455 kv. These three tests were made in the General Electric high-voltage laboratory at Pittsfield, Mass.

Before conversion to 280 kv. the line was in commercial operation at 150 kv. and the insulation consisted of nine 10-in. cap-and-pin suspension units except at anchor towers, where double strings of eleven units each were used. There were arcing horns at the top and bottom of suspension strings and on the upper side of dead-end.

For the purpose of the experiments, shield rings were installed at the bottom of all suspension strings and at the top of the center suspension. With one or two exceptions, the old arcing horns were left at the top of the outer suspensions. The arcing horns at the lower ends of suspension strings were not removed, being within the influence of the shield ring and inert. When necessary to tie down the line shield rings were placed at the top of the tie-down strings. The double-string dead-ends had oval shields attached at the line end; the old arcing horns were left at the tower end.

The shape and size of the shield rings employed was determined after considerable investigation of the voltage distribution along the insulator strings under different conditions. The potential gradient for nine-unit strings is shown in Fig. 7. The arcing characteristics of the shields are good. The deep straight-sided ring, shaped so as to cause arcs to start from its lower edge, produces an electrostatic field of a shape that keeps the arc well away from the insulators. Under wet conditions the arc starts from the ring clear of the lower insulators. This is well shown in Figs. 1, 2 and 3, which illustrate 60-cycle flashovers made in the General Electric Company's laboratory. The first shield was made of cast iron, but the greater number are of cast aluminum. The practicability of substituting pressed steel has been under consideration.

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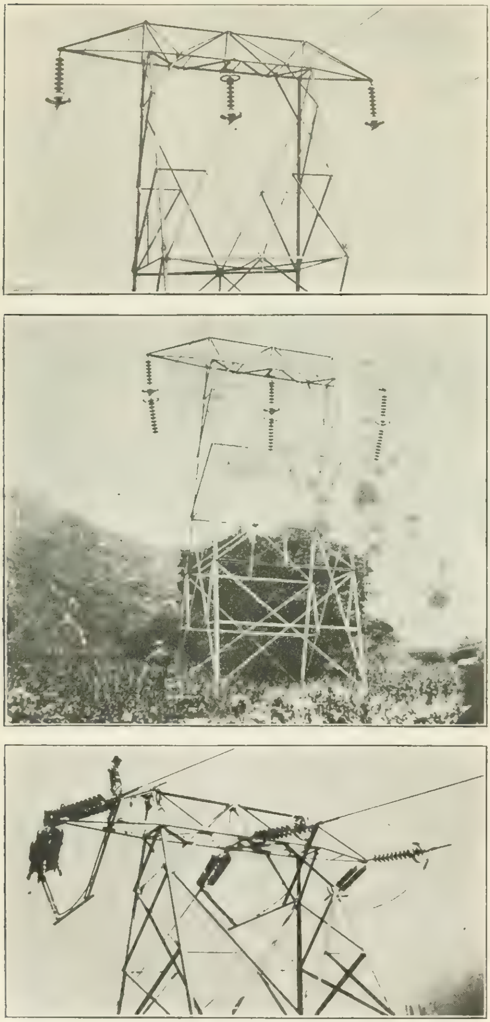
*Supplements several series of tests made by H. Michener and the writer during the past year at the high-tension laboratories at Stanford University, the Ohio Brass Company, the General Electric Company and the Westinghouse Electric & Manufacturing Company. The Southern California Edison Company is indebted to the executives of these organizations and to Prof. Harris J. Ryan and A. O. Austin, F. W. Peek and Charles Fortescue, who placed their apparatus at our disposal and assisted us in every possible way in the solution of our problem.

The 27 miles (43 km.) of experimental line has 291 suspension strings, of which 249 were left with nine insulators and the remaining forty-two strings were increased in length by adding two more insulators to each. There were forty-eight tie-down strings, which had one more insulator than the corresponding suspension string, and 348 double dead-end strings, in which the number of insulators was not changed.


FIGS. 4, 5 AND 6—INSULATOR SHIELD RINGS ON SUSPENSION UNIT, ON TIE-DOWN TOWER AND AT DEAD END

The conductors are steel-core aluminum concentric-strand cables with a total cross-section of 683,500 circ.mils. The individual wires are 0.1059 in. (2.68 mm.) in diameter, and the diameter of the cable is 0.96 in. (24.38 mm.). The conductors are separated by 17 ft. 3 in. (5.8 m.) and are arranged in a horizontal plane, the height of conductors above ground at towers being 37 ft. (11.2 m.). Single-circuit, structural-steel towers are used with a normal spacing of 660 ft. (301 m.). The experimental section of the line goes chiefly over hilly country and the spans are of irregular length up to a maximum of 2,871 ft. (875 m.) with an average length of 928 ft. (282 m.). The East Big Creek line, which is similar in construction, parallels the experimental line, the separation of the two tower lines center to center being 82 ft. (35 m.). The elevation of the experimental line ranges from 1,000 ft. to 2,000 ft. (300 m. to 600 m.) above sea level, with an average of about 1,500 ft. (450 m.).

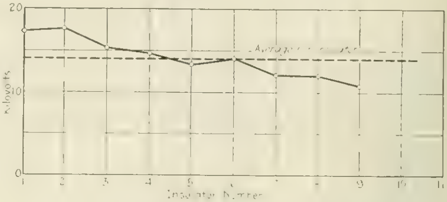


FIG. 7—VOLTAGE DISTRIBUTION ALONG SHIELDED SUSPENSION STRING (127 KV. TO GROUND)

When energizing the line at 280 kv. the connections were made as shown in Fig. 8. Three 4,500-kva. transformers, each having a ratio of 36 kv. to 150 kv., were connected grounded-star on both sides. On the low-tension side they were attached to the 64-kv. bus of Eagle Rock substation, the terminal receiving station of the Big Creek lines. When energizing the line at 241 kv., the transformer ratio was 72 kv. to 150 kv., and the low-tension side was connected in delta. The transformer iron losses were excluded by the method of

TABLE I—TYPICAL EXAMPLES OF CORONA LOSS MEASUREMENT

Date (1921)	Time	Barometer (Cm.)	Temperature, (Deg. C)	Weather	Voltage to Neutral (Kv.)	Miles of Circuit	Corona and Leakage Loss (Kw.)	Critical Voltage (Kv.)	Coefficient* (M_0)
9/20	3.45 p.m.	72.3	28	Clear	156.0	7	82	124.8	0.818
9/27	10.00 a.m.	72.2	37	Clear	156.0	12	47	138.0	0.932
9/27	8.00 p.m.	71.9	23	Clear	156.0	12	73	133.5	0.864
9/29	4.00 a.m.	71.9	17	Clear	158.5	12	179	123.2	0.782
10/8	4.00 a.m.	72.3	12	Clear	159.0	19.5	619	107.6	0.668
10/8	8.00 a.m.	72.4	23	Clear	156.6	19.5	249	124.0	0.799
10/8	7.30 p.m.	72.4	19	Clear	164.0	19.5	394	123.0	0.780
10/8	10.00 p.m.	72.3	17	Clear	164.0	19.5	658	111.0	0.701
10/9	2.00 a.m.	72.4	17	Clear	156.6	19.5	236	114.9	0.724
10/20	2.35 p.m.	72.1	34	Clear	139.5	27.0	0	139.5	0.935
10/4	8.00 p.m.	72.3	17	Cloudy	164.0	19.5	857	103.5	0.654
10/2	4.00 p.m.	72.4	21	Cloudy	163.0	19.5	515	116.8	0.746
10/21	12.00 p.m.	71.8	16	Cloudy	138.3	27.0	137	117.8	0.747
10/22	6.00 a.m.	71.9	16	Cloudy	139.4	27.0	45	127.7	0.809
10/23	2.05 a.m.	72.0	13	Cloudy	142.7	27.0	19	135 1	0.844
10/12	9.15 p.m.	72.0	13	Fog	161.5	19.5	830	102.0	0.638
10/12	10.10 p.m.	72.0	13	Fog	164.0	19.5	726	108.9	0.681
10/12	11.10 p.m.	72.0	13	Fog	164.0	19.5	883	102.6	0.641
10/5	10.00 a.m.	72.3	17	Heavy mist	159.0	19.5	354	120.1	0 758
10/4	8.00 p.m.	72.4	17	Heavy mist	159.0	19.5	368	119.4	0.753
9/30	2.00 p.m.	71.8	20	Rain	159.0	19.5	552	110.4	0.709
9/30	3.00 p.m.	71.7	19	Rain	159.0	19.5	526	111.4	0.714
9/30	8.00 p.m.	71.7	17	Rain	161.5	19.5	598	111.0	0.706
10/23	8.30 a.m.	72.2	12	Rain	138.0	27.0	58	124.6	0.774
10/23	10.25 a.m.	72.2	13	Rain	141.0	27.0	32	131.1	0.819
10/23	11.40 a.m.	72 2	12	Rain	141.0	27.0	243	113 6	0 706
10/23	1.45 p.m.	72 1	12	Rain	141.0	27.0	132	122.5	0.763

* Coefficients in Peek's formula.

TABLE II—CORONA LOSS AT DIFFERENT VOLTAGES
(Length of circuit, 19.5 miles. Frequency, 50 cycles. Date of test, Oct. 12, 1921)
Temperature, 110 C. Barometer, 72.0 Cm.

Time (A. M.)	Voltage to Neutral (Kv.)	Total Loss (Kw.)	Transformer and Line, I^2R Loss (Kw.)	Corona and Leakage Loss (Kw.)	Average Charging Current (Amp.)	Loss per Conductor per Mile	Excess Over Critical Voltage (Kv.)	Disruptive Critical Voltage (Kv.)	Coefficient* (M_0)
12.50	124.7	26.4	8	18	11.4	0.308	8.7	116.0	0.721
1.05	116.2	0	7	0	10.5	0	0	116.2	0.722
1.20	133.1	13.2	10	3	12.4	0.051	3.5	129.6	0.805
1.30	139.5	66	11	55	13.1	0.941	15.3	124.2	0.772
1.43	147.9	119	12	107	13.7	1.83	21.4	126.5	0.786
1.55	155.5	264	14	250	14.4	4.28	32.7	122.8	0.763
2.05	158.5	356	14	342	14.9	5.85	38.2	120.3	0.747
Average									0.759

* In Peek's formula.

measurement, only correction for I²R losses in the transformer high-tension windings and line being necessary.

With 278 kv. between conductors, the observed charging currents of 19.5 miles of line were 15.0, 16.1 and 14.6 amp. for the west only, center and easterly conductors respectively, averaging 15.23 amp. The calculated current is 13.83, using the weighted mean spacing and hyperbolic formula. As shown by an analysis of the voltage wave, harmonics were sufficient to account for an increase in charging current of about 3 per cent, leaving a 7 per cent increase above the calculated to be explained by the presence of the adjacent east line, the overhead ground wire, the increase of capacity due to corona and the presence of the shield rings and line hardware. With 27 miles (43 km.) of line energized at 241.5 kv., the charging currents were 17.3, 18.7 and 17.6 respectively, averaging 17.87. This is 7.5 per cent greater than the calculated. The current wave is less distorted than when operating at the higher voltage.

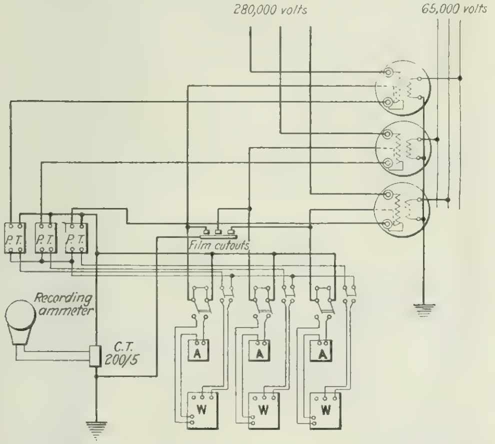


FIG. 8—CONNECTIONS EMPLOYED FOR CONDUCTING FIELD TESTS

The conductor which was involved was considerably larger than those referred to in most published data. Moreover, it was well weathered and had probably reached a permanent surface condition, the deposit formed upon it by precipitation at 150 kv. increasing the irregularity factor. Energized at 278 kv. to 284 kv. and with atmospheric conditions varying from hot and dry to heavy fog, the total loss from the 19½ miles of circuit ranged from 300 kw. to 880 kw., there being apparently more loss in fog than in rain. One clear morning a test was made energizing the line separately from a steam turbo-generator, so that the voltage could be varied at will. The results in Table II correspond closely to those calculated by Peek's formula.

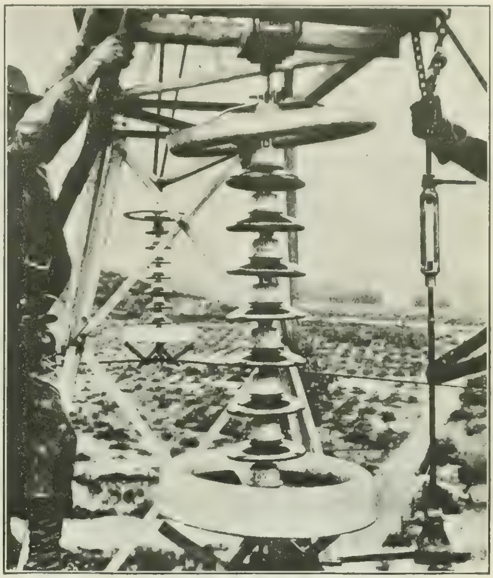


FIG. 9—CLOSE-UP OF SHIELDED INSULATOR STRING

There is no measurable corona loss in 27 miles of line at 241 kv. in clear weather, the maximum observed so far in rain being 243 kw., or an average of 3 kw. per mile per wire. At the proposed operating voltage of 220 kv. the losses are negligible. A few of the readings taken throughout the day are given in Table I.

The line was energized prior to the first rain of the rainy season. When this rain occurred one of the nine-unit suspension strings flashed over. Inspection showed that a surface failure along the drip line had occurred. The arc behaved identically as did those produced in the laboratory under artificial rain. Starting from the lower

FIG. 10—TRANSFORMERS ENABLING 280,000 VOLT TESTS

ring shield, it jumped to the cap of the No. 3 unit, cascaded No. 4, then jumped clear to the cap of No. 7 and cascaded both No. 8 and No. 9, shattering the latter. This failure is an isolated case, and definite general conclusions cannot be drawn from it, but it probably establishes a limit at which there is undoubtedly danger, and it doubtless disposes of the possibility of operating at 220 kw. upon nine-unit strings, the margin of safety between 220 kv. and 280 kv. being uncomfortably small. It should also be remembered that a greater margin of safety should be provided in a long line that may be subject to potential surges of unknown amount.

When energized at 280 kv. the line is very noisy and corona is abundant on the cable in the span, but none can be seen on the insulators or shields or on the conductor within a distance of about 3 ft. (0.9 m.) on either side of the shield ring. At 241 kv. there is a very slight noise. At 220 kv. operation will not be noticeably different from that at 150 kv. Since the whole 27-mile length of line has been energized at 241 kv., several rainstorms have occurred. No insulator trouble developed.

Analysis of Proposed Power Act of California

Effort to Substitute State Ownership of Electric Utilities for System Which Under Private Ownership Has Been Marvel of World

CALIFORNIA has long been recognized as a leader in hydro-electric development in the United States. Census figures just announced show that California also stands eighth in the value of her manufactured products and fifth in the number of her manufacturing industries. This record of industrial progress has largely been made possible by the development and utilization of electric power. Seeing the possibilities in the wealth of California's raw products and agricultural areas, private enterprise has gone into the mountains, harnessed the rivers and tamed the waterfalls and today is furnishing more than a million horsepower to turn the wheels of the state's numerous factories and lift the waters for irrigating the many thousand acres of fertile lands. All this has been done with a foresight and efficiency that have brought credit and renown to the Pacific Coast.

There has been launched in California a campaign for a proposed water and power act—an enactment that would mortgage the state to the extent of $500,000,000, to be controlled by a body of five men to be appointed by the Governor every four years. Under the terms of the bill, bonds will be issued to finance the undertaking, which will furnish power to various communities, these in turn to reimburse the state from the earnings of the properties, if there are any. Property of any private power corporation would be liable to condemnation and seizure by the board controlling the funds.

Naturally the scheme has been subjected to much criticism. The first criticism is that it is a subterfuge, in that it proposes to do by indirection—that is, by a majority vote—what to do by ordinary constitutional procedure would require a two-thirds vote.

Private utilities have spent and are spending millions of dollars in the development of the water-power resources of the state, under most rigid state supervision and regulation. For the state to enter into competition with such established companies is asserted to be highly unjust. California's tax requirements have already reached the point where any further additions would be very burdensome. Yet despite the cry for retrenchment, less taxes and more efficiency in the government the proposed power bill will add materially to the tax burden.

The proponents of this bill state that it means no increased taxes, yet the bill itself provides that state funds may be drawn upon in event of failure to meet bond interest or principal from the sale of power.

MEASURE TO BE SUBMITTED TO THE VOTERS

The proposed enactment will in all probability be placed as an initiative measure upon the ballot at the November, 1922, election for the citizens of California to pass upon. If adopted, it would become part of the organic law of the state and could only be altered by another vote of the people. The act would create a water and power board appointed by the Governor. One member of this board, the chairman, would receive $15,000 a year and the other four an allowance of $20 a day plus expenses.

It is contemplated that the board shall acquire or construct for municipalities or districts all necessary distributing systems. The board shall establish such rates for service as in its judgment will provide expenses of operation, maintenance, depreciation and reserve for losses, and in addition provide funds to cover interest charges on all bonds issued under the act. The board must further add to the rates such amount as will in fifty years repay the cost of the project supplying the service. Where a city or town or district desires to purchase its distributing system, there must be added to the rates sufficient to repay the cost in twenty-five years.

POWERS GIVEN BOARD

The powers given the board are greater than those of all other boards in the state combined. It is given the unrestricted power, without the concurrence of the Legislature or the approval of any other governmental body, to require the issuance and sale of state bonds in the amount of five hundred millions of dollars. This is approximately seven times the present total state indebtedness.

The board has power to condemn, in the name of the state, any private property, including public utility property already appropriated to public use, which the board may find necessary for the purposes of the act, and to take immediate possession and use of such properties by paying into court such amount of money as the court upon five days' notice to the owner of the property may determine to be reasonably adequate to secure to the owner payment of just compensation. No appeal lies to the courts as to the necessity for the proposed taking of private property. The board acts as judge and jury in its own case in this regard.

The sole and virtually unrestricted power to dictate what projects shall be developed, the order of their development, what communities shall receive power and water from the state, what prices shall be paid by these communities for water and power and all other matters relating to the conditions of service is vested in the board.

It may require the reservation from sale of all state lands, including school lands. It can use these lands and materials on or under them for its own uses. It has power to reserve from appropriation for any period it may desire all waters in the state. It may make all facilities, materials and supplies, raw or finished, that may be used in its work, including anything from the largest generator to the smallest insulator. It is to have authority to issue to pay interest on bonds of earlier issue and thus pyramid the state debt. It may issue bonds also to pay costs of operation and maintenance. Among the other authority granted the board is the power to adopt rules and regulations to govern its activities.

The proposed act contains an important statement of principle affecting private companies—namely, that state and political subdivisions have a preferred right to service controlled by the board as against private companies, and that political subdivisions near the source of supply have a preference over those more remote. There is a limitation on the power of the board to supply private utilities with electricity—the limit being 20 per cent of the total amount under the control of the board.

Possibilities of Competition

While the act does not provide any specific objects to be undertaken or how or in what order hydro-electric properties are to be constructed, acquired or condemned, it may be assumed, as far as existing privately owned electric utilities are concerned, that one of the three following plans will be adopted:

(1) To take over all existing electric utility plants and supply electric service to the entire state.

(2) To parallel existing plants and systems.

(3) To take over some of the existing electric plants, presumably those most advantageously located and most efficiently operated.

It is, of course, possible the board might decide first to enter fields not now served by utility companies.

The present investment in privately owned electric utility companies in California is approximately one billion dollars. It has been estimated by qualified experts that in the next ten years there will be required an additional eight hundred million dollars for development of electric power in the state, to keep pace with the expected demands. Obviously, the five hundred million dollars authorized by the act would go only a short distance in acquiring existing electric properties scattered throughout the state.

If the intention should be to parallel existing plants and systems, such paralleling would bring about competitive conditions which are contrary to the spirit and letter of the public utility laws and break faith with existing utilities operating under them. Finally, if the intention should be to take over some of the existing plants, leaving the rest to operate by themselves, what justification could be given to those other portions of the state which would have to support the state bonds but which receive no service? If there is to be a gain by the operations of the state-controlled service, then why should one section of the state be favored over another, while the credit of the entire state is behind the scheme?

The proposed act would provide a scheme for furnishing water and power to take the place of plants and systems which are now operating efficiently and adequately and are under the control of a public regulating body, the Railroad Commission of the State of California. A most remarkable electrical development has been made in California under private ownership and private initiative and enterprise. Nowhere else in the world is the present per capita consumption of electricity equaled; in no part of the United States has electrical energy been so freely used for agricultural purposes, and nowhere else are electric distribution lines so broadly distributed through rural communities. All this has been brought about without state aid or assistance—with rates for service that average lower than in any other state in the Union or any other part of North America.

Opinion of Herbert Hoover

In a report made by the Secretary of Commerce, Herbert Hoover, to President Harding regarding a proposed superpower project in the East, the Secretary says:

"At the present time California companies are carrying current over wires 300 miles long, while the greatest distance contemplated in the Atlantic project is only 200 miles. Furthermore, all of the great California power companies are 'hooked up' so that continuous service—something almost unheard of in the East —is practically assured in California. And that feature, together with economy, makes up the underlying object of a superpower project. Nowhere is power so cheap as in California."

If such are the conditions in California, it is reasonable to ask why the state should seek to raise large sums of money to do something that is universally acknowledged to be already well done, particularly when California now needs and will require in the near future large sums of money for good roads, harbor facilities, hospitals, prisons and educational institutions which are admittedly objects of state support and ownership. Private enterprise has brought hundreds of millions of dollars from the East to help develop the West—why shut the door against the inpouring of such capital in the future?

Venturesome Enterprise

The money initially provided under the proposed water and power act is $140,000,000 more than the total cost of the Panama Canal. It would add $146 to the public debt for every man, woman and child in the state and would beyond any doubt greatly increase the taxes.

It may safely be asserted that the amendment, if adopted and carried into effect, would plunge the State of California into the most venturesome enterprise ever undertaken by any state and under the most unfavorable circumstances. The govermental machinery necessary to be set up would result in the increase of state officials and employees to many times their present number, and all other departments of state government would be completely overshadowed in importance and cost by this new department. The proposal goes further in the way of injecting government into business than has as yet been undertaken in America. This tremendous and hazardous departure on the part of the state is being proposed without the slightest apparent justification on the ground of necessity, and the only basis upon which it is urged is that it will result in cheaper service. This cheaper service is being promised without any proof that the promise can be fulfilled, and the pledge is being made by men without experience in the subject. The entire scheme has all the earmarks of a political movement.

Fixed-Resistor Battery-Charging Method Receiving More Attention

Automatic Charging Through Fixed Resistances Eliminates Heavy Initial Currents and Minimizes Effects of Voltage and Temperature Variation — Compared with Constant-Potential Charging

By F. L. SPANGLER and A. J. HORTON

THE fixed-resistor or modified constant-potential method of charging vehicle storage batteries has been in use to a limited extent for a considerable time, but it has recently received more attention, partly because the United States government made a thorough investigation of this method during the war and adopted it for charging industrial truck batteries. This method of charging is increasing in popularity because it offers a means of charging storage-battery vehicles without attendance during charge and may be successfully applied in almost every case encountered in practice where a source of direct-current power is available. It also possesses other advantages of a minor nature which might well be borne in mind when considering charging equipment.

The fixed-resistor method of battery charging is a modification of the constant-potential method and has the following additional advantages: (1) There are no heavy initial currents, making large leads and switches unnecessary; (2) it may be used under any condition of bus voltage above 2.4 volts per cell, and (3) slight voltage variations and temperature changes do not materially affect charging characteristics. Compared with the constant-current method of charging, the fixed-resistor method with ampere-hour meter cut-off is preferred for the following reasons: (1) The life of the battery is materially increased by assuring proper charging; (2) no attendant is required during charge, and (3) the time required for charging may in some cases be shortened. The one disadvantage inherent in the fixed-resistor method compared with the constant-potential method is that energy is lost in the charging resistance.

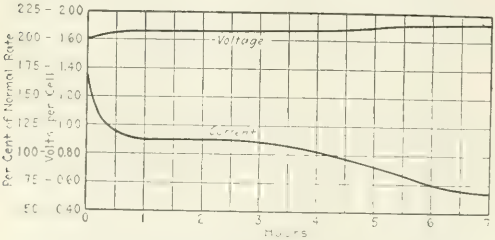


FIG. 1—CURRENT AND VOLTAGE CURVES FOR SIXTY TYPE A EDISON CELLS BEING CHARGED WITH A BUS VOLTAGE OF 110 BY THE FIXED-RESISTOR METHOD

The fixed-resistor method involves the use of a fixed step of resistance, connected in series with the battery, which is then connected to a circuit having a constant voltage of a value somewhat higher than the full-charge battery voltage. This method gives a tapering charge, the amount of taper depending on the ratio that the number of cells in the battery bears to the line voltage. This ratio also determines the value of the fixed resistor and, in the case of the lead battery, the minimum time in which it can be charged by this method.

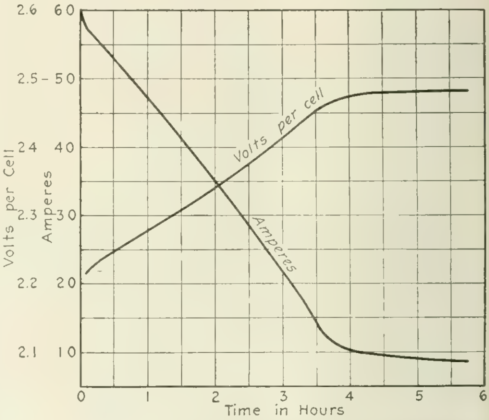


FIG. 2—CHANGE IN VOLTAGE AND CURRENT WHEN CHARGING BY FIXED-RESISTOR METHOD

As voltage readings are no true indication of the state of charge, an ampere-hour meter must necessarily be used. This meter is usually mounted on the vehicle and connected permanently in circuit with the battery, so that it registers the current of both charge and discharge. Contacts should be provided on the ampere-hour meter and suitable charging equipment used so that no attention is required after the start of the charge. The current will be automatically regulated so that it never exceeds the proper charging rate regardless of the previous state of discharge of the battery; when the battery is fully charged the contacts on the ampere-hour meter will close and cause a magnet switch on the charging panel to open the circuit.

For charging nickel-iron alkaline batteries by the fixed-resistor method the value of the resistor is chosen so that the average value of the charging current throughout the charge is equal to the normal charging rate. The complete charge will then be given in seven hours; if the battery has been only partly discharged, the charging time will be proportionately shorter. Where the value of the battery voltage is only slightly lower than that of the line voltage, the charge will taper off rapidly. For instance, a fully discharged

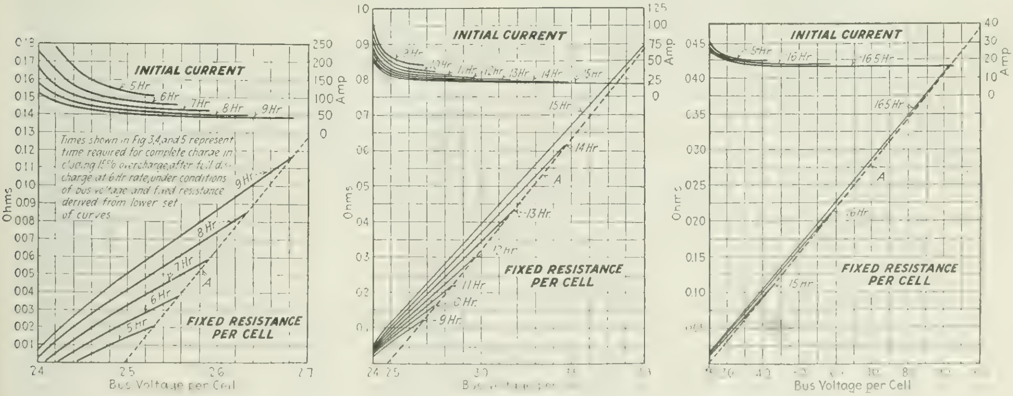
CONSTANTS TO BE APPLIED TO DATA IN FIGS. 3, 4 AND 5 FOR VARIOUS TYPES OF CELLS

No. of Plates	"Ironclad" Type MVY	"Exide" Type MVY	"Hycap-Exide" Type MV	"Thin-Exide" Type MV
7	0.43	0.41	....	....
9	0.57	0.54	0.48	0.41
11	0.71	0.68	0.60	0.52
13	0.86	0.82	0.72	0.62
15	1.00	0.95	0.84	0.72
17	1.14	1.09	0.96	0.82
19	1.29	1.23	1.08	0.93
21	1.43	1.36	1.20	1.03
23	1.57	1.50	1.32	1.13
25	1.71	1.64	1.44	1.23
27	1.86	1.78	....	1.34
29	2.00	1.91	1.68	1.44
31	2.14	2.05	....	1.54
33	2.28	2.18	1.92	1.65

Multiply the initial current derived from Figs. 3, 4 or 5 by the constant corresponding to the type of cell in the above table. Divide the fixed resistance obtained rom Figs. 3, 4 or 5 by the same constant and multiply by the number of cells.

battery of sixty type A Edison cells on a 115-volt circuit will take 160 per cent of normal current at the start of the charge and about 70 per cent at the finish. Where the difference between the battery voltage and line voltage is greater, the taper of the current from start to finish will be less. With the above battery charging from a 250-volt circuit, the starting current will be 118 per cent of normal and the finishing current 94 per cent. A typical curve, prepared by the Edison Storage Battery Company, showing the charge of an Edison battery by the fixed-resistor method, is shown in Fig. 1. The line voltage in this case was 1.84 volts per cell, giving conditions equivalent to a battery of sixty type A cells charging from a 110-volt line.

To charge a lead battery by the fixed-resistor method, the value of the resistor must be such that at the termination of the charge the charging current will have decreased to the finishing rate for the battery. The amount of resistance used determines the value of the current at the start of the charge, and this in turn determines the time required for charging. For example, if a battery of 42 "MV-15 Ironclad" cells is to be charged from a 115-volt circuit, the normal constant current charging rate is 40 amp. and the finishing rate 16 amp. In order to limit the current to 16 amp. at the finish of the charge, a fixed resistor of 0.67 ohm is required. This resistor will pass 35 amp. to the battery at the start of the charge, and with the current values at the start and finish fixed it is found that ten hours is required for a complete charge.



FIGS. 3, 4 AND 5—RELATIVE VALUES OF TIME, CURRENT, RESISTANCE AND BUS VOLTAGE FOR CHARGING LEAD CELLS

When charging from a line voltage of 2.5 volts per cell, a complete charge is given in five hours, but the starting current will be nearly three times normal. By using a resistor of greater ohmic value in circuit, so the time of charge is lengthened to eight hours, the starting current will be one and one-half times normal. While no injury to the battery will result in either case, the higher starting current is generally objectionable as it requires a heavier capacity in the charging equipment and introduces peaks in the current demand.

Any line voltage higher than 2.5 volts per cell can be used, but a longer time is required for a complete charge, for with a greater voltage drop across the resistor the rise in battery voltage as the charge progresses has less effect on the circuit and the taper of the current is consequently less. Thus, with 40 "MV-15 Ironclad" cells charging from a 230-volt circuit, or at 5.75 volts per cell, the starting current will be 45 per cent of normal and the minimum time required sixteen hours.

The relative values of times, charging current and resistance required for a given line voltage and number of lead cells of the "Exide" type can be found from the curves Figs. 3, 4 and 5, which were prepared by the Electric Storage Battery Company. The lower set of curves in each figure are for determining the value of the fixed resistance, and in the upper set give the corresponding initial current. Take, for instance, the example used above, a battery of forty-four type MV-15 "Ironclad" cells to be charged from a potential of 115 volts with a bus voltage per cell of 115 ÷ 44, or 2.61. This value of voltage intersects the eight-hour and nine-hour curves in Fig. 3, but not the seven-hour curve, the minimum time being about seven and one-half hours. Therefore, seven and one-half hours or more are required to give the battery a complete charge, including a 15 per cent overcharge, after a discharge of rated capacity. Assuming eight hours as the time, the point on the eight-hour line gives 0.0087 ohm per cell when projected on the vertical scale. The total resistance required in circuit is therefore 0.0087 × 44, or 0.3828 ohm. The corresponding ampere reading, taken from the eight-hour curve at the top of the figure, is 50, which is the initial and maximum current.

A line voltage per cell of 2.53 or smaller generally makes it desirable to increase the time required for charging considerably in excess of the minimum time, thereby keeping down the initial charging current to a value low enough to render switches and conductors of unusually large capacity unnecessary, and large peaks will not be introduced in the current demand. Reference to Fig. 3 shows that with a line voltage of 2.5 volts per cell a complete charge after discharge of rated capacity of the battery can be given in five hours, but the initial current will be 117 amp., which is almost three times the normal charging rate of a type MV-15 "Ironclad" cell. By using a greater resistance in circuit the time of charge may be lengthened to eight hours or more. Assuming an eight-hour charge, the starting and maximum current is only 60 amp., or one and one-half times normal.

If forty-four type MV-25 "Exide" cells were used in place of the MV-15 "Ironclad" in the previous example, the initial current obtained from the curves would be multiplied by the constant for the MV-25 "Exide" cell given in the table (page 283). This would give a current of 50 × 1.64, or 82 amp. The resistance obtained is divided by the same constant, which gives 0.3828 ÷ 1.64, or 0.233 ohm, which is the value of the resistance that is required in circuit with the battery for charging.

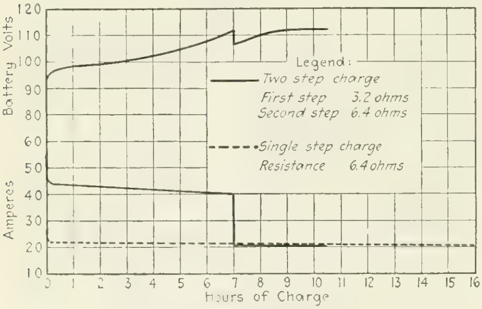


FIG. 6—EFFECTS OF SINGLE-STEP AND TWO-STEP FIXED-RESISTOR CHARGING

Values for resistance and time cannot be taken to the right of the dotted line in Figs. 3, 4 and 5 unless an additional resistance is inserted in circuit near the end of the charge to reduce the rate at or below the finishing rate. The use of this second resistance, known as the two-step method of charging, will be discussed later. The curves are limited on the right by the finishing rate of the battery and on the left by the initial current, which should generally not exceed 100 amp., but may be as high as 180 amp. or 200 amp., when extra large conductors and switch equipment are used.

The data derived from the curves are not absolutely fixed, as actual results depend somewhat on temperature, condition of cells, time standing after discharge, etc. However, the calculated results will be sufficiently accurate for all practical purposes. A study of these curves shows that as the bus voltage per cell increases both the time required for charging and the charging resistance per cell likewise increase; also, the lowest bus voltage per cell gives virtually a true constant-potential charge with high initial current, and as the bus voltage increases the initial current approaches the value of the finishing rate, thus tending toward a constant-current charge.

This is shown in the curves in Figs. 2 and 6. In Fig. 2 the charge is made with a bus voltage of 2.53 volts per cell, and the resulting ampere curve is quite steep and somewhat similar to that produced by a constant-potential charge. In Fig. 6 the dotted curve shows a fixed-resistor charge with a bus voltage of 5.6 volts per cell. The charging current curve is very flat and approximates a constant-current charge. The former curve was furnished by the Electric Storage Battery Company and the latter by the Cutler-Hammer Manufacturing Company.

To choose as long a time as possible for completing the charge is advisable, as this means lower charging rates, which result in lower cell temperatures and require apparatus and circuits of smaller capacity.

Two-Step Method Shortens Charging Time

The time required by the fixed-resistor method to charge a battery fully following a discharge of rated capacity depends upon the value of bus voltage per cell, as the curves in Figs. 3, 4 and 5 show. With a large bus voltage per cell a relatively long time is required for charging. This time may, however, be appreciably reduced by dividing the charging time into two periods, each using a different value of resistance, so that the charging rate during the first period will be much higher than that during the last period. This is known as the two-step method of charging. The purpose of an additional resistance is to bring the charging current down to or below the finishing rate at the end of the charge. The insertion of this second resistance in the circuit is accomplished by a magnetic contactor, which can be actuated at the proper time by a double-contact-making ampere-hour meter with its second contact so placed on the dial that the needle operates the contactor and inserts the second resistance in circuit when the battery is 80 or 85 per cent fully charged. The zero contact point on the meter causes the battery circuit to be opened when charging is completed.

A curve made from a charge by the two-step method is shown by the solid lines on Fig. 6. This shows a charge of a battery of forty-four MV-19 "Ironclad" cells from a 246-volt line, or with a bus voltage of 5.6 volts per cell, after a discharge of rated capacity. The charge starts at about 48 amp. through a resistance of 3.2 ohms and continues for seven hours, the current gradually falling to 40 amp. This corresponds to a charge of 85 per cent of the rated capacity of the battery. The charging resistance is doubled at this point, giving a value of 6.4 ohms. The current immediately falls to 21 amp., and the rate gradually tapers off to 20 amp. at the end of the charge. The time required for the full charge, including 15 per cent overcharge, is about ten and one-half hours, whereas the minimum time required for a full charge with a similar value of bus voltage per cell and only one step of resistance in circuit is, as shown by the dotted line, sixteen hours. The use of the second resistance has, therefore, decreased the time required for a full charge by about 35 per cent.

The charge can be somewhat accelerated by reducing the starting resistance to one-third of the value of the finishing resistance, in which case the total time required for a complete charge is reduced about 45 per cent from the time taken by the single-step fixed-resistor method, the higher initial current being partly offset by the necessity for reducing the rate at an earlier stage of the charge.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Use of Metric System Would Help American Engineering Practice in Norway

To the Editors of the ELECTRICAL WORLD:

The characterization of the attitude of Norwegian engineers toward their American confrères made by C. N. Anderson in the ELECTRICAL WORLD for Dec. 17 is striking, and his suggestion concerning the need for American catalogs in European technical schools has my entire approval. I do not, however, believe that German propaganda is the primary reason for the preponderance of Teutonic influence in the schools of Norway. The trouble lies with the difficult British system of weights and measures used in America. The employment of pounds, gallons and feet and inches builds up a barrier between Norwegian and American engineers the height of which is not entirely realized by Americans. The disinclination of engineering students familiar with the metric system to climb this barrier is reasonable, and they naturally turn to the highly developed source of technical information close by and ready for application without any need to employ conversion factors. Here lies in all probability the reason why Norwegian engineers are not keeping in touch with the progress of American engineering.

Stavanger Elektricitetverk, CHR. GRASSDAL.
Stavanger, Norway.

Unstable Operation of Paralleled Stations

To the Editors of the ELECTRICAL WORLD:

Some questions have been raised regarding the phenomena which arise when stations are operating in parallel and short circuits occur at different points with and without reactors in circuit. These conditions were considered in the article on "Unstable Operation of Generating Stations in Parallel," which was published in the Aug. 27, 1921, issue of the ELECTRICAL WORLD, but the writer judges, from letters which he has received, that a further explanation would not be unwelcome.

Assuming that no reactor is in the circuit subjected to the short circuit, the power factor will be relatively high, so the voltage will not be seriously affected, and the current will be high, consequently the kilowatt load will be high. The station prime movers will drop back, causing phase displacement between the stations, but the synchronizing power will remain high because the voltage is not materially lowered, synchronizing power dropping off with the square of the voltage.

Assume a reactor to have been in this feeder, the current would have been very much lower, the power factor would have been lower, the armature reaction would have been higher, and consequently the voltage would have dropped to a lower value. The phase displacement, owing to a lighter kilowatt load, would have been less, but the synchronizing power would have also been much less because it drops off with the *square* of the voltage.

Now assume the "short" to have occurred close to one of the paralleled stations with no reactor in circuit. The current would be very high, limited only by the impedance of the generator armatures, the power factor would be very low because of low resistance, the kilowatt load would be correspondingly light, but the voltage would be most seriously affected by the highly reactive and heavy current. Consequently the degree of stability of the parallel operation of the stations would be very low, so low in fact that they might drift out of synchronism.

Had a reactor been in the circuit, the station voltage would have been held up by the low power factor, current being limited to a much lower value. The power factor of the short-circuit current would be still lower, the kilowatt load lighter, phase displacement less, synchronizing power of the stations much greater, and hence there would be a higher degree of stability.

There are modifying conditions in almost all cases of trouble, no two exactly alike. In the solution of such troubles, or the prediction of what will happen, all details must be considered, such as the amount of load on each station at the time, power factor of the load, characteristics of the lines, characteristics of individual units in the affected portion of the system, both generators and turbines, and, of course, the ability of the apparatus to clear the "short" before the phase displacement limit or the allowable reduction in voltage is reached. D. D. HIGGINS,

Assistant Chief Engineer Northwest Station.
Commonwealth Edison Company,
Chicago, Ill.

Filtering Harmonics Out of Power Circuits

To the Editors of the ELECTRICAL WORLD:

Like many other operating companies in the United States, we are experiencing a very heavy hum on the load dispatcher's telephone lines, which are close to and directly under the power lines. Evidently the hum is due to one or more harmonics in the power circuit.

We desire to filter out this hum without disturbing the voice modulations to any great extent. I realize that this is a very difficult job, and perhaps an impossible one, as the hum we wish to eliminate is probably within the normal range of voice frequencies. However, it is my impression that a good deal can be done in this direction, and I am sure that some experimental work has been carried on and very possibly the solution has been reached.

We know that the hum can be eliminated by using the carrier-current system, and we have ordered carrier-current telephone sets to use on extensions of our present telephone system. We desire, however, to improve the speech transmission on our present telephone lines without discarding the present equipment and putting in the very expensive carrier-current system on these older lines.

Any solution reached for one company would be of material assistance to all other companies having telephone lines close to high-voltage power lines. I will appreciate very much any information you can gather from other sources relative to this particular point.

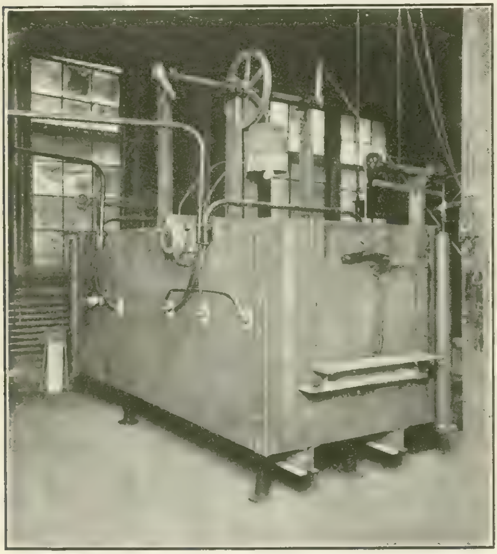
E. P. PECK,
General Superintendent Electrical Department.
Utica (N. Y.) Gas & Electric Company.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Operating Costs of Electric Furnace for Baking Vitreous Enamel

COMPARATIVE figures on the operation of an electric furnace for baking vitreous enamel and one using oil as a fuel show that for the same period of time and doing the same work the cost per hour with the electric furnace was 31 cents less than that of the oil furnace. In addition, production was increased approximately 50 per cent, and rejections decreased from 20 per cent with the oil furnace to less than 1 per cent with the electric furnace.



PRODUCTION INCREASED 50 PER CENT BY USING ELECTRIC FURNACE FOR BAKING VITREOUS ENAMEL

Working on two different materials, push-buttons and resistance tubes, 1.87 kw.-hr. was consumed per pound of buttons at a cost per pound of $0.023, and for the resistance tubes 0.541 kw.-hr. per pound at a cost of $0.006. The cost per hour for operating the oil furnace was 72 cents, representing 6 gal. of oil at 12 cents a gallon. The cost per hour of the electric furnace was 41 cents.

The electric furnace on which these figures were obtained was used by the General Electric Company at its Schenectady plant for various kinds of vitreous-enamel work. It is a two-compartment furnace divided by a door which can be raised or lowered when a batch is to be transferred from one compartment to another. The front compartment is used as a preheater, where the tubes are held at a temperature of 570 deg. Fahr. for six minutes. This is done because if the body of the tube is subjected to too high an initial temperature it will crack. The conected load on this compartment is 9 kw., and the temperature is automatically controlled by a thermostat. When preheating is accomplished the work is moved into the second, or baking, compartment by raising the door between. In this compartment it is subjected to a temperature of 1,650 deg. Fahr. for six minutes, emerging finished. The connected load in this compartment is 24 kw., and the temperature is automatically regulated by a thermostat.

The heating units in both chambers are arranged so as to give a very even heat distribution, and, since thermostats control the temperature, it is absolutely uinform during the preheating and baking periods. Another advantage is that preheating and baking can be carried on at the same time on two different batches of work.

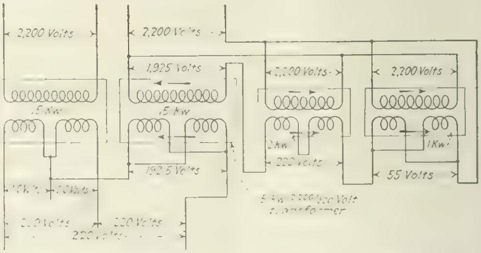
Each compartment is 48 in. long by 18 in. wide by 24 in. high, and will hold a tray containing thirty-six tubes. The tubes weigh about 0.75 lb. each and the tray 30 lb., making a total of 57 lb. in each compartment. The over-all dimensions of the furnace are 13 ft. long by 5 ft. wide by 7 ft. high.

FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Obtaining Three-Phase from Two-Phase in Emergency

OWING to an oversight, transformers for converting from three-phase to two-phase energy were recently shipped to Concord Junction for the supply of service to the M. D. Jones Foundry Company. The Concord central station generates two-phase, 60-cycle, 2,200-volt energy, and Scott-connection transformers had been ordered in order to deliver three-phase energy to this customer. The temporary installation described below was therefore installed to give the desired three-phase service.



USE OF FOUR TRANSFORMERS TO OBTAIN THREE-PHASE FROM TWO-PHASE

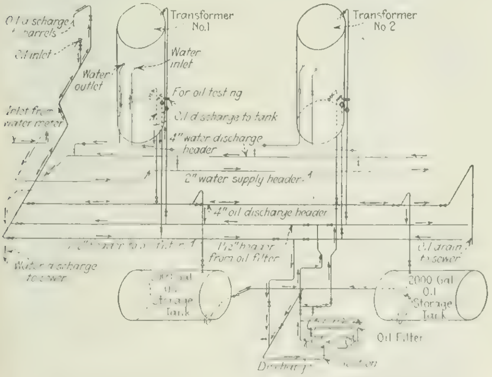
Four transformers with the following characteristics were used: one 15 kva., 2,200/110-220-volt transformer connected up three-wire so that lighting and one phase of the power load could be supplied from it; one 15-kva., 2,200/220-440-volt transformer connected for 220 volts for the other phase; one 2-kva. 2,200/110-220-volt transformer conected for 220 volts, with its secondary in series with one 1-kva., 2,200/55-110-volt transformer connected for 55 volts, these last two transformers having their secondary coils in series and "bucking" the primary of one 15-kva., 2,200/220-440-volt transformer.

A. W. Lee,
Manager.
Concord Municipal Light Plant,
Concord, Mass.

Flexible Oil and Water System for Transformer Substation

The system of piping installed in a recently constructed substation of the Union Electric Light and Power Company, St. Louis, for storing and filtering the transformer oil and for supplying the cooling water is shown in the accompanying isometric diagram. The transformers (rated at 3,000 kva.) each require about 1,500 gal. of oil and are installed on the first floor so that the oil from any or all transformers can be drained into either storage tank by gravity. The oil from any transformer can be pumped through the filter to the same or any other transformer or to either storage tank. Any transformer can be filled from either storage tank and each tank can be emptied into the other.

At present a total of about 4,500 gal. of oil is carried in the system, which is equipped with a 12-in. General Electric filter press. The oil in the transformers is tested every month and is filtered whenever the dielectric strength is found to be too low. Connections of 1.5-in. pipe are used between the transformers and the headers to and from the oil filter, but there is a 4-in. pipe from the oil-discharge header which allows the transformers to be rapidly emptied either into the storage tanks or into the sewer. The water-cooling system which is supplied from the city mains consists of a 2-in. supply header and a 4-in. discharge header into which each transformer is tapped. Only two transformers are shown, but three were installed and more could be added if desired.



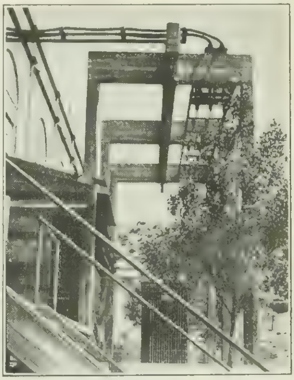
OIL-STORAGE, PIPING AND WATER-COOLING SYSTEM FOR SUBSTATION

Walter H. Millan,
Superintendent of Substations.
Union Electric Light & Power Company,
St. Louis, Mo.

Unusual Bus Structure Utilized for Industrial Substation

An outdoor substation embodying a number of somewhat unusual features in bus arrangement was recently constructed in a Texas industrial plant under the supervision of the writer. The capacity and voltage were rather low, but the points to receive attention were appearance, permanence of structure and facility of repairs in case of trouble.

Energy is generated and distributed through the plant at 440 volts, three-phase, 60 cycles. The feeder system was necessarily heavy and had been extended from time to time as new load was added. Further increase in load required a circuit of 1,500 kva. capacity. The copper cost for 440-volt distribution would be considerably in excess of the cost for equipment necessary to step the voltage up to 2,300 for transmission and step it down at the receiving end even for the comparatively short distance of 800 feet. This station was accordingly designed as the step-up station for this feeder. As the energy was all used on one circuit the design was simplified by the omission of disconnecting switches and oil switches on the 2,300-volt side. The transformers were handled as a part of the line and switched in and out by means of the 2,000-amp. automatic oil circuit breaker on the 440-volt side. Sufficient transformers were available at the time of purchasing for the step-up and step-down stations, but none for spares. As the spare transformers would delay delivery considerably, it was decided to dispense with them. In order partly to compensate for the omission of the spare units, facilities for the repair of damaged transformers received more attention in the design than is usual. Arrangements were also made for operating in open delta while repairs were being conducted. The columns were extended to a sufficient height to allow a core to be withdrawn from its case in place and passed over the remaining transformers while they are in operation. An I-beam trolley enables the core to be readily carried to the end of the structure and landed in the vacant space for repairs. The bus arrangement is such that safe clearance is allowed to pass the core.



CLEARANCES PROVIDED SO ONE TRANSFORMER MAY BE REPAIRED WHILE OTHERS ARE IN SERVICE

The trolley beam is a 9-in. I-beam suspended from the under side of the central longitudinal concrete beam. A crawl or trolley is mounted on this beam to operate its full length and carries a set of chain blocks. These blocks are only placed on the crawl when required, an eyebolt being installed on the side of the cantilever beam to facilitate their mounting.

Clearance for passing the cores is provided by suspending the 2,300-volt busbars from 6-in. channels set in the concrete beams. This places the bottom of the bus about 9 in. above the bottom of the trolley beam and well above the chain blocks. The 440-volt busbars were placed vertically on the opposite side at about the height of the transformer terminals. They are of heavy bar construction and are supported by channels set in the concrete columns. The adjacent power plant was of concrete column and beam construction. Thus a similar type was adopted for the substation with the addition of some 6-in. channels set in the concrete to support the busbars and some future switching and metering equipment. The result was a design of pleasing appearance which conforms well with the lines of the adjacent building. The structure is permanent and was installed at a cost little in excess of the more common steel or wood structures of a similar nature. A 7-ft. woven-wire fence with two strands of barbed wire at the top was stretched around the columns to prevent the entrance of unauthorized persons.

The designs were worked out by the plant engineering forces and all bus work was fabricated locally. The original plans called for an outdoor type of switch. As delivery could not be made promptly on this type and size of switch, an indoor type was finally obtained and housed in a temporary building to be replaced later by a permanent structure when the outdoor type switch arrived. T. H. Arnold.

El Paso, Tex.

Lead Covered 600,000 Circ.Mil Cable Span Suspended by Messenger

An unusual installation of 4,000-volt overhead cable for a very short run has been made by the Calumet & Arizona Mining Company at Bisbee, Ariz. The cable leads from the generating station to an adjacent building on the other side of railway tracks. The presence of steam lines and other piping prevented underground construction, and it was undesirable to use open wire for such a short distance. For those reasons a three-conductor, 600,000-circ.mil, lead-covered, steel-armored cable was suspended from a messenger which is supported by steel poles, as shown in the illustration.

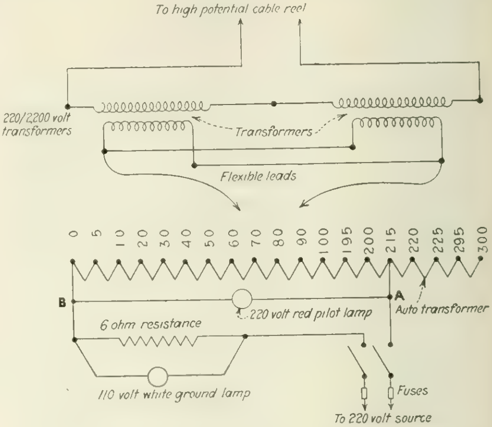
OBSTRUCTIONS FROM UNDERGROUND STEAM PIPES CAUSE USE OF AËRIAL CABLE FOR SHORT RUN

W. R. Gibson,
Chief Electrician.
Calumet & Arizona Mining Company,
Bisbee, Ariz.

Simple Insulation-Testing Apparatus with 6,000-Volt Range

Insulation-testing apparatus giving a voltage range of 100 to 6,000 in 100-volt steps can be readily made up and will prove very useful in repair shops and other places where it is necessary to test insulation for breakdown. Several of these apparatus have been in use in the shop of a motor manufacturer in the East for a number of years and have proved very satisfactory.

The apparatus consists essentially of three transformers. The first unit is an auto-transformer wound with 300 turns of wire designed to give one volt per turn and having taps brought out so that any voltage from 5 to 300 may be obtained in 5-volt steps. In every case the voltage obtained is indicated by the difference between the numbers of the taps used. The voltage thus obtained is applied through two flexible leads with light insulated spring clips to two standard 220/2,200-volt transformers of 2½ kva. capacity, each with the low-potential windings connected in parallel and the high-potential windings in series. This gives a voltage ratio of twenty to one.



STEP-UP TRANSFORMERS SUPPLIED BY AUTO-TRANSFORMER TO OBTAIN VARIABLE VOLTAGE

The transformers are protected from excessive current on short circuit by a 6-ohm resistance in series with the feed lines. Under short-circuit conditions the voltage drop across this resistance is sufficient to light the white lamp while the red lamp grows dim, since it is connected across transformer turns that are virtually shorted. The primary use of the red lamp is to indicate that the apparatus has voltage applied, and when burning brightly the lamp also shows that the testing circuit is clear of shorts. The white lamp, when lighted, even if dimly, is a positive indication of a ground.

It will be noted on the diagram that the lines *A* and *B* are connected to 0 and 215 on the auto-transformer. Owing to the drop in the 6-ohm resistance the voltage across *A* and *B* is not the same as the voltage of the mains. For accurate results *B* is connected to 0 and *A* to any point near the line voltage. By measuring the voltage across *A* and *B* after they are connected to the auto-transformer *A* can be connected to the tap nearest to the voltage so measured.

The type of cables for attaching to the high-tension side was decided after exhaustive tests covering a period of four or five years. The cable consists of single-conductor stranded rubber-covered double-braided No. 12 wire, twisted together, filled with cord, taped with two layers of plain cambric tape and dipped in an air-drying varnish. This gives greater flexibility and longer wear than could be obtained by any other method. The leads are kept in better condition and much ill usage is avoided by the use of self-winding reels.*

The reels are made of wood with sheet-iron flanges. The flanges are rounded over on the outer periphery so as to present no cutting edges to the cable. Two pieces of square copper wire fastened on each side of the wooden reel form collector rings. The sliding contacts are made up similar to a plate-type rheostat contact. A good strong clock spring provides the power for winding up the cable reel. The main switch is operated by a rope passing over a small pulley and so arranged with a spring that the switch will not stay in unless the rope is pulled tight. The reel is also locked in position when this rope is pulled so that the spring tension will not pull the cable out of the operator's hand. The cable reel is locked by means of a brake on the wheel operated by the rope that closes the line switch. This arrangement requires two men to operate it but provides the maximum of safety. The handles on the end of the cables are made of oiled wood, a small universal joint being used to connect the leads to the tip of the handle.

EUSTACE C. SOARES,
Ophuls, Hill & McCreery, Inc., Electrical Engineer.
New York City.

Peculiar Behavior of Rotary Converters

SOME very puzzling trouble developed recently with booster-type rotary converters which had been operating satisfactorily for ten years. One had been started in the usual manner by the induction motor attached to the main shaft, but the direct-current voltage failed to "build up." As this sometimes happens owing to loss or reversal of residual magnetism, recourse was made to "flashing" the field across the main direct-current bus, but this did not help any. Consequently the field was left connected to the bus and the rotary started as a separately excited machine. The armature had made only a few dozen revolutions when smoke began to pour out. The field was promptly disconnected, and when rotation stopped it was found that three coils at irregular intervals around the armature were so hot that the insulation was blistered.

A careful inspection of the commutator showed that most of the undercutting was filled or partially filled with carbon dust which had become hard and glazed. Furthermore, the slots between bars connected to the three hot coils showed spots where the filling was glazed over the top with copper, much the same as if it had been plated. After these spots had been cleaned out the machine started as usual and ran satisfactorily.

A few weeks later another one of the converters developed trouble in starting except that it "built up" enough voltage without separate excitation to burn out an armature coil before the field circuit could be opened. Within a short time two more rotaries developed similar trouble.

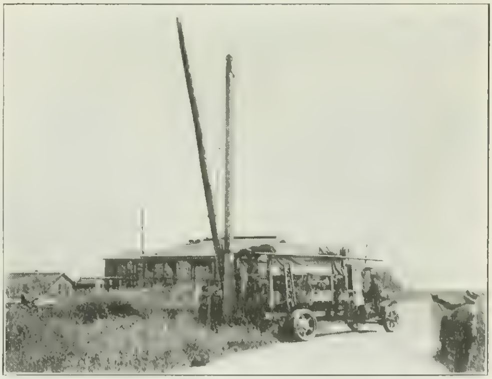
Thereafter the undercutting was always cleaned out before starting a machine. To do this scrapers were made which would not only remove deposit in the slots but would bevel the edges of the commutator bars slightly. While this treatment has stopped the trouble with the shorted commutator bars, and consequently hot coils, it has not prevented accumulation of dust between commutator segments, which occurred even before trouble was experienced.

Other rotaries in the same room with undercutting entirely filled with dust give no trouble. The machines that have given the trouble operate at the same load as they have done for ten years, namely, a little less than full-load rating, and have the same type and grade of brushes and brush holders. Furthermore, the same grinding and undercutting devices and methods are used.

E. C. CHANNING.
Niagara Falls, N. Y.

Pole Derrick Pulls from 75 to 100 Poles a Day

THE removal of 1,100 poles at Camp Taylor was speeded up considerably when the Louisville Gas & Electric Company mounted a pole derrick on a truck. The gin pole is carried on top of the body frame of the truck and is therefore entirely out of the way of other vehicles and does not interfere with the regular function of the truck. This pole passes through a loose collar mounted at the rear corner of the truck so that by tightening up on a set of blocks the pole can be raised to a vertical position with the butt end resting on the ground. Then three guy ropes are run out in order to steady the gin pole, as shown in illustration. A ½-in. steel cable passes over the pulley at the top to an engine-driven winch which has three forward speeds and one reverse. Power is furnished to this winch by an ordinary chain which is driven by a special gear mounted on a shaft extending through the transmission gear case. With this equipment a gang of five men removed from 75 to 100 poles a day, varying from 30 ft. to 60 ft. in length. In order to loosen a pole without any digging a lineman climbs up the pole and shakes it. Then a bucket of water is poured around the pole and the winch readily pulls the pole out without undue strain.



PORTABLE DERRICK USES MOTOR-DRIVEN WINCH TO PULL POLES

GEORGE M. MILLER,
Superintendent Construction and Distribution.
Louisville (Ky.) Gas & Electric Company.

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*Since writing this article there has been developed a new form of cable called "Tirex," made by the Simplex Wire Company. I believe this material would make better leads than the ones described in the article.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

New Interest and Activity Apparent in Rural Business

Many Central-Station Companies Are Planning Extensions to Meet Demand for Service in Outlying Communities

THE farmer throughout the country has been hard hit this year by the low prices at which he has been compelled to sell his produce, and he is crying poor. The feeling of executives of central-station companies across the country, however, shows a strong belief in the ability of the rural population to equip itself for electric service this year and come onto the lines. Plans are being made for connecting up the business that is waiting on the individual farms and also the larger load that is already organized around some village plant and eager for a more dependable source of supply.

The Oklahoma Gas & Electric Company says:

> Our plans for the coming year cover a great variety of activities, one of the most interesting of which will be the connecting up of outlying communities. First, in the undeveloped state that this country is in, most of the towns installed municipal plants on account of their isolated conditions, but through the aid of transmission lines this condition is gradually being overcome. Wherever possible, the towns are discarding municipal ownership on account of the cost and are applying for transmission-line service furnished by our company. Last year we were successful in adding three towns to our division by this method. For the coming year we have plans under way to add at least ten more.

The Manchester (N. H.) Traction, Light & Power Company sees distinct impetus to come as a reaction to lowering labor and material costs. They say:

> Our method of charging on line extensions will remain the same as that of the past year, but as the cost of material has been lowered considerably and as labor will probably be reduced in the coming year, we look forward to some improvement along these lines. Many "prospects" who heretofore did not see their way clear to accept our terms will be glad to take service when they can get the benefit of the reduction of both labor and material.

The Southern California Edison Company has planned an active campaign of reaching out into new territories. It writes:

> It is expected that line extensions will be made upon a liberal basis during 1922. Throughout the entire area of southern California there has been and continues to be a heavy demand for houses, and new construction is being carried on in this direction on a large scale. The company is taking care of all reasonable applications for service, including extensions of distribution lines when necessary. These remarks apply to urban, suburban and interurban business.

The Rochester Gas & Electric Corporation is also getting ready for this market. Here is its message:

> We are now working on a rural-line extension plan which we shall be able soon to offer to the rural sections. This probably will involve the form of rural ownership, this company to maintain and repair the line on a rate to be based upon these conditions.

The Cleveland (Ohio) Electric Illuminating Company does not extend into the rural districts to any great distance, but it says:

> We have worked out a plan under which we provide service for outlying municipalities which are beyond our present lines. Briefly, that consists of having the municipality build its own distributing system, the construction work to be done according to our standard specifications. When the work is completed we will connect to it at our expense, lease the distributing system from the municipality, operate over it and provide service to consumers the same as we do elsewhere. We do not pay any rental for the property thus leased—the consideration being that we supply service at our standard rates and that we maintain the property owned by the municipality at our cost. This lease is made for a period of ten years and carries with it an option on our part to purchase the distributing system owned by the municipality at any time we choose within the ten-year period.

And this suggestion from a large Indiana company brings up another thought that looks into the early future:

> We will run a line extension to take on new business if the extension is in any way reasonable, as we feel that now is the time to load up our idle station. At the present time it is hard to get money for increased station capacity, but when business becomes normal the probabilities are we shall have no difficulty in financing additional capacity. It is up to us therefore to get as much business as possible, and this can be done in a growing territory by being very liberal on the subject of distribution-line extensions.

There seems to be a definite trend of thinking, in other words, toward making extensions to reach new business in outlying territory and the tapping of these new sources of income. Out of this planning there will come undoubtedly a power of selling that will produce next year a market which will assimilate a large volume of both materials and appliances and represent a permanent income of no small value for the electric light and power company.

Cashing In on the Electrical Show

MEMBERS of the electrical industry in Spokane, Wash., were not content merely to hold a successful electrical show and then forget about it until next time. Instead, immediately following the show, held Dec. 5 to 10, about fifty representatives of each branch of the industry gathered together and held a businesslike conference on "How to Cash in on the Electric Show."

The keynote of the meeting was sounded by Lewis A. Lewis, sales manager of the Washington Water Power Company, who said in part: "We in the electrical industry are not competitors. Our competitors are the fellows who have something besides electrical supplies and service to sell the public. The reason for holding educational exhibits similar to the electric show is to present to the people a display of their 'electrical servants' and to sell them the electrical idea. In order to 'cash in' on our efforts we must continue them along the same lines of co-operative, educational work."

Other electrical men brought out specific methods of carrying the message to the general public by means of co-operative advertising, direct-by-mail advertising and a general stiffening of the sales effort.

Electrical Home Draws 15,124 Visitors in Utica, N. Y.

On Dec. 3 a "home electric" was opened in Utica, N. Y., and during the two weeks that followed 15,124 people inspected it. The accompanying picture gives some idea as to what extent the public was interested in electrical equipment for the home. Other views of the Utica "home electric" are shown on page 270 of this issue of the Electrical World.

This home was made possible through the combined efforts of the local electrical fraternity, the building contractor and one of Utica's leading department stores. Before it was opened to the public the firms participating were supplied with pamphlets for distribution to their customers. One of these contained a map showing the location of the home, the various landmarks near by and roads leading to it. The Utica Gas & Electric Company attached stickers to monthly bills inviting customers to visit the home. Arrows similar to those used by auto clubs, announcing that the home was open and indicating the direction of the route to it, were placed on poles all over the city and along highways in adjoining towns and villages within a radius of 25 miles. Strings of lamps were installed along the street leading to the house, and projectors floodlighted it at night.

Almost immediate results were apparent from this electrical home. The contractor-dealers were much pleased with the success which attended their efforts and felt well compensated for the time, money and energy expended in bringing it to fruition. They reported that their Christmas sales were greatly increased as a direct result, and the electrical interests of Utica have established a closer bond of understanding than ever before. In the broader field of educating the public in the wider use of electrical equipment and the better and more complete wiring of homes the results will continue to increase.

What Other Companies Are Doing

Albany, Ore.—The remaining $90,000 of an original three-hundred-thousand-dollar issue of 8 per cent convertible gold notes of the Mountain States Power Company has been offered to the company's cutsomers and the public. The company serves approximately 20,000 customers in forty-two communities of Oregon, Washington, Idaho and Montana.

Oklahoma City, Okla. — On Tuesday, Jan. 3, the cashier of the Oklahoma Gas & Electric Company's office in this city handled 1,825 customers and the contract department took care of 341 orders for connecting and disconnecting services. So far as the records show this was the company's largest single day's business.

Boston, Mass.—Substantial increases in commercial activities are reported by several of the central-stations managed by Charles H. Tenney & Company. The Fitchburg Gas & Electric Light Company sold 1,139 electric heating devices in 1921 compared with 707 in 1920, a gain of 61 per cent. Twelve electric washers were sold by the Malden Electric Company in the week ended Jan. 7, and during this week all but one of the Tenney electric companies gained from 4.5 to 66.7 per cent in kilowatt-hour output compared with the same week last year. The Salem company gained 5,016 hp. in motors and 388 lighting meters in 1921. Persistent sales efforts account for these figures.

New York.—A handbook showing automobile routes and charging stations for electric vehicles has just been issued by the automobile bureau of the New York Edison Company. It is for free distribution among owners and operators of electric passenger cars and commercial vehicles. Two maps are included. One shows the location of all the charging stations in New York City, and the other shows the routes and garage facilities for electric vehicle tours. The increasing touring capacity of the electric vehicle is indicated by this map, for it covers routes as far north as Pittsfield, Mass., as far east as New Haven, Conn, and Southampton, Long Island, as far west as Delaware Water Gap and as far south as Atlantic City. There are eight pages of information on the maintenance and operation of electric vehicles and on the care and charging of storage batteries.

PEOPLE WAITING IN LINE TO INSPECT UTICA'S ELECTRICAL HOME

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Care and Operation of Power Transformers.—J. G. CORRIN.—A study of the care that should be taken as to the proper setting of circuit breakers, relays, lightning arresters, etc., both as applied to the transformers and to the various parts of the system. The transformers should be inspected periodically to insure that all electrical connections are tight and that the bushings are clean and in good condition. It is advisable to inspect the oil at least twice a year, the frequency of the inspection depending upon operating conditions. Thermometer readings should be noted frequently and checked against load conditions as indicated by the station's meter equipment. When installing loading equipment on the system it is advisable to watch the actual loading as shown by the meters, as the diversity factor for the system may have gradually changed, thus bringing the peak load up to a value beyond the assumed figure.—*Paper read before the Philadelphia A. I. and S. E. E.*

Lamps and Lighting

Reduce Your Wastage of Light.—WARD HARRISON and J. R. COLVILLE.—A timely article on the maintenance of lighting units in various industries in order to insure the maximum usefulness of existing facilities. Among the items discussed are the extent and causes of lighting depreciation, value of light wasted, and systematic maintenance. An illustration shows the use of the foot-candle meter, while tables demonstrate the effect of undervoltage and improper building maintenance on illumination. Experience has shown that in many factories more than 30 per cent of the light paid for is allowed to go to waste. One-half to two-thirds is being thrown away through lack of attention to simple maintenance requirements. In a plant where the entire time of one man is required the cost of cleaning open reflectors should not exceed 3 cents each.—*Electrical Review and Industrial Engineer*, January, 1922.

Generation, Transmission and Distribution

Questions on the Economic Value of the Overhead Grounded Wire.—E. E. F. CREIGHTON.—This article deals with the analysis made for a public service commission of the advantages and disadvantages of ground wire on steel poles. The functions of the overhead grounded wire are noted under nine divisions. On wooden poles the use of grounded wire is detrimental, owing to decreasing the spark voltage between power wires and ground, while on metal towers no such effect is noted.—*Journal of A. I. E. E.*, January, 1922.

Hydraulic Accumulation of Energy by Means of Pumps.—J. GODIN.—An elaborate and interesting account of the possibility of augmenting the power output of hydro-electric stations by returning the tailrace water to an artificial lake above the power house by means of high-pressure pumps driven during hours of low demand. In the first part of the paper the author describes in general outlines the salient features of such plants, explaining the different possible systems, the type of machines used and the over-all efficiency which may be expected. Then follows a description of the power station of Chevenoz, which has been operating since 1909. The direct output of this plant is 780 kw. under a head of 50 m. A pumping set is installed, consisting of a synchronous machine which gives 650 hp. as a motor or 450 kw. at 80 per cent power factor as a generator. On the same shaft is mounted a centrifugal eight-stage pump delivering 85 lb. of water per second to a height of 400 m. and a Pelton wheel of 670 hp. An artificial reservoir of 10,000 cu.m. capacity is provided about 400 m. above the power house. Once a week from Saturday night until Sunday night about 5,000 cu.m. of water is pumped into the upper reservoir. This can be used during the peak-load hours of the week. As a rule the stored energy is used for three hours every day, which gives an addition of 27 per cent to the normal output of the power house. The over-all efficiency is calculated to 50 per cent for full load and 37½ per cent for half load. A water-level indicator tells the attendant every night how much of the stored energy is left in the reservoir. Similar plants in France, Switzerland and Italy are mentioned.—*Revue Générale de l'Electricité*, Dec. 17, 1921.

Modern European Tendencies in Power-Plant Design.—A. W. H. GRIEPE.—One of the most notable tendencies is the replacing of small steam-power plants by new steam plants built near the mines. This means a growth in the transmission systems operated from the large generating stations near the mines and the closing down of the small plants. Among the other items discussed are modifications in boiler proportions, types of steam boilers in use, boiler tubes and superheaters, types of stokers used, cinder and soot disposal, preheating of the air, flues and stacks, low-grade fuels used, tendency to use higher steam pressure and superheat, and cooling-water systems. Practically the only type of turbine used is the horizonal.—*Power*, Jan. 10, 1922.

Traction

Recent Progress in Electric Locomotive Design.—This article gives the details of the electric freight and passenger locomotives which are now being built for the North-Eastern Railway, England. Comparative tests between the latest types indicate that the electric engines handled the load more economically than steam engines and in other ways were more advantageous.—*Electrician (London)*, Jan 6, 1922.

Graphic Records Improve Line Maintenance.—Describes methods employed in maintaining high-tension trolley, telephone and signal lines on the Illinois Traction System in which graphic records form an important part of the scheme. The method of organizing the work and keeping records and methods of making inspections are recorded.—*Electric Railway Journal*, Dec. 31, 1921.

Analysis and Control of Factory Transportation.—F. A. Pope.—Methods by which idle time is checked, performance records of tires and batteries best secured, daily service recorded, and the final analysis of cost and performance made.—*Factory*, January, 1922.

Installations, Systems and Appliances

How to Follow up Power Costs.—N. A. Craigue.—In the industries where power forms an important part of the total conversion cost some method must be used to ascertain the amount of power consumed, so that the ultimate costs will be a positive indication of accuracy and reflect an operating condition. To arrive at the desired figure meters may be used actually to measure the power consumed, a cost rate may be applied, and the final cost obtained will be the charge against the product.—*Industrial Management*, January, 1922.

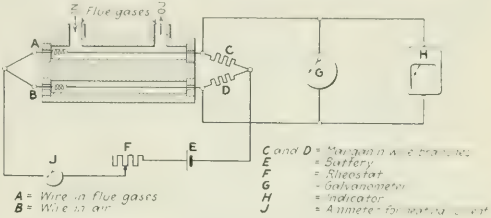
Semi-Continuous Bar Mill for Alloy Steel.—F. L. Prentiss.—A description of the new 12-in. electrically operated semi-continuous bar mill of the United Alloy Steel Corporation, Canton, Ohio. The unusual feature of this plant is the cooling bed. This is made up of two distinct sections. The first portion is the inclined escapement bed, which in this case has racks very much shorter than usual. Its function is to control bars while they drop from rolling heat to annealing heat. The second portion is a horizontal notched bed capable of receiving several bars in the same notch. Connecting these two is a mechanism designed to place flat alloy spring steel in an orderly pack in the first notch. Such a pack retains its heat very much longer than a single bar, and the necessary self-annealing is thus performed in these slowly cooling packs. A description is also given of the various other apparatus used in the plant.—*Iron Age*, Jan. 12, 1922.

Comparative Investigations on Heating and Cooking Apparatus.—P. Schlapfer.—A report of most elaborate and detailed tests made on heating and cooking by coal, gas and electricity and measuring the efficiency and cost of each method. The paper comprises thirty pages, twenty tabulations and twenty-seven illustrations. While the paper does not contain any technicalities on the electrical construction of the heating apparatus used, any heating engineer will find in this article a host of valuable data concerning comparative costs.—*Bulletin de l'Association Suisse des Electriciens*, December, 1921.

Electrophysics and Magnetism

Disintegration of Walls of Vacuum Tube Caused by Positive Ions.—H. P. Waran.—The author examines the extent of the disintegration of the walls of a tube caused by the bombardment of ions deflected on to it by a magnetic field. An ordinary Plucker discharge tube was used.—*Philosophical Magazine (London)*, January, 1922.

Electric Carbon-Dioxide Recording Instrument.—M. Moeller.—The temperature of an electrically heated resistance wire will depend upon the heat conductivity of the gas surrounding this wire. In a gas of poor conductivity the wire will get hotter than in a good conducting gas. The heat conductivity of carbon-dioxide is about 40 per cent less than that of all the other gases contained in the flues of boilers; consequently a wire heated in an atmosphere of such flue gases will get considerably hotter than a similar wire heated in air, and its temperature will be proportioned to the percentage of carbon-dioxide contained in the gases. Using the two wires as branches of a bridge connection, a simple method is given to determine their temperature difference by their proportional ohmic difference. An indicating or curve-drawing instrument, graduated directly in per cent of CO_2 may then be used in parallel with the galvanometer. Fine platinum wires are used, which change their resistance at about 3½ per cent for each 10 deg. C. temperature rise.—*Siemens Zeitschrift*, December, 1921.



USE OF PLATINUM WIRE IN FLUE GASES TO DETERMINE CABBON-DIOXIDE CONTENT

Telegraphy, Telephony and Signals

Printing Telegraph by Radio.—R. A. Heising.—Experiments on substitution of a radio transmission link for the customery wire transmission line on the commercial multiplex printing telegraph. Results are given of tests made between New York and Cliffwood, N. J., a distance of 25 miles. The usual outgoing signals from the printer were transmitted by wire to the radio room, where by means of a relay controlling the radio transmitter they were converted into radio signals. The received signals at Cliffwood actuated a polar relay and converted the radio signals back to wire signals which were relayed by wire back to the printer laboratory in New York. These tests showed that 180 words per minute could be satisfactorily sent.—*Journal of Franklin Institute*, January, 1922.

Miscellaneous

Compounding the Combustion Engine.—Elmer A. Sperry.—To engineers versed in the problems of selecting and designing prime movers the advantages of the compound combustion engine are readily apparent. It is light compared with the normal Diesel, being in special cases, according to the author, less than one-tenth and in some instances less than one-twentieth the weight for the same output. Its mechanical efficiency is extremely high, and a distinct gain in over-all efficiency from fuel to shaft is said to have been made, as well as a very definite gain in simplicity, direct performance and smoothness of the crank-shaft diagram. This has been achieved while adhering to the best practice, namely, four-cycle operation. The article presents the results of research made by the author extending over a period of years, during which it is claimed that not only has the high-pressure principle been thoroughly established but all the important requirements have been worked out and finally an engine embodying almost all the advantages has been subjected to long, continuous runs.—*Mechanical Engineer*, January, 1922.

New Books

Reviews of the latest contributions to technical, industrial and commercial literature of particular interest to members of the electrical industry

La Théorie et la Pratique des Radiocommunications. Vol. II. La Propagation des Ondes Electromagnétiques à la Surface de la Terre. By Léon Bouthillon. Paris: Librairie Delagrave. 340 pages, 125 illustrations.

A purely mathematical treatment of the laws governing the propagation of electromagnetic waves along the surface of the earth and the effect of geographic and meteorologic conditions.

In One Man's Life: Theodore N. Vail. By Ralph Bigelow Paine. New York: Harper & Brothers. 359 pages, illustrated.

In his charming current reminiscences the American playwright Augustus Thomas remarks: "At the Centennial Exposition in Philadelphia in 1876 the Bell telephone was regarded as a toy. Visitors permitted to listen to the voice of a friend speaking from the next room examined the legs of the table to find the tube which they were sure Mr. Bell had concealed to convey the sound." It was the aim and the good fortune of Theodore N. Vail to take that "toy" and convert it, as a public utility, into one of the greatest boons civilization ever received at the hands of science and invention. As has been said very epigrammatically: "Bell invented the telephone and Vail created the telephone business." With the inherited electrical aptitudes of one whose forebears had assisted vitally in the creation of the telegraph, the young operator and railway mail superintendent took into the new telephone field boundless imagination, ability, energy, executive force, and the result is seen today in millions of telephone stations and billions of switchboard connections, giving employment to vast aggregations of capital and labor and affording intercourse of ineffable value throughout the world, more particularly in these United States. How it all came about is set forth in flowing narrative in these gossipy pages, which, though they only skirt the technical art underlying, deal generously with the work of such men as Carty, Lockwood, Scribner, Pupin and Patterson. This is not a history of the telephone but of the great captain of the telephone industry-utility, and much of its useful merit lies in the picture of the stages and processes by which he took the little "butter stamp" and founded upon it the greatest of all the arts of modern intercommunication.

To no other man of these times was there given such vision of the demands and possibilities of public service, or such swift intuitions as to the best ways in which to build up a vast utility property on the basis of good will and benefits rendered to the community. The portrait is drawn of a big, lovable, attractive personality, with many interests in life and much achievement in varied enterprises; but the fame and glory of Vail will rest ever upon his successful endeavor to perfect the great organization of which he more than any one else must be regarded as the creator. It is curious that this is the first attempt of any kind to do justice to those, other than the inventors, to whom are due all the great industries and public utilities covered by the activities of this journal. One would like to see some more of them, or at least some helpful review of what they did and how they did it—of such men as William Orton of the Western Union, George Stockley of the Brush Electric Company, Enos M. Barton of the Western Electric, E. H. Johnson of the Edison Electric Light Company, C. A. Coffin of the General Electric Company, E. D. Adams in Niagara Power, and others whose courage, sagacity and initiative weigh equally with inventive gift or mechanical skill. Much is to be learned from such careers, founded upon simple commercial instincts.

Radio Questions and Answers on Government Examination for Radio Operator's License. By Arthur R. Nilson. New York: McGraw-Hill Book Company, Inc. 84 pages, illustrated.

This book, which is written by an associate member of the Institute of Radio Engineers and a director of a Y. M. C. A. radio school, is prepared especially for students and operators who are about to take the government examinations for a radio operator's license. The material does not represent one person's opinion, but is compiled from various sources. The work is not complete by any means, but it does cover many questions arising in amateur radio operations. In preparing the book the author has evidently assumed that the reader understands the theory of radio operation completely. In general, he considers the theoretical side of radio, spark and arc transmitters, storage batteries, motors, generators, and receiving apparatus, including vacuum tubes. He discusses law and traffic regulations and license examinations and gives electrical definitions and a bibliography on the subject of radio.

The J. E. Aldred Lectures on Engineering Practice, 1920-21. Baltimore: The Johns Hopkins Press. Paper, 285 pages, illustrated.

Here is the fifth series of a course of lectures founded in the School of Engineering of the Johns Hopkins University through the generosity of J. E. Aldred for the purpose of furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. In each of the series so far given in successive years there have been nine lectures, three in each of the civil, electrical and mechanical engineering branches. The purpose of the lectures is to deal with every-day working methods of design, construction and operation, rather than with theory or new and striking applications. They are intended for undergraduate students of the third and fourth years. The lectures on electrical subjects are all of immediate present interest. That by F. B. Jewett on "Recent Advances in Long-Distance Telephony" is an excellent historical outline of the sequence of development leading to the remarkable achievements lately evident in that field and contains interesting matter not published elsewhere. Philip Torchio's lecture on "The Power Distribution Systems of Large Cities" obviously carries the stamp of experienced authority, as does that of John V. L. Hogan on "Radio Telephony," setting forth in simple terms the principles and modern methods in that field. Of the lectures in the other branches the most striking are those by Robert Ridgway on "Subway Construction in New York City" and by Azel Ames on "Railway Signaling." Typography and arrangement are excellent.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Government Wants Curb on Amateur Radio Telephony

AS THE result of a discussion at a meeting of the Cabinet on Tuesday, when the increasing use of the wireless telephone came up, President Harding instructed Secretary Hoover to call a conference of army, navy and commercial experts on the subject in order to find a way to prevent amateur interference with radio for commercial uses and for purposes of national defense. The findings of the conference are to be reported back to the Cabinet so that it may formulate suggestions for controlling legislation.

Five Per Cent Issues Begin to Appear

TWO first-mortgage 5 per cent electric light and power company bond issues came out this week, one a million-dollar issue of the Sierra & San Francisco Power Company, dated Aug. 1, 1909, and due Aug. 1, 1949, and the other a two-million-dollar forty-year issue, due March 1, 1952. The former issue bore an offering price of 86 and the latter one of 73.

These are the first 5 per cents in the light and power field reported this year. Only six or seven were reported during 1921. Such low-rate issues, even though offered at a large discount, indicate a marked turn in the security market. The industry had been led to think for a long time that, outside of municipal and railroad issues, it was almost impossible to interest investors in anything bearing such a low rate of interest except at a discount that was prohibitive. Even at low prices, bankers hesitated to handle such flotations because the public demanded a higher stated rate of interest.

Boston Municipal Lighting Plant Order Vetoed

NO MUNICIPAL electric lighting plant will be established at Boston in the near future. This is the result of a veto by Mayor Peters during the closing hours of his administration of a recently passed order by the City Council favoring the entrance of the city into the lighting field. The veto was the last official act of the retiring Mayor, and it was based in part upon a report of Corporation Counsel A. D. Hill, which pointed out that under the present laws the city would be obliged, if the company so elected, to purchase the plant of the Edison Electric Illuminating Company. Municipal establishment of a lighting plant requires passage by the Council of the necessary order in two consecutive years, followed by a referendum. Had the Mayor signed the recent order, it might have been possible for the Council to put the measure through again within a short time after the opening of the new administration, and this might have led to a referendum at the December city election. Agitation for municipal ownership has been confined largely to the sensational press, and the issue has not as yet passed out of the early political stages. Very little popular demand exists for such an undertaking in Boston at this time.

Electric Utilities Have Built Up Coal Reserves

FIGURES compiled jointly by the Bureau of the Census and the United States Geological Survey relative to bituminous coal in storage show that utilities, in contrast with the general industrial companies, have continued to build up their coal reserves. The report states that the utilities on Jan. 1 had more coal than last November, more coal than a year ago, and even more than on Jan. 1, 1919. The increase, it is stated, was not universal, however. In some states stocks have fallen. In New England, the Rocky Mountain territory and Missouri, Kansas, Oklahoma, Arkansas, Maryland and Virginia the coal stocks of electric utilities were lower on Jan. 1 than they were three years ago. The supply reported by 836 electric utility plants on Jan. 1 was sufficient to last fifty-one days. This may be compared with thirty-nine days on July 15, 1918; forty-nine days on Nov. 11, 1918; forty-nine days on Jan. 1, 1919; forty-eight days on April 1, 1919; twenty-one days on March 1, 1920; twenty-two days on June 1, 1920; forty-four days on Jan. 1, 1921; forty-eight days on April 1, 1921; forty-four days on Aug. 1, 1921, and fifty-four days on Nov. 1, 1921.

Patent Bill Near Final Stage

APPROVAL of the plan for the early consideration of the Patent Office relief bill has been secured from Senate leaders. It is expected that the bill will be called up in the very near future and passed with a minimum of discussion.

Southern California Edison to Spend $22,500,000 This Year

ANNOUNCEMENT was made by President John B. Miller on Jan. 26 that, by action of its board of directors, the Southern California Edison Company of Los Angeles is authorized to spend $22,500,000 in 1922 for additional water-power development and extensions to its transmission and distribution system. This is the largest annual budget appropriation in the history of the company. The total expenditure will include $10,951,000 for water-power development, $3,333,000 for 220,000-volt transmission lines, $8,124,615 for improvements and extensions to distribution lines and substations, and $125,385 for subsidiary companies. About 50 per cent of the amount authorized will be spent in the construction of new water-power plants on the Big Creek and San Joaquin developments of the company. The other half will be expended on the transmission and distribution system, covering the greater part of southern and central California.

Early in 1923 Big Creek Power Plant No. 3, which will have an initial installed capacity of 65,000 hp., will be completed. Situated on the main branch of the San Joaquin River a little more than 5 miles below Big Creek Power House No. 8, the new plant will use the water from San Joaquin River and Big Creek through a total fall of 855 ft. Water will be diverted from the main river by a dam 125 ft. in height and will be conducted to the plant through a tunnel line 30,000 ft. in length and 21 ft. square, which is being blasted through the solid granite of the mountain formation. With the completion of this plant the water from Huntington Lake will be used through four plants in series under a total aggregate fall of 5,574 ft. Final plans for this power house call for six generating units and a total rating of 200,000 hp.

The Huntington Lake Development

Active work on the Florence Lake tunnel, which will have a length of 13½ miles and will be 14 ft. square, is to go forward. This tunnel will be used to divert the waters from the south fork of the San Joaquin River through the mountain range into Huntington Lake, where the water will be conserved in Huntington Lake and Shaver Lake until it can be used economically for power production through the chain of power houses situated below these lakes. Construction on this large tunnel was started in the fall of 1920, and it is planned to complete it by the spring of 1926, at a total cost of approximately $12,000,000. By increasing the water supply into Huntington Lake, Florence Lake tunnel will make possible the generation of an additional 560,000 hp. in the power houses below Huntington Lake. The expenditures during 1922 on this tunnel will amount to $1,900,000.

In the ultimate development of all the power available at Big Creek there will be required six sets of 220,000-volt transmission lines. By adopting this new system of transmission, instead of continuing at 150,000 volts, Mr. Miller states that a total ultimate saving in transmission-line investment of $30,000,000 will be effected.

Not only must additional generating plants and transmission lines be provided to take care of an increase in the electrical load, Mr. Miller asserts, but there must also be constructed additions to the electric distribution system and new substations to deliver the electrical energy to the consumers' meters. Included in the budget appropriation for 1922 is an item of $8,000,000 to cover these requirements. On the basis of current growth, 50,000 new consumers on the Edison system will be supplied with electrical energy this year, and twelve new substations will be constructed for the purpose of delivering energy from the main transmission circuits to the distribution lines of the company. More than 20,000 poles will be used to support the distribution lines which will be built, and approximately 2,000 miles of wire for the distribution of the energy to the consumer will be put up.

Funds for the new work will be obtained by the sale of the company's bonds through banking houses and by sale to the company's consumers and the people of southern and central California of the company's stock. More than 27,000 individuals are now Edison stockholders.

Water Power League of America Passes Out of Existence

THE Water Power League of America virtually terminated its existence on Feb. 8 after a two-day conference held in the Engineering Societies Building, New York, at which none of the officers was in evidence except the secretary and at which none of the celebrities advertised to appear was present. An attempt was made to instill new life into the organization, but the poorly attended sessions dragged along wearily.

A very able address was made by Henry I. Harriman, president of the New England Power Company, at the morning session of Feb. 7 on New England's interest in the St. Lawrence development. Mr. Harriman was in favor of the canalization of the St. Lawrence River for shipping purposes and of the development of the river for hydro-electric purposes, claiming that thereby lower freight rates would be obtained and that New England would receive much-needed electrical energy at low rates.

Amendments to Federal Act Proposed

None of the speakers scheduled for the Tuesday afternoon session made an appearance. These included Ex-Governor A. E. Smith of New York, Professor L. P. Breckenridge of Yale University and R. A. Lundquist of the Department of Commerce. The Wednesday session was devoted to an address by Charles Edward Russell of Detroit, the well-known socialistic writer, who spoke on "Credits and Currency and Ford's Money Plan." Walter W. Pollack of Philadelphia spoke on general taxation. Before disbanding, the organization considered certain amendments to the federal power act which were proposed by the Boston Society of Engineers. The amendments passed were as follows:

> That the accounting requirements (Section 11) be only such as are required by the public service commission of the state in which projects are located.
>
> To remove from Section 10c any possibility of the licensee being required to maintain navigation structures excepting such as may be a part of the dam or project of the licensee.
>
> That Section 10c be amended by substituting for the words "adequate depreciation reserves" in line 5 the words "such reserves as may be reasonably necessary" and by providing that, excepting where reserves are controlled by state regulation, the amount of reserves shall be determined in the first instance and annually by the licensee subject to approval by the commission, and that in case of inability to reach an agreement the above-mentioned amounts shall be determined by appeal to the district court of the United States for the district in which the project may be located.
>
> That Section 10d should provide that earnings of companies whose rates are controlled by state public service commissions shall be assumed to be not in excess of "a reasonable rate of return."
>
> That Section 14 provide that the fair value at the time of taking over be paid for lands, rights-of-way, water rights, etc., instead of the value at the time of an acquisition.
>
> That Section 15 should provide for an extension of at least ten years in place of the annual extension here provided for.

At the conclusion of the session a reorganization of the league was suggested; but inasmuch as there were only about twenty present at the time and few of these were members of the Water Power League, it is doubtful if anything will come of the proposal. Attempts will be made to reach former members of the league and solicit their financial support and aid in increasing the membership.

Commonwealth Edison Planning Increase in Authorized Capital Stock

STOCKHOLDERS of the Commonwealth Edison Company will be asked at the annual meeting, Feb. 27, to vote on the question of increasing the authorized capital stock from $60,000,000 to $80,000,000. No new financing is contemplated at this time, but the directors wish to provide as far ahead as possible facilities whereby financing can be done by junior rather than senior securities.

"Issuance of the company's new stock from time to time—it is always offered at par to old stockholders—has given old stockholders unusual opportunity for investment," said Samuel Insull, president of the company, in discussing the proposal. "The last issue of stock, a little less than $4,500,000, offered on Dec. 8, 1921, was so successful that there is now nothing to offer old stockholders.

"It is the purpose to issue only such new stock as may be required to produce the new capital necessary for plant and equipment as they are needed. Last year the Commonwealth Edison Company added more than 60,000 new customers. This gives some idea of the continued growth of the company and of the electrical business as a whole."

Muscle Shoals Hearings Started This Week

HEARINGS started this week before congressional committees on the disposition of the government nitrate and hydro-electric project on the Tennessee River at Muscle Shoals. The Senate also received a copy of the Ford offer and after some opposition referred it to the agricultural committee. In the House there was considerable opposition by the agricultural bloc to the reference of the bill to the committee on military affairs, and an effort is now being made to secure a re-reference.

It is known that the Senate committee on agriculture is amicably disposed toward the Ford proposition. Senator Wadsworth and other members known to oppose the development insisted that the bill should be referred to the appropriations committee direct.

Hearings began before the military affairs committee of the House on Wednesday. Secretary Weeks testified, presenting little new matter, but amplifying the views expressed in his letter of transmittal and abstracted in last week's issue of the ELECTRICAL WORLD. He gave new emphasis, however, to many points. Among these was his insistence that the lease should be for a period no longer than fifty years. He also suggested that any sale of power by Mr. Ford, in case he did not use the entire output for his own industries, should be under regulations to be formulated by the Federal Power Commission.

That difficulties may be expected in adjusting claims with the Alabama Power Company and that a substantial sum will be required to purchase the right-of-way for the 88-mile transmission line to the Warrior River plant were predictions by Secretary Weeks. He urged that responsibility should be definite with regard to the manufacture of nitrate. There is difference of opinion as to whether or not the agreement would compel the operation of the nitrate plant at a loss. The Secretary suggested that there should be a guarantee, either by the formation of a company with sufficient capital or by the giving of a bond in sufficient amount, to insure the continuance of this operation throughout the life of the contract.

While several members of the committee very obviously have preconceived ideas as to just what ought to be done with the Ford offer, most of them appear to be open to conviction either for or against it.

Utah Company Seeks Permits for Projects to Develop 800,000 Hp. Maximum

APPLICATIONS for preliminary permits during the week ended Feb. 4 were received by the Federal Power Commission as follows:

The Utah Power & Light Company of Salt Lake City has applied for a permit covering the development of the power in Green River between Flaming Gorge in Northern Utah and Rattlesnake Canyon, above Green River, and the power in the Gampa River between Craig, Col., and the junction of the Gampa with the Green River. The method of development proposed on the Green River is by a series of six dams and pools with power houses at each dam. The Gampa development is to be made by a series of four dams and power houses. The total primary power which will be made available by these projects is estimated at 560,000 hp. The installation contemplated is 800,000 hp.

The Houston Power Company of Newton, Ala., has submitted a plan for the construction of a dam 33 ft. high in the Choctawhatchee River just above Newton. The power house is to be an integral part of the dam. It is estimated that 600 hp. of primary power will be available, but it is the intention to install equipment to generate 3,000 hp.

The Eureka Hydro-Electric Company of Eureka, Mont., has applied for a permit covering the construction of a dam, a flume and two power houses on Graves Creek, 9 miles from Eureka. About 750 hp. of primary power is estimated to be available, but the company expects to install equipment sufficient to generate 2,500 hp. The power is to be used for irrigation and public utility purposes.

The Spirit Lake Railway & Power Company, Vancouver, Wash., requests a permit to cover projects on the Toutle and Green Rivers in Cowlitz County, Wash. The site covered by this application is just below the company's project at the outlet of Spirit Lake. The primary power at that point is figured as being 40,000 hp., and the company announces its intention to install equipment rated at 50,000 hp. The power is to be used for public utility purposes.

Electrical Rules Covering Construction Work in Atlanta

IN ACCORDANCE with an ordinance organizing the Board of Electrical Control for the city of Atlanta, rules and regulations for electrical construction within the city limits have been issued bearing date of January, 1922. The basis is the National Electrical Code preceded by seven pages dealing with the following points: Sizes of wire to use for 220-volt, three-phase alternating-current motors based on 100-ft. run or less; wiring specifications for passenger elevators and freight elevators; requirements covering the types and the installation of knife switches, oil switches, electric motors, outlet boxes, insulating tape, fixtures, studs and conduits.

The Board of Electrical Control for Atlanta consists of the chairman of the committee on electric lights, telephone and telegraph, the city engineer and the chairman of the committee on electric and other railways. The board is responsible for the inspection of all electrical construction, installation and equipment, whether inside or outside of buildings, and has the power to order removed, repaired or rebuilt any such construction. It also passes on the ability and responsibility of applicants for permission to do electrical contracting in the city. The actions of the Board of Electrical Control are executed by the superintendent of electrical affairs, who is subjected to its orders and elected by the people for two years.

Provisions of the Ordinance

The ordinance which created the Board of Electrical Control and specifies the duties of the superintendent of electrical affairs embodies the following wiring regulations in Sections 24 to 34 inclusive:

Section 24. Be it ordained by the Mayor and General Council that it shall be unlawful for any person to bridge a fuse block with wire or to fuse any conductor above its rated carrying capacity.

Section 25. That every fuse must be plainly marked with the number of amperes it is designed to carry.

Section 26. That any person convicted of violating any of the provisions of this ordinance be fined not exceeding $25 or imprisoned not exceeding ten days, one or both penalties to be inflicted at the discretion of the Recorder.

Section 27. Each person standing the examination required to be held by the board, under the terms of this ordinance, shall before taking such examination pay to the city tax collector the sum of $6, and this sum shall be passed to the credit of the board, and it is hereby specially apportioned to said board and shall be paid over to the examining committee of said board, in equal sums, as a fee or salary for the work done by said committee of said board in holding said examination.

Section 28. That on all installations only two wire branch circuits will be allowed and three wire feeders.

Section 29. That in all installations where half-inch iron conduits are used only three No. 14 wires or three No. 12 or two No. 10 single wires will be allowed in this size conduit, nor will more than four No. 14 single wires or four No. 12 single wires, nor more than two No. 14 or No. 12 duplex wires, be approved in three-quarter-inch conduit. Conduits of a size to permit of the easy insertion and withdrawal of other numbers and sizes of wires must be provided. The use of any compounds or lubricants other than soapstone is prohibited.

Section 30. That in all buildings using metal ceiling the canopy for electric fixtures must have insulators permanently attached where it is possible to do so.

Section 31. That in all houses where electric bells are used wires for furnishing this service shall have either waterproof or damp-proof insulation.

Section 32. That electrical contractors wiring old houses for electric lights where electric or gas-light systems have been used are required to remove all such wires from attic, fixtures, etc., before wiring said house for electric lights.

Section 33. It shall be unlawful for any plumber, gas or steam fitter or other person to install, fix or place any metal pipe in a building nearer than 3 in. from an electric light or power wire, unless such electric light or power wires are insulated under such requirements as may be imposed by the superintendent of electrical affairs.

Section 34. Whenever such pipes, now or hereafter erected, are moved under permission of Section 1 of this ordinance, such work shall be done under the direction of the superintendent of electrical affairs, and by a competent electric wireman at the expense of the person procuring the change.

First Safety Switch Congress Is Held at Pittsburgh

More than 700 executives and safety, electrical and mechanical engineers attended the first safety switch congress held in America, which took place at the Chatham Hotel, Pittsburgh, recently. Thirteen switch manufacturers exhibited various types and sizes of safety switches, and electrical engineers and superintendents had an opportunity to offer suggestions to the designers. Tentative arrangements are being made to hold a congress and give the exhibit in Detroit, Indianapolis, Cincinnati, Buffalo, Boston, Cleveland, Chicago, St. Louis, Philadelphia, Birmingham and Toronto.

Western New England Inspectors Discuss Fuse Ratings

A meeting of the Western New England Association of Electrical Inspectors was held at Hartford, Conn., two or three weeks ago, and these officers were elected for 1922 and 1923: President, Thomas Henry Day of Hartford; vice-president, W. C. Field of Springfield, Mass.; treasurer, A. W. Hopkins of Springfield; secretary, R. J. Forsyth of Greenfield, Mass.

The principal topic of discussion was the advisability of increasing the rating of the present 10-amp. fuse allowed on branch circuits to 15 amp., and a committee was appointed to make tests and report at the next meeting. There was also discussion on the advisability of omitting the fuse on the grounded wire of branch circuits. It was the general expression that the omission of the fuse would be a good thing and tend to reduce the life hazard, provided that the rule on the use of identified wire went into effect, that all fixtures were grounded and no switches placed in the grounded wire of the branch circuit.

The next meeting of the association will be held in Middletown, Conn., May 10.

Pacific Gas & Electric Elects Four More Vice-Presidents

Appointment of four additional vice-presidents and the adoption of a reorganization plan involving many changes have just been announced by the Pacific Gas & Electric Company through Wigginton E. Creed, its president. The new vice-presidents are A. H. Markwart, former director of engineering, who becomes vice-president in charge of engineering; W. G. Vincent, Jr., former executive engineer, who becomes vice-president and executive engineer; Willis S. Yard, former engineer of gas department, who becomes vice-president in charge of gas construction and operation, and R. E. Fisher, former manager of the commercial department, who becomes vice-president in charge of sales.

These four officials, with P. M. Downing, vice-president in charge of electrical construction and operation, and F. A. Leach, Jr., vice-president in charge of public relations and service, will be called the "management officers" of the company and will be responsible to John A. Britton, vice-president and general manager. Changes in the departmental organization include the appointment of W. B. Bosley as general counsel for the company, Leo H. Susman as attorney in the law department and former State Senator Charles P. Cutten as attorney of the rate department.

California Utilities to Finish Rebuilding Overhead Systems

FOLLOWING a recent hearing before the California Railroad Commission to inquire into the extent of the compliance by the utilities of that state with the state laws governing the construction and maintenance of transmission and distribution systems, the commission decided to make an inspection of the conditions as they exist on the ground and determine what, if any, further extensions of time will be allowed the various companies to complete work they may have on hand. This inspection will be begun March 1, three inspectors being assigned to the task.

The laws referred to were enacted in 1911 as Chapter 499 of the statutes of that year and amended by Chapter 600 of the Statutes of 1915. In brief, they cover the spacing between the poles and the conductors, the separation between conductors and ground, the distinctive marking of cross-arms carrying wires energized above 600 volts, the insulation of guy wires, the insulation of conductors running vertically along poles, the hanging of transformers with reference to other energized devices such as arc lamps, the strength of "overbuilds" and the suspension of cables to messengers and poles.

Merger of Indiana Utilities Gives Rise to Vigorous Protest

APPROVAL given by the Public Service Commission of Indiana to the merger into the Indiana Electric Corporation of seven electric utilities (see ELECTRICAL WORLD for Feb. 4, page 247) has occasioned a loud protest from some of the communities affected. The city governments of Indianapolis and Kokomo and various industrial concerns of the former city are among the protestants, and they have filed with the commission a petition asking for a rehearing of the case and setting forth fifty-one reasons why they hold the consolidation and the proposed issue of $17,496,000 in securities to be "unlawful, illegal and void."

The petition contends that the corporation is not a utility and cannot legally function as one; that the commission had no right to permit it, on a capitalization of only $10,000, to issue the securities authorized; that the capitalization authorized is in excess of the total capitalization of the companies involved; that two companies, the American Public Utilities Company and the Merchants' Public Utilities Company, involved in the sale were not parties to the action; that the merger is in conflict with the utilities law; that it adds another to five holding companies already in existence, and that it makes the determination of adequate and proper rates impossible, the valuation being excessive, as is the working capital authorized, and the order failing to designate the amount of cash and securities to be paid for each property or to allocate to each utility its proportion of working capital and going value.

Mayor Shank of Indianapolis staged a spectacular demonstration against the commission, five or six thousand persons marching to the State House to protest to Governor McCray. The Governor refused to leave his office to address the crowd and told a delegation that visited him that it should go to the office of the commission for an explanation of the order. The commission awaited the delegates, but they did not call upon it. Mayor Shank, after speaking out of doors to the crowd, returned to the City Hall and did not go to the Governor's office. The expected demand for the discharge of the members of the commission was not made.

Natural-Gas Generation Cheaper than Fuel Oil in Southern California

ON THE basis that a steam generating station may be operated more cheaply by using natural gas as fuel than by using fuel oil, and in order to effect the greatest economy in over-all operation and lessened investment, the Southern California Edison Company and the San Joaquin Light & Power Corporation have applied to the California Railroad Commission for approval of a contract whereby the latter company will install in its Midway steam generating station a 12,500-kw. turbo-generator and the necessary boilers and other equipment for the sole use of the former. In addition to the output of this unit, which is to be operated at the direction of the Southern California Edison Company, the San Joaquin company will supply additional power up to a total limit of 20,000 kw. if it can do so without embarrassing its own consumers. In effect the new unit will be a standby unit and give the Southern California Edison Company a reserve source until it brings into operation its next hydro-electric station on the San Joaquin River, which will be about June, 1923.

The Midway station was constructed last year to a rating of 12,500 kw. at a cost of $1,559,800. It burns natural gas from the nearby fields. The contract referred to is drawn on an estimated cost of $1,200,000 for the unit, and a fixed monthly charge of $42,485 plus an energy charge of $0.00333 per kilowatt-hour is set as compensation. The contract runs from Aug. 1, 1922, to June 1, 1923, and during this time it is estimated that 80,000,000 kw.-hr. will be sold the Southern California Edison Company under the contract. The energy is to be metered at the receiving substations of the Edison company at 65,000 volts and at as near 85 per cent power factor as practicable.

Large and Optimistic Attendance at Pacific Coast Jobbers' Meeting

AN OPTIMISTIC tone which has resulted from a clarifying of the general business situation marked the quarterly meeting of the Pacific Coast Division of the Electrical Supply Jobbers' Association held in Del Monte, Cal., last week. Liquidation has proceeded until present stocks can be considered normal, and with careful buying proportionate to the demands as they appear it is felt that as the year grows older any semblance of tenseness will disappear.

The attendance at the meeting was unusually large. Men were there representing all branches of the industry from every section of the country. Robert Sibley, editor of the *Journal of Electricity and Western Industry*, addressed the meeting on the subject of business forecasting, and Eustace Cullinan of San Francisco, chairman of the newly organized Greater California League, which has been formed to combat the proposed five-hundred-million-dollar California state power act, redirected attention to the menace which this act brings to the state. Charles Wiggins, manager of the electrical department of Dunham, Carrigan & Hayden of San Francisco, was elected chairman of the division

Need for New Illinois Lighting Code Requirements Shown

FACTORY lighting with special emphasis on accident prevention was the topic before the Western Society of Engineers at its meeting on Jan. 26. Two addresses were made, one by R. W. Hamilton, assistant chief factory inspector, Illinois Department of Labor, and the other by Otis L. Johnson of the Benjamin Electric Manufacturing Company. Both speakers urged a new code because, owing to advanced knowledge and new conditions, the health, safety and comfort act of 1909 had become almost obsolete, at least so far as lighting is concerned.

At the close of this meeting a motion was adopted which suggested that the ten engineering societies select representatives for a common committee to discuss the revision of the act referred to.

Company Held Liable for Guy Wrongly Placed on Its Pole

HOLDING that a public utility company was aware of the condition of a guy placed on one of its poles and that the method of placing the guy was not in compliance with the electrical safety code, the Wisconsin Industrial Commission recently awarded a 15 per cent increase of compensation to an employee of the company who was injured as a result of the condition of the guy. In this case a guy wire had been attached to a pole of the Oconto Service Company by another company, and the Oconto company claimed that it was not responsible. The commission held that the "respondent, chargeable with the condition of the guy wire, could easily have remedied it and thus prevented the injury. It failed, however, to take action in any manner and thus, we believe, violated the orders in question."

Customer-Ownership Problems Discussed by Insull Managers

THE importance of the customer-ownership idea and the present state of the utility market were points discussed before the managers of the Insull properties at a two-day conference held recently at Chicago. Executives and managers came from Illinois, Wisconsin, Indiana, Missouri, Oklahoma, Texas, Nebraska, Kentucky, Maine, New Hampshire, Vermont and New York. They were highly enthusiastic over the success attained in promoting the cutsomer-ownership plan. These delegates represented more than 56,000 stockholders and 28,000 bondholders in the Insull properties. The discussion brought out a feeling that the central-station companies are now in better condition than non-regulated utilities, since the former companies experienced little inflation and therefore have not felt severely the effects of deflation. The delegates considered the customer-ownership financing plan as the coming major factor in obtaining new capital and discussed the methods pursued in selling more than $12,000,000 worth of securities to the customers of the Middle West Utility Company and its subsidiaries The $11,000,000 in securities sold to the customers of the Commonwealth Edison Company was also a topic of comment.

Martin J. Insull spoke on the investment requirements for 1922, and "The Public Utilities as a National Institution" was discussed by E. Hill Leeth of Halsey, Stuart & Company. John F. Gilchrist talked about the customer ownership of public utilities, and F. H. Scheel recounted some successful selling methods for floating securities.

Western Inspectors Recommend Few Changes in National Electrical Code

AFTER adopting a resolution on Jan. 19 that their association would adhere to the National Electrical Code and that they would use only inspected electrical appliances and would deprecate and discourage divergence therefrom until the fullest opportunity had been given for discussion, the Western Association of Electrical Inspectors, meeting at Chicago, invited the National Contractors and Dealers' Association, the Associated Manufacturers of Electrical Supplies, the Electric Power Club, the Electrical Supply Jobbers' Association, the National Association of Electrical Inspectors, the National Board of Fire Underwriters, the Underwriters' Laboratories, the National Fire Protection Association, the N. E. L. A. and the International Association of Municipal Electricians to take similar official action. In adopting this resolution the association was governed by the fact that the sale and use of unapproved electrical devices tends to destroy the advantages sought from co-operative effort by the industry. To obtain this co-operation two representatives were appointed to confer with representatives of other bodies.

Summing up the underground situation, F. S. Sengstock said that there was considerable difference of opinion among engineers as to the proper duct beds, manholes and types of ducts. Suitable insulation and protection formed another point of difference. The voltages of cables were often three or five times that of the system the cables were to operate. This, indeed, seemed to be the rule rather than the exception. Another point of difference was the fact that engineers often called for lead-sheathed cable with a sheathing two or three times that required by the Underwriters' Laboratories and accordingly had trouble because of the Leyden jar effect on the extra-heavy sheathing.

Although the committee on the National Electrical Code reported no recommendations for amendments to it and although the chairman had decided to submit no report, several suggestions for changes were received by the chairman on Dec. 1. One suggestion involved a change on high-tension systems to give specifications covering the construction and installation of busbars, wiring switches and instruments. This proposal was referred to the chairman of the electrical committee, who assigned it to a sub-committee for an investigation and report.

The committee on theater wiring and show equipment, F. V. Lucas chairman, recommended a change in Rule 38J by adding this sentence: "All dressing rooms must be provided with a separately fused outlet, together with a switch marked 'heater outlet.'" A change in Rule 38F was recommended that would cause it to read as follows: "An independent master connection must be provided on each side of the stage of at least 100 amp., properly fused and provided with terminals for connecting cable. These are to be used for connecting plugging boxes which require current in excess of the regular 50-amp. stage pockets." In discussing the requirement of a switchboard for controlling stage lights for small halls or school auditoriums, the general sentiment of the association was that it would work too great a hardship on the owner of the hall.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Northern Indiana Contracts.—The Northern Indiana Gas & Electric Company has petitioned the Indiana Public Service Commission to approve a number of contracts which the company has entered into with some of its large power consumers in Hammond, East Chicago, Indiana Harbor and Whiting. The contracts provide for electric power at the present rate, with a 20 per cent surcharge. They are to be in effect until June, 1923.

Health Hints by Wireless.—A semi-weekly "wireless telephone health bulletin service" has been inaugurated by the United States Public Health Service. It is planned to broadcast every Tuesday and Friday through the naval radio station at Anacostia, Va., a message of advice on how the average man and woman may insure continued good health. Under very favorable weather conditions it is expected that the messages will be heard on the Pacific Coast, in Europe and the north part of South America.

Canadian Maritime Provinces Have Potential Water Power of 500,000 Hp.—It is estimated by the Department of the Interior at Ottawa that there are hydro-electric power resources in the Provinces of New Brunswick and Nova Scotia capable of developing 500,000 hp. on a commercial basis. The largest single possible source of power is at Grand Falls, N. B., but the cost of development and the distance to a profitable market have thus far prevented development there. Eventually it is hoped that their will be a network of transmission lines covering the Maritime Provinces, interconnected to equalize the service and carrying power to every corner.

Fourth Circuit Between Niagara and Toronto Under Way.—A saving of about 15 miles in distance and of nearly $500,000 in the cost of the new transmission line of the Ontario Hydro-Electric Commission between the Queenston plant and the city of Toronto is being effected by carrying the line across Burlington Beach, on Lake Ontario, instead of through Hamilton, further north. The existing towers are 880 ft. apart, which, the *Canadian Engineer* says, is a record span for swinging electric cables. When the new line is completed the "Hydro" system will have four complete circuits between Toronto and Niagara capable of carrying 200,000 hp. This is exclusive of the two circuits of the Electrical Development Company, soon to be absorbed.

Salt Lake City's Ornamental Lighting System Celebrated. — A banquet given by the State Street and Broadway improvement associations of Salt Lake City, Utah, was held at the Newhouse Hotel recently to celebrate the inauguration on Oct. 5 last of the city's new "white way" lighting system, one of the most modern in the United States, reference to which was made in the Electrical World for Oct. 22, page 837, and an attractive souvenir program and menu card has been issued.

North State Power Company Seeks Higher Rates.—The North State Power Company is petitioning the State Corporation Commission of North Carolina for an increase in rates for lighting and power of approximately 30 per cent. The North State Power Company bought the business of the Cumberland Railway & Power Company, which, it is maintained, was operated at a loss while in receivership. The rates now in force and from which the company is asking relief are the same as those under which the concern went upon the rocks.

First Step Taken in Davis Bridge Development.—The New England Power Company has awarded a contract to the Rollin Construction Company, Boston, for the driving of a tunnel of 25-ft. diameter and 1,600 ft. long, through the hill country near Davis Bridge, Vt., as a preliminary step in the ultimate construction of a 20,000-hp. hydro-electric development long under consideration at this point. Work will begin immediately on the tunnel, which is necessary to free the river bed in case it is later decided to proceed with the construction of a dam capable of backing the water up about 10 miles for storage purposes in connection with the company's hydro-electric plant service. A development involving two 10,000-hp. units is under consideration for Davis Bridge, but, contrary to press reports, only the tunnel work has as yet been authorized. Work is progressing rapidly on the automatic hydro-electric plant of the company at Searsburg, Vt., rated at 5,000 kva.

"Joint Electricity Authority" for London.—Approval has finally been given, the *Engineer* asserts, by the Electricity Commissioners for the establishment of a "joint authority" on the lines of the proposals made by the London County Council, local authorities owning electricity undertakings and a number of the principal supply companies. Under this scheme a progressive closing of existing stations would take place during the next few years, and supplies of energy would be taken in bulk from other stations by an interconnecting cable system. In the second stage of the work, which has been modified by the Electricity Commissioners, a large riverside station, with a rating of about 200,000 kw., would be built to reinforce the supply from the group stations retained during the earlier stage of development. The first of the big new capital stations to be sanctioned would be the 100,000-kw. station of the County of London company at Barking.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical Supply Jobbers' Association.—The Atlantic Division of this association will hold its next meeting on Feb. 28 at the Hotel Commodore, New York City.

Section Meetings of the A. I. E. E.—Institute meetings still to be held this month include: Fort Wayne, Feb. 16, "The History and Future of Niagara," Frank B. Taylor; Baltimore, Feb. 17, "The Hell Gate Station," H. W. Leitch; Schenectady, Feb. 17, "Magnetism," L. T. Robinson; Cleveland, Feb. 21, "The Superpower System," W. S. Murray; Erie, Feb. 21, "Safety Engineering," M. C. Goodspeed; Atlanta, Feb. 23, "Bloom Mill Electrification," S. N. Roberts; New York (with A.S.M.E.), Feb. 24, "Central-Station Operation;" Utah, Feb. 24, "Wireless on Wire Lines," C. C. Pratt.

Rocky Mountain Electrical Co-operative League.—P. M. Parry, commercial manager of the Utah Power & Light Company, has been elected chairman of the advisory committee of this league for the year 1922. Mr. Parry has been a central-station-company representative on the committee since the foundation of the league a year ago and is thoroughly familiar with its workings and an ardent believer in co-operation. The other officers of the committee are J. A. Kahn, president of the Capital Electric Company of Salt Lake City, vice-president, and R. M. Bleak, superintendent of lighting and appliance sales, Utah Power & Light Company, secretary-treasurer.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Cleveland, Feb. 13; Pittsburgh, Feb. 18; Birmingham, Feb. 25; Philadelphia, March 4; Chicago, March 15.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

A. I. E. E. Section Meetings—Fort Wayne, Feb. 16; Baltimore, Feb. 17; Schenectady, Feb. 17; Cleveland, Feb. 21; Erie, Feb. 21; Atlanta, Feb. 23; New York, Feb. 24; Utah, Feb. 24; Vancouver, March 3.

American Physical Society—New York, Feb. 25.

Prime Movers Committee, N. E. L. A.—Pittsburgh, Feb. 27-28.

Electrical Supply Jobbers' Association—Atlantic Division, New York, Feb. 28.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association — Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Supreme Court in New Jersey Can Set Aside Commission Order as "Unjust and Unreasonable."—The action of the Supreme Court of New Jersey (in Hackensack Water Company vs. Board of Public Utility Commissioners) in setting aside an order of the commission as unjust and unreasonable amounted to a declaration that the evidence before the board did not justify its order, and the court's finding was therefore not in conflict with the law, the Court of Errors and Appeals has asserted, and the Supreme Court's decision that the increased rates asked by the water company and opposed by the commission should be paid pending a rehearing on appeal was merely declaratory of the company's statutory right and not a usurpation of jurisdiction. (115 At. 128.)*

Contract Right to Construct Tunnel Under Land of Another Not Lost by Laches.—The Supreme Court, Appellate Division, of New York State has affirmed the judgment of the Supreme Court, Niagara County, in Hydraulic Power Company of Niagara Falls vs. Pettebone-Cataract Paper Company and in Same vs. Cataract City Milling Company (see ELECTRICAL WORLD for Oct. 2, 1920, page 704), to the effect that the right under a contract executed in 1900 to construct a tunnel for water-power purposes under the land of another person at some future indefinite time cannot be lost by laches merely because construction was not started until 1914, the only substantial change in circumstances lying in the enhanced value of electric power for manufacturing and like purposes. (191 N. Y. S. 12.)

Use of Tree to Fasten Guy Wire Does Not Impose Duty to Keep Tree Safe.—In Piculian vs. Union Electric Light & Power Company damages were sought for personal injuries caused by a limb falling from a tree to which guy wires of the defendant company were attached, the contention being that a beam placed in the tree by the company had killed the tree, thereby rendering the company liable for injury due to the decay of its branches. It was shown that the tree had been partly dead for several years before the accident and that the limb that fell was not in contact with the beam, but higher up. The St. Louis Court of Appeals found that the tree was not a part of the company's line and that the owner of the abutting property, who in this case was the plaintiff, was responsible for keeping it in a safe condition. (234 S. W. 1006.)

Contributory Negligence of Lineman Bars Recovery for Death.—A telephone lineman who knew that an electric light wire a little above the telephone wire which he was to repair and on the same pole was uninsulated, and who had been instructed by his employer to request that the current be shut off if he had to work in proximity to it, was contributorily negligent as a matter of law in going to work on the telephone line without requesting that this current be shut off and in working with one leg over a grounded telephone wire while his head was in close proximity to the electric light wire. So holding, the Kansas City (Mo.) Court of Appeals sustained the lower court's refusal, in Rosser vs. City of Fayette, to award damages because of the fatal injury. (235 S. W. 153.)

When Shying Mules Demolish Pole, the Mules, Not the Pole, Are Proximate Cause of Injury.—One Cundiff having brought suit against the city of Owensboro, Ky., because of injury sustained when a team of mules left the roadbed and struck an electric light pole alleged to be defective, breaking the pole and then running away, the trial court directed the jury to bring in a verdict for the city. This instruction has been sustained by the Court of Appeals of Kentucky, which declared that, the facts being admitted, only a question of law remained, which was rightly settled when the trial judge decided that the shying of the mules and not the defective condition of the pole was the proximate cause of the injury. A municipality, moreover, is not an insurer of the safety of its ways, but is only bound to exercise ordinary care. (235 S. W. 15.)

Company's Only Duty to Licensee on Its Property Is to Refrain from Wilfully Injuring Him.—In two suits brought by one Hafey against the Dwight Manufacturing Company and the Turners Falls Power & Electric Company respectively damages were sought for the death of a man killed by the contact of a steel fishing pole he was carrying with an uninsulated 13,200-volt line owned by the latter company and installed in a lot belonging to the former. This line was said to have sagged within 10 ft. of the ground. The lot was commonly used for ball games, but could be reached only by a railroad bridge across which all were warned by a "no trespassing" sign not to go. The Supreme Judicial Court of Massachusetts held that the victim was at the utmost a licensee on this property, even though there was a well-worn path across it on which he was walking, and that neither company owed him any duty except to refrain from willfully injuring him. The court further held that the plaintiff, being only a licensee, was not harmed by the exclusion of expert testimony as to whether the transmission line was properly installed. (133 N. E. 107.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Business Conditions and Depreciation Reserve.—On account of business depression the Tuma Light, Gas & Water Company has been authorized by the Arizona Corporation Commission to set aside only two-thirds of the usual annual depreciation reserve, thus enabling the company to lower rates. The remaining one-third is to be carried forward and amortized the following year or as soon as circumstances will permit.

Faulty Method of Calculating Cost of Renewals and Replacements. — The Pennsylvania Public Service Commission in proceedings to fix rates for a combined gas and electric company pointed out that an estimate of an allowance for renewals and replacements based upon reproduction cost, grouping the items according to their life expectancy, determining the total annual requirements and expressing the same as a percentage of the cost new of the depreciable property less the salvage value, was erroneous when the resulting percentage was then applied to an estimated cost new of the property based upon peak prices.

Redding Entitled to Wholesale Rate.—By an order of the California Railroad Commission the city of Redding is held to be entitled to the wholesale rate in its purchase of power from the Pacific Gas & Electric Company. The city recently took over, upon valuation fixed by the commission, the local electric distributing system and entered into a contract with the Pacific company to purchase the power at the local substation. The company offered the city its resale rate, but the city contended it was entitled to the wholesale rate. It is estimated that the city will save from 5 to 10 per cent on its power bill through the commission's decision in its favor.

Apportionment of Capital Stock.—To take the capital stock of a gas company and electric company which have been merged twenty-seven years as a basis for allocating the present capital stock between the gas business and the electric business would obviously be unfair, since it would assume an identical increase on the part of the two utilities, the Public Utilities Commission of Connecticut said in a rate proceeding affecting the Stamford Gas & Electric Company. The commission's method involved a comparison of the gross operating revenue and the total operating expense of each department together with the respondent company's average figures for each of these departments.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

William C. Clarke has been appointed general manager of the Westerly (R. I.) Light & Power Company and of the Mystic Power Company, with headquarters at Westerly, succeeding the late M. H. Spellman. Mr. Clarke has been an executive in Rhode Island utility circles for about fourteen years and has been in close touch with developments south and west of Providence in the central-station and traction fields since 1901. He was educated at the Rhode Island State College and the Massachusetts Institute of Technology. He was chief clerk in the office of the Sea View Railroad Company in 1901 and also served in this capacity for the Narragansett Pier Electric Light & Power Company. In 1909 he was made general manager of these properties and also of the Wickford (R. I.) Light & Water Company. Upon purchase of the Sea View Railroad by the Rhode Island Company he was retained as superintendent of the Sea View division and was also made superintendent of the Narragansett Pier Railroad, a steam road. In 1916 Mr. Clarke resigned from railway work and became an assistant to the general superintendent of the Narragansett Electric Lighting Company of Providence, still devoting part of his time to the Narragansett Pier and Wickford lighting companies, of which he retains the managership.

W. C. CLARKE

W. B. Head has recently been elected chairman of the board of directors of the Texas Power & Light Company and the Dallas Power & Light Company. This position makes Mr. Head a leading figure in the electrical industry in the State of Texas. Mr. Head was born in Arkansas and went to Texas in 1895, where he engaged in teaching. Three years later he organized what was known at that time as the Head Telephone Company. In 1900 Mr. Head engaged in the electric light and power and ice business at Grandview and in 1905 acquired control of the Stephenville Light & Water Company. He became associated with Colonel Strickland in 1910, serving as general superintendent of the lighting properties owned by the Strickland interests at that time. Two years later he was one of the incorporators of the Texas Power & Light Company, to which he sold his electrical interests. Mr. Head was active in the acquisition of all the properties of the Texas Power & Light Company and became vice-president of the Dallas Power & Light Company and the Dallas Railway Company when the properties were taken over by the Strickland interests. Subsequently he was made vice-president of the Texas Power & Light Company.

R. E. Fisher, formerly manager of the commercial department of the Pacific Gas & Electric Company, San Francisco, has been elected a vice-president of the company in charge of sales. Mr. Fisher has been active for years in developing the use of electrical energy in the agricultural districts of central and northern California. He was born in Kansas in 1882. His first position in the electrical industry was that of salesman for the General Electric Company. Two years later he entered the electrical contracting business under the name of Kurtz-Fisher Company. In 1909 he became connected with the newly formed Pacific States Electric Company, assisting in the organization and development of its sales policy. In 1911 he was employed by the Pacific Gas & Electric Company, and he was placed in charge of the commercial department of that company in the latter part of 1920.

R. E. FISHER

Dr. Harold Pender, recently appointed chairman of the standards committee of the American Institute of Electric Engineers, is director of the department of electrical engineering, University of Pennsylvania. Dr. Pender was born in 1879 and was graduated from Johns Hopkins University with the degree of A.B. in 1898, receiving the degree of Ph.D. from the same institution in 1901. Following graduation he was instructor at the McDonough School and during the following year was instructor in physics at Syracuse University In 1903 Dr. Pender went to the Sorbonne, Paris, at the invitation of the French government, to make certain experiments on the magnetic effect of a moving electric charge. Following his return from Europe, Dr. Pender entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company and was subsequently made a member of the engineering staff of that company. From 1904 to 1909 Dr. Pender served in a consulting capacity for various railroads and power companies. In 1909 he became connected with the Massachusetts Institute of Technology as professor of electrical engineering and in 1914 was appointed professor in charge of the department of engineering at the University of Pennsylvania. In the last seven years Dr. Pender has been successively manager and vice-president of the Institute of Electrical Engineers. He served on its standards committee from 1914 to 1920. In the summer of 1921 he was appointed chairman of this committee by President McClellan. In addition to his educational activities, Dr. Pender has served as consulting engineer for several firms and has done considerable work as a patent expert. He is the author of a large number of textbooks and contributions to the technical press.

HAROLD PENDER

Frederick W. Prince has resigned his position as advertising manager of the Westinghouse Lamp Company. Mr. Prince has had varied experience in the electrical industry, having been connected with both central-station and manufacturing companies. After being graduated from Trinity College, Hartford, Conn., with a B.A. degree, followed by a special electrical engineering course, he entered the employ of the Hartford Electric Light Company in its testing department. Two years later he became superintendent of construction for the company and with the expansion of its facilities in 1907 was appointed manager of the lighting department. As such he had charge of all commercial relations with the public. In 1917 he resigned this position to accept the post of commercial engineer of the Franklin Electric Manufacturing Company. When that company was purchased by the Westinghouse Lamp Company Mr. Prince came to New York in the commercial engineering department of the latter company. In the fall of 1919 he was appointed advertising manager of the company, the position he held at the time of his resignation. He is a member of the N. E. L. A. and the I. E. S. Mr. Prince is maintaining headquarters for the present in the Singer Building, New York City.

F. W. PRINCE

Philip Seabury Smith has resigned as chief of the Latin-American Division of the Bureau of Foreign and Domestic Commerce to become associate editor of *Ingeniería Internacional.* Mr. Smith is well-known for his engineering and industrial investigations carried on in Spain and South America. He is a graduate in electrical engineering of Yale University, class of 1907, and immediately on his graduation entered the employ of the General Electric Company, where he remained for about nine years, holding several important positions. From the foreign department of this company he went to the Department of Commerce in March, 1916, and remained in that connection until the present. During this time he made a trip of two and one-half years through the West Indies and South America to investigate and report on the opportunities for the sale there of electrical material and the investment of capital in hydro-electric enterprises. In 1919 he made similar investigations in Spain and the following year went again to South America. He was Commercial Attaché to the American Ministry in Lima, Peru, before being appointed to his last position.

George D. B. Van Tassel has been appointed by the Whitlock Coil Pipe Company to represent its interests in Detroit and its vicinity.

Carl G. Schluederberg, assistant to the manager of the supply department, Westinghouse Electric & Manufacturing Company, left New York City recently on an extended trip to South America. He will spend three months in studying electrical merchandising business conditions in Latin America in the interest of the Westinghouse company and will visit points in Chile, Peru, Uruguay, Paraguay and Brazil. Mr. Schluederberg was graduated from the School of Electrical Engineering of Cornell University in 1902 and in that year entered the employ of the Westinghouse Electric & Manufacturing Company, taking up the company's college graduate apprenticeship course. After a year in the shops, he was transferred to the Pittsburgh sales office. In 1905 he entered upon company research work, doing electrochemical as well as post-graduate work at Cornell University. He continued at Cornell until 1908, when he completed this work and was awarded the degree of doctor of philosophy and a degree in chemistry. He also spent some time abroad on special investigations and subsequently became associated with the Carnegie Steel Company in electrical and metallurgical work. In 1910 Mr. Schluederberg returned to the Westinghouse company as commercial engineer in the supply department and from 1911 until 1915 was in charge of switchboard work. Since 1915 he has been assistant to the manager of the supply department, in charge of various phases of its work including central stations, railways, syndicates, licensees and educational work. He is a member of a number of engineering and other societies and has been particularly active in the American Electrochemical Society. He has published a number of articles covering original research work on electrochemical activities and developments.

C. G. SCHLUEDERBERG

Obituary

Robert Knight Dana, for many years a copper wire manufacturer, died of pneumonia at his home in New York on Feb. 1. Mr. Dana was seventy-five years old.

Ernest L. Munger, for twenty-six years superintendent and manager of the Gloucester Electric Light Company, dropped dead at his home on Jan. 21. Mr. Munger was superintendent of the Gloucester Electric Light Company for twenty-three years before being promoted to the position of general manager of that company in 1918. He was born in Torrington, Conn., in 1868. Mr. Munger was one of the most widely known electric light and power executives in New England.

Dr. Edward Hopkinson, M. P., died on Jan. 15 at his home in Alderley Edge, England. He was born in 1859 and was graduated from the University of London in 1881 with the degree of doctor of science in the branch of electricity. The year following his graduation he became assistant to Sir William Siemens, continuing with him until the latter's death. Dr. Hopkinson was a pioneer of electric traction. In the year 1884 he joined the firm of Mather & Platt and took charge of their electrical engineering department. In 1887 he became a partner in the firm, and when the firm was converted to a limited company in 1892 he was one of its managing directors. While he was a member of this firm the first full-gage electric railway in England was constructed, Dr. Hopkinson being responsible for the design of the electric locomotives. He was also vice-chairman of the Chloride Electrical Storage Battery Company. Dr. Hopkinson took out many important patents and was the designer of the "Manchester" dynamo and motor and of various improvements in connection with dynamos and the application of electricity. He was a past-president of the Institution of Mechanical Engineers, a member of the council of the Institution of Electrical Engineers and a first chairman of the Manchester Section. He was also active in a number of other technical societies. Dr. Hopkinson entered Parliament in 1918 as Unionist member for the Clayton Division of Manchester.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Locust-Pin Demand Gaining

THERE has been a considerable increase in the demand for locust pins since Sept. 1 last, according to a large manufacturer of this class of material, and sales at present are at least 50 per cent better than they were six months ago. Business is expected to increase steadily all during the spring months so that by the time the construction season is reached the full production of manufacturers will be engaged. During January shipments ran slightly ahead of production, which at the present time is estimated to be between 90 per cent and 95 per cent of normal. Deliveries have been good all during the fall and winter, but there is some doubt expressed by producers that this will be the case next spring. It is predicted also that there will be a considerable increase in the prices of pins within the next three months. The supply of locust timber is becoming limited, according to manufacturers, and the owners of it are disposed to make the price higher and are in a position to do so.

Spotty Conditions in Fuse Market, but General Tone Better

SALES of fuses since the first of the year have been more or less spotty, most manufacturers reporting conditions improving over six months ago and a few stating that the market is upset by price cutting. The situation taken as a whole is as good as the average conditions in general industry, and the prospect is for a healthy increase in sales during the spring. The majority of producers appear to be working on a 10 per cent to 15 per cent better basis than last September, and one reports doing double the business of six months ago.

The main cause for this improvement can be summed up in the words "increased construction." Permits for residences have climbed steadily, not only in the South and the Southwest, where building may be expected to go ahead during the winter, but in the Middle West, the East and New England. The type of building going on now, it is true, requires fewer and cheaper fuses than does industrial construction; but volume of sales has been increasing nevertheless. Other factors in the bettering of the situation have been an easier financial market, greater confidence in prices and absorption of overstocks, permitting dealers and jobbers to order up to their requirements. Deliveries of raw materials to manufacturers and of the finished products to jobbers and dealers were never better.

Prices have been fairly well stabilized since Jan. 1, though there are some who claim that the absence of price change is merely a lull between price wars. This view is not widespread. It is true that the fall of 1921 saw as keen competition in this market as has been experienced in years, but there is little doubt that now manufacturers and jobbers have about reached bottom and that it would be suicidal to go further on the price-cutting path. There may and probably will be some adjustment still, but it will result from economy of manufacture or distribution and not from a desire to make sales without regard to profit or loss. To say that the market is absolutely stable is to guess, but at least liquidation is slowing up and should soon come to a halt.

Sales are likely to remain at their present level for the next two months, the reason being that building will not increase before that time, while those buildings started in the fall have already been supplied with electrical material. After that the rise of the sales curve should be rapid and continuous. In comparison with the entire electrical industry the wiring material manufacturer may count himself fortunate in his connection with the building industry. No other industry in 1921 so nearly approached the 1920 figure as did construction, and no other is expected to go ahead so fast this year.

Japanese 1918 and 1919 Electrical Imports Largely from America

THE Japanese market for foreign-made electrical goods was practically controlled by American manufacturers in 1918 and 1919, according to figures obtained by the Bureau of Foreign and Domestic Commerce from the Electrical Bureau, Department of Communications, Tokyo, Japan. In 1918 only two other countries, Great Britain and Switzerland, are listed as exporting electrical goods to Japan, and the amounts are negligible. During the following years Sweden and Kwantung Province were added to the list, but even so the total of electrical exports to Japan from all countries other than the United States are much less than those from the latter country.

The grand total of imports for 1918 was valued at $2,524,114. Of this amount $2,361,777 worth, or 93.6 per cent, came from the United States. Only two kinds of material, waterwheels and meters, were imported from Switzerland, the total valued at $116,357. Great Britain supplied generators, motors and parts, converters, switchboards, meters, storage batteries, insulated wire and electric cars, but only in very small quantities. The United States sold Japan all these articles and in considerably larger amounts. Those articles imported in largest amounts from this country were generators connected with motors, valued at $241,241; generators and motors separately, $1,497,619, and meters $384,925.

DETAILED IMPORTS FROM PRINCIPAL COUNTRIES TO JAPAN OF PRINCIPAL KINDS OF ELECTRICAL MACHINERY, ETC., IN 1918

	United States of America	Switzerland	Great Britain
Waterwheels....	$16,031	$16,148	..
Generators connected with motors.....	241,241	.	. .
Generators, motors and parts..........	1,497,619	...	$22,911
Transformers.	7,386	.....	....
Converters............	97,398	......	1,093
Switchboards and parts..	18,760	......	2,438
Electric meters........	384,925	100,209	18,502
Storage batteries	10,771	....	101
Wires for marine telegraph and telephone	3,315	....	...
Insulated electric wire...............	37,420	.....	756
Electric cars and parts...............	46,911	. ...	179
Total...........................	$2,361,777	$116,357	$45,980
Grand total..........................			$2,524,114

PRINCIPAL COUNTRIES FROM WHICH ELECTRICAL MACHINERY, ETC., WERE IMPORTED INTO JAPAN IN 1919

Countries	Quantities (Lb.)	Value
Great Britain.	1,142,532	$414,252
United States of America	5,829,331	2,652,019
Switzerland . . .	898,399	486,536
Kwantung Province	22,133	4,985
Sweden .	185,330	145,562
Total	8,077,725	3,703,354

In the following year imports from Great Britain increased over 900 per cent, while those from Switzerland grew about 400 per cent. American exports to Japan increased only a few per cent, but were still more than double the total from all the other countries. Commodities are not listed for 1919. It is interesting to note that Sweden entered the market with sales amounting to $145,562. The grand total was 50 per cent ahead of 1918.

Figures for 1920 are not complete, failing to list countries of origin. The yearly total was only slightly ahead of 1920 in value, but considerably less in volume. It is probable that 1921 figures will show the reverse. Dynamos, motors, transformers, converters, armatures and dynamos combined with motive machinery occupied the most prominent place, being imported to a value of $3,372,117. Imports of meters of all kinds came to $571,144.

IMPORTATION OF ELECTRICAL APPARATUS INTO JAPAN IN 1920

Kind	Quantity (Lb.)	Value
Ammeters and voltmeters	49,878	$154,530
Wattmeters	97,151	152,665
Other meters	....	263,949
Accumulators	....	41,269
Dynamos, electric motors, transformers, converters and armatures	7,366,417	3,030,936
Dynamos combined with motive machinery	....	341,181
Total	7,513,446	$3,984,530

(Detailed statistics of import, by countries, for 1920, not yet available)

As shown by figures in the article on Japanese exports in the Feb. 4 issue of the Electrical World, the balance of trade in electrical goods for the years 1918 and 1919 was decidedly in favor of Japan. Exports in 1918 were $7,995,063 against imports of $2,524,114, while in 1919 imports of $3,703,524 were overshadowed by exports of $6,022,374.

Quiet Safety Switch Market with Spring Increase Expected

MANUFACTURERS of safety switches state that January sales ran about even with those of the last quarter of 1921. In some cases a slight decrease was noted but has caused no discouragement, being considered more or less seasonal. The last three months of 1921 saw demand slowly getting under way as building increased so that manufacturers, jobbers and dealers have had an opportunity to get rid of overstocks. Buying, it is true, has been of the hand-to-mouth variety all this time, but orders are frequent and now show a tendency to become more liberal. The reason for this is undoubtedly greater confidence in the stability of prices. Several companies have reported better buying by central stations whose purchasing power has increased during the last year and which will probably increase their buying during the spring months. It is interesting to note that sales of the safety-type switch seem to be improving more rapidly than those of the open knife switch.

The question of price has been an important one for the last six months, and many orders are still being sought strictly on a price basis. The opinion of manufacturers on the matter of increases from present prices is divided, some considering it a good move and others an unwise one under today's conditions, but all believe that liquidation is practically over. Quotations were reduced steadily throughout 1921, every manufacturer having dropped quotations from three to four times in that period. Some producers feel they have gone too far in this movement and have now got their prices below production costs. Added to this is the gradual recovery of prices of raw materials, such as copper, steel, fiber and slate. Under all these circumstances it is felt that it would not be surprising to see the manufacturers increase their net quotations in the spring. If this does not happen, the increases in production costs must be equalized by more economical manufacturing and sales systems.

The outlook for the next six months is at least satisfactory. The first quarter may not show quite such good sales as the fourth quarter of 1921, but after April 1 demand is expected to show a steady increase, and one which will possess all the element of permanence. The market without doubt will remain highly competitive, but there will be less and less price cutting as time goes on and manufacturers realize that they must make a profit in order to stay in business. The business is inextricably tangled, of course, with the building industry, and as that goes next spring so will go the safety-switch market. Judging by figures on contemplated work, safety-switch manufacturers will have all they can handle if 75 per cent of this construction goes through. Several estimates place probable 1922 business at 125 to 150 per cent of 1921 volume.

German Electrical Exports Increase

DECEMBER exports of electrical goods from Germany showed a slight increase, according to a report received by the United States Department of Commerce. The figures for all exports show a balance of trade favorable to Germany, the first recorded since the beginning of 1921. December imports were valued at 13,700,000,000 paper marks, while exports were valued at 14,600,000,000 paper marks. The volume of trade, however, showed an unfavorable balance by about the same ratio.

Metal Market Situation

LARGE selling agencies toward the end of last week reduced the price of electrolytic copper to 13⅝ cents per pound for February and March delivery. Smaller producers and agencies had been selling at this level for several days and are reported to have gone as low as 13½ cents in a very few cases. There are large amounts of distress metal on the market. All this flurry would seem to have been caused by the prospective opening of the mines. These low prices are said to have resulted in a number of inquiries from wiredrawers and brass makers, but so far little business has resulted.

Speaking in this connection, it is becoming increasingly evident that the heavy buying in November and December did not mean greater consumption, but rather the fear of consumers that there might be a shortage this spring. In some cases the needs of both the first and second quarter of 1922 were taken care of and such buyers are entirely out of the market now. If there is considerable activity in the automobile industry this spring, the copper market will feel it through the brass manufacturers.

Domestic consumption, it is estimated, will remain for several months at about 60,000,000 lb. of virgin copper per month. Foreign buying probably will do well if it keeps to 50,000,000 lb. per month. Output from all sources now totals about 65,000,000 lb. per month, so that those mines that are resuming will have to keep down their output to about 40,000,000 lb. monthly or else run the risk of building up another shortage. Most mines in this country will have resumed operations by April 1.

NEW YORK METAL MARKET PRICES

	Jan. 31, 1922	Feb. 7, 1922
Copper:	£ s. d.	£ s. d
London, standard spot	64 0 0	61 10 0
	Cents per Pound	Cents per Pound
Prime Lake	13.50-13.62½	13.37½
Electrolytic	13 37½	13.00-13.25
Casting	12.75-12.87½	12.75
Wire, base	15.00-15.25	14.50-14.75
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.40	4.40
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.85 4 90	4.82½-4.87½
Tin, straits	32.00	31.75
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	Jan. 31, 1922	Feb. 7, 1922
Heavy copper and wire	11.00-11.25	10.75-11.00
Brass, heavy	5.00 -5.25	4.75- 5.00
Brass, light	4.50 -4.75	4.25- 4.50
Lead, heavy	3.50 -3.75	3.50- 3.75
Zinc, old scrap	2.00 -2.25	2.00- 2.12½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical market has been in a state of uncertainty the last week, though all indications are that when the wavering is done demand will be found to be on the upward path. Conditions seem to have improved in the East more quickly than in the Middle West and West. New York jobbers report a fairly satisfactory total for January and one larger than had been expected. Wiring supplies there are being bought on a hand-to-mouth basis though orders are numerous. One jobber reports closing two large South American orders for wiring supplies. The Landis award has been accepted by the Building Trades Council of Chicago, and building prospects there are brighter than they have been for months.

New York reports two price changes, one of 5 per cent less on flexible armored conductor and a readjustment on some items on the heating appliance list. Boston notes weaker prices on some wiring supplies as well as rigid conduit, elbows and couplings.

NEW YORK

Without trying to inject a false note of optimism into the general situation, conditions in the electrical trade appear to be decidedly on the up grade. A particularly good indication of this is the fact that while business has been moving along steadily without any startling breaks, the total sales by jobbers since Jan. 1 have been much better than the day-to-day impression would suggest. Wiring supplies are moving fairly well, but the orders for the most part are for small quantities, showing that there is still a strong tendency toward hand-to-mouth buying. Export business has increased somewhat and one jobber reports having filled two good-sized orders for general wiring material for South American shipment during the past month.

Two price changes were announced this week. Manufacturers have reduced the price of flexible armored conductor by about 5 per cent, which brings this material back to about the same level as quoted just prior to the recent shortage. The other change in prices is announced by the Simplex Electric Heating Company, which has revised its list prices on heating appliances. Not all items of the line have been reduced. The maximum reduction is about 10 per cent on one type of electric ranges and from 5 to 10 per cent on some of the small appliances.

Conduit.—No change in price was noted this week. Demand is moderate, but sales are steady, with jobbers' stocks in fairly good shape. Prices were quoted this week as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $46; ¾-in., $57 to $59, and 1-in., $82 to $84 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft.

Rubber-Covered Wire.—Little change has been noted in the wire market, except that prices appear to have stiffened without any change in quotations. No. 14 rubber-covered sells for $6.50 per 1,000 ft. in 5,000-ft. lots. Stocks are ample to good.

Flexible Armored Conductor.—A reduction of about 5 per cent has been announced by the manufacturers. No. 14 two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $45 per 1,000 ft. in that quantity. Demand is a little easier, but this is probably on account of better stocks in jobbers' hands and prompt deliveries from manufacturers.

Lamp Cord.—Sales are moderate and jobbers' stocks are good. No. 18, cotton-twisted, is quoted at $12.90 per 1,000 ft., and the parallel at $15.60 per 1,000 ft. Silk cord is moving slowly. The same sizes in silk twisted sells for $25.20 per 1,000 ft. and the parallel at $27.40 per 1,000 ft.

Tape.—Both friction and rubber tape are quoted at 36 cents per pound in 100-lb. lots. Demand is moderate and stocks are fair.

Heating Appliances.—A revised price list on Simplex appliances has been issued. The new prices show a reduction of about 10 per cent on one type of electric range, and on the smaller devices the reduction varies from 5 to 10 per cent. The prices on some items remain unchanged.

Radio Equipment.—All jobbers report an active demand for wireless equipment, of which there is an acute shortage. Small telephone receiving outfits are moving rapidly, and dealers report an undiminished demand for parts.

CHICAGO

The outstanding event of the week was the announcement on Saturday morning that the Building Trades Council had accepted the Landis wage award. The members also agreed to work with non-union men until the situation had time to iron itself out and until they had regained the public confidence. While this may not settle the entire controversy another step has been taken in the right direction which will lead to a revival in the building industry.

Business in electrical lines has been fair and steady, with few pronounced sales of any particular items. The demand for wiring materials had an even movement and no price changes are evident. Motor sales have not increased materially for some months. High tension equipment is selling fairly well. A reduction in outlet boxes of ten points has been reported. Lamp sales are steady and the mill type seems to move the easiest.

Wire.—The demand for wiring materials has been steady, but few large orders have been reported. The general activity on No. 14 rubber-covered wire has been fair but not very pronounced. It sells for $6.75 to $6.85 per 1,000 ft. in 5,000-ft. lots and jobbers' stocks are in fair shape. Movement of weatherproof and bare wire has also been fair and no price changes have occurred. Stocks of both of these materials are ample.

Rigid Conduit.—The call for conduit has been fair with few large orders. The price for the ½-in. black pipe is $45 per 1,000 ft. in 5,000-ft lots. Dealers' stocks are fair to good.

Flexible Armored Conductor.—The two-wire, double-strip conductor sells for $46 to $47 per 1,000 ft. in lots of 5,000 ft. The demand had not been strong, although in a few cases good orders have been received.

Tape.—Both friction and rubber tape are available in lots of 100 lb. at 36 cents per pound. The call for tape has been steady and jobbers' stocks are in good shape.

Motors.—Activity for the past month has not been very different from that of the past three months, since the entire line is moving slowly. Jobbers and dealers feel that with the coming spring construction a fairly good market can be expected. The fractional-horsepower motors are moving better than the large sizes. One manufacturer reports a fairly good business for motors used on small air compressors. Another company had fair business on large motor replacements for central stations.

Lamps.—Sales of lamps are holding up, and while all lines are moving well, the 25-watt mill type is leading all others.

Fixtures.—The after-holiday movement of fixtures has been fair, and dealers report an increasing interest shown by the public on fixtures for new homes. Portable fixtures are the most popular of this line. Jobbers' stocks are ample to supply the trade.

BOSTON

Trade shows little change from week to week at present, but inquiries are more active and much important work is apparently on the verge of development. Stocks are meeting current requirements without difficulty, and very little buying for stock is being done. Prices are weaker in rigid conduit, loom and fittings, with prospective reductions in knobs and tubes before the week ends. Building and engineering contracts in New England show a very healthy increase over the preceding week. Wage reductions of about 20 per cent accompanied by increased hours of running per week are going into effect in various cotton mills in New England to meet Southern competition. Minor disturbances to production have occurred. Other textile mills are active, and the tone of business is better in some metal-working industries. Excellent gains in central-station output over this period last year are reported.

Wire.—Small-order business features the market, repair jobs absorbing a perceptible proportion of the turnover. With increasing building construction in sight, rubber-covered wire will feel the improvement before long, it is believed. No. 14 is quoted at $6.75 per 1,000 ft. in 5,000-ft. lots and $7.25 in 1,000-ft. sales.

Motors.—Inquiries are a little larger in volume, though sales are mainly confined to integral sizes in few-unit orders well below 25 hp. Business offered is chiefly in alternating-current outfits.

Sockets.—Light demand is noted, without much tendency toward price readjustment. Most of the jobbers are holding the 31½-cent price on pulls in case lots, although dissatisfaction is widespread at the alleged small spread between this price and the jobber's cost.

Loom.—Prices are weaker, owing to the fall in cotton. Light sales are reported, the 1,000-ft. to 5,000-ft. lot quotations being $16 and $17 per 1,000 ft. on $\frac{7}{32}$-in. and ¼-in. sizes, respectively, and $14.75 and $16 on the corresponding sizes in 5,000-ft. or larger lots.

Porcelain.—Further price reductions were expected this week owing to announced decreases in manufacturing cost on knobs and tubes.

Flexible Armored Conductor.—No. 14 single-strip is moving quietly at $45 per 1,000 ft. in 1,000-ft. lots. The feeling is strong against the present alleged low margin of profit in jobbing this material.

Vacuum Cleaners.—Although January business was not any too good, sales are responding to vigorous merchandising. Interest in new designs is alert, and some central-station companies are picking up more trade. Competition is sharp.

Washers.—A moderate improvement in washer sales is reported in some quarters.

Rigid Conduit.—Sales are not very active. Prices on pipe and fittings were changed slightly downward in new schedules effective Feb. 3. On less than 5,000-lb. orders black conduit per 1,000 ft. sells at $48.32 in the ½-in. size against $49.21 before. Black elbows per 100 in this size are quoted at $10.04 and couplings at $4.75. The corresponding present prices of galvanized pipe, ½-in., are $53.42, while elbows are priced at $11.18 and couplings at $5.31.

ATLANTA

The unusually inclement weather of the past two weeks has had a depressing effect upon business activities generally, electrical jobbers reporting business for the past week the lowest in the new year. This is a result of the reaction from purchasing immediately after inventory and poor weather conditions. There is no general tendency as yet to restock, purchases being largely on the basis of immediate requirements. That the outlook is considered satisfactory is, however, indicated by the tendency on the part of manufacturing firms to continue operating for the purpose of accumulating stocks to meet the demand expected within the next sixty days. For example, brick, lumber and hosiery lines all show a healthy activity in the manufacturing end and reasonably good stocks are being accumulated. Electrical jobbers are stocking up to reasonable amounts with seasonal lines, such as fans.

Building permits continue to show up remarkably well in Atlanta, the number for January totaling 270 with a valuation of $1,045,000, this being more than a 100 per cent increase over January, 1921. Building permits throughout the Southeast compare favorably with the building activities in Atlanta, and as a result wholesale hardware and electrical jobbers report a very fair movement in the hardware and electrical lines entering into this construction.

Electric Hoists.—An unusual volume of inquiries is being received, most interest seeming to be displayed in the coast and terminal centers, thereby indicating a reawakening in the dock and railway terminal lines. While orders are still scarce, there should be some business in this line shortly.

Industrial Motors.—This line continues rather slow, even in the popular sizes, few orders of sufficient size as to be worthy of mention having been received of late.

Wire.—Rubber-covered wire in sizes No. 14 to No. 4 has increased in price approximately 7½ per cent recently. All sizes are moving fairly well, with No. 14 and No. 12 the most popular. Prices, in lots of 5,000 ft., No. 14, $8 per 1,000 ft.; No. 12, $10 per 1,000 ft.

Lighting Fixtures.—Both the commercial and residential lighting-fixture lines are rather slow at the present time, the trade just beginning to feel the building slump in the latter part of 1921. Construction is on the boom, and all jobbers expect this line to be very brisk within the next thirty days or so and are stocking up to meet the expected demand.

Flashlights.—This line is moving very well, with sales of batteries and lamps excellent. Jobbers report ample stocks.

Electric Ranges.—Ranges are practically dormant at this time, owing to the market having been flooded with cut-priced ranges. Jobbers are offering ranges at very low prices in order to move their stocks.

Dry Batteries.—Dry batteries are moving very slowly, storage batteries and bell-ringing transformers having seemed to transplant them in popularity in the cities.

ST. LOUIS

Jobbers here report that business last week was distinctly dull, and several state that the volume reached during January was less than in any preceding month for several years. Wiring supplies are moving slowly and the appliance business is dull. On the other hand, sales of motors show some improvement, and considerable interest is found in both small and large generating units, one shoe company buying generating equipment for last week for an outlying plant. Poles and pole-line material have been quiet, but indications point to early improvement.

In surveying the opinions of the local jobbers regarding prospects for trade developments in the next few months confidence that there will be improvement is generally found. The municipalities are interested in developing power and street-lighting systems, and considerable business will come from this source if the necessary bond issues can be satisfactorily floated. The central-station companis are behind in their power-plant, transmission-line and distribution system developments and will probably have to do considerable construction work this year. Electric ranges are finding improved demand in the smaller towns where gas service is unavailable, and more effort in the larger places will be spent this year in promoting range sales. Considerable construction of dwellings is expected as soon as spring opens, particularly if the St. Louis wage scale is adjusted. The demands from the industrials should improve, but will probably be quiet as compared with former years. The movement of radio equipment is now extremely active and the demand is expected to increase. The appliance business for a few months may be subnormal. The sale of farm-lighting plants will depend largely upon crop conditions, which can now be only conjectured. All expect, on the whole, better business than last year, and with it, because of less liquidation and reduced overhead, better profits.

Wire.—Prices on bare and weatherproof are easier, the established quotations being 17 cents per pound for weatherproof and 16½ cents for bare. Rubber-covered prices are unchanged. No. 14 selling for $6.70 per 1,000 ft. in 10,000-ft. lots and $6.75 per 1,000-ft. in 5,000-ft. lots. The demand the past week for all kinds and sizes has been dull. Stocks are in conservative condition.

Porcelain.—With the lowering of stocks there has been a stiffening of prices. The 2½-in. tubes now sell for $6.15 per 1,000 in barrel lots, and likewise the 3-in. sells for $7.50 per 1,000. "Nail-it" knobs remain at about $19.50 per 1,000 in barrel lots. Two-wire and three-wire unglazed cleats, in barrel lots, are priced at $14.95 per 1,000. The demand the past few weeks has been very quiet.

Fans.—Fans constitute one of the principal sources of orders today, and the demand continues strong. A very good season is expected.

Poles and Cross-Arms.—Movement at the present time is rather quiet, but surveys recently made indicate that the central-station and telephone companies will be in the market soon for considerable quantities. The 3¼-in. x 4¼-in. fir arms, per 100, f.o.b. St. Louis, are priced as follows: 3-ft., $51.38; 4-ft., $68.31; 6-ft., $102.77; 8-ft., $137.03; 10-ft., $152.25. Northern white cedar poles, 7-in. tops, in carload lots, f.o.b. St. Louis, are priced as follows: 30-ft., $8.90; 35-ft., $14.60; 40-ft., $18.65; 45-ft., $21.75.

Insulators.—Telephone companies have been good buyers, but the demand from the central-station companies shows some decrease. St. Louis stocks are in good shape, and immediate factory shipment of the usual styles can be obtained. Prices are firm.

Sockets.—Sales have been steady, but the volume has suffered to some extent the past month. Stocks are well in line with the requirements. The following are representative prices: Key, $18.15 per 100; keyless, $16.50 per 100; pull, $33 per 100.

Switches.—Easier prices are found. The 5-amp. single throw, non-indicating snap switch is priced at $16.52 per 100, and the same in the indicating type at $17.60 per 100. Single-throw push-button switches are selling for $19.25 per 100, and the three-way push-button for $29.50 per 100. Unbrushed brass single-gang plates are quoted at $7.70 per 100. The demand is slack.

SAN FRANCISCO

In the large California cities building activity continues at record figures. The value of building permits for January, 1922, is as follows: Los Angeles, $7,975,168; San Francisco, $5,528,978; Oakland, $1,329,405; San Diego, $769,465. The comparative values for January, 1921, were: Los Angeles, $3,096,579; San Francisco, $3,659,227; Oakland, $542,239; San Diego, $499,342. Besides the larger cities some of the interior cities, such as San José, serving specially prosperous districts should, in the opinion of many observers, enjoy a building boom this year, following upon several years of depression caused by surplus crops. Crops for 1921 of the principal farm and orchard products showed an approximate 20 per cent decline from 1920 figures, but welcome rains and ample power facilities, compelling no curtailment of irrigation, as well as lower labor costs, promise favorable crops for 1922. The large holdover stocks of fruit which curtailed the 1921 outputs of the packing companies have about all been sold, and decreased prices and an increasing export business are reasons for justifiable optimism. It is believed by many that one more crop must be sold in the state before present conditions will be appreciably better.

Pole-Line Hardware.—Prices have been adjusted without any marked changes. Good movement is reported with a splendid year in sight.

Cross-Arms.—New Regulations increasing by 6 in. the center-to-center space will be cared for by new stocks. Several months have been given to manufacturers and dealers in which to move present stocks, so that the situation will be cared for without hardship. The market on cross-arms has been very good, and as this year will be a year of lateral building, it will continue to improve. Legitimate dealers have been somewhat disturbed by the sporadic competition of farmers who have a few acres of timber to be disposed of from time to time.

Radio Apparatus.—This class of business was never better, and constructive efforts to improve it, such as standardized broadcasting and improvement of broadcasting service, will attract a class of trade more profitable than that dependent on schoolboys' experiments. Local stocks are rather poor, and nearly all manufacturers represented locally are sold to the limit. An increasing number of dealers in radio apparatus is noted, although so far this business has not been dissociated from the standard electrical retail stores.

SALT LAKE CITY—DENVER

The month of January came to a close with a rather dull general record in merchandising. There is scarcely a line that escaped the slowing-down tendency, but, of course, January is normally a month of falling off in sales. A gradual pick-up is looked for from now on. Compared with January, 1921, the past month has been rather disappointing in the electrical business. Jobbers' books show a general falling off of about 20 per cent. Since retail dealers are buying in consignments barely sufficient to cover current needs, this means that their volume has shown a large shrinkage. This record also is not especially encouraging in view of the fact that prices of electrical merchandise have fallen off from 20 to 25 per cent, but viewed from another angle it is rather natural for sales to decrease in an era of a falling market. Private investment in good bonds continues to be an outstanding tendency. Money rates are slightly lower and credit is easier. Farmers are just now clamoring for extended time on notes, and the demand is creating a critical situation for many country banks. It is believed that with timely federal aid the crisis will be successfully bridged. Every means is being sought to lower tax burdens by trimming salary budgets and eliminating superfluous public employees. Scores of intermountain buyers are now active in the Eastern markets. The weather is not favorable to building, although a substantial construction program for spring is taking definite form. Non-employment in the larger cities presents a perplexing situation. Relief is coming from a score of sources, but the means of furnishing even temporary work for the jobless are inadequate.

SEATTLE—PORTLAND

The most encouraging features of the business outlook for the Northwest are the large amount of building construction under way and contemplated and the exceptionally bright outlook for the lumber industry, which is of primary importance to this section. Seattle building permits for January exceeded those for any January in the history of the city with the exception of 1909 during the Alaska-Yukon-Pacific Exposition construction period. Building permits for Portland during January exceeded those of January, 1921, by over 75 per cent, and prospects indicate that permits for February will more than double those for January. Reports from 131 mills for the week ended Jan. 28 show lumber production only 12 per cent below normal, with new business 3 per cent and shipments 12 per cent below production. The value of exports for the Oregon customs district during January showed an increase of more than 6 per cent over those for the same month a year ago.

The business outlook is rather better than for some time. There is far more new business in sight now than there was at the close of the year. One electrical jobber put the ratio as high as three to one. Prices have held firm for the most part, no important changes having been reported during the week. The demand for lamps has dropped off materially owing to the season of the year. Electrical permits for Portland during January, 1922, showed an increase of 48 per cent over January, 1921.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Nilco Uses Two Former General Electric Plants

The Nilco Lamp Works, Inc., Emporium, Pa., is now operating at the former plants of the General Electric Company at Emporium and St. Mary's, Pa. The company has been incorporated under the laws of Pennsylvania with a capital of $100,000 to manufacture electric lamps. B. G. Erskine is president and Guy S. Felt is treasurer.

Witherbee Moves and Centralizes Manufacturing Facilities

The Witherbee Storage Battery Company, 643 West Forty-third Street, New York, has closed its two manufacturing plants, one in New York and the other at North Bergen, N. J., and will move to its new factory at Belleville, N. J. The executive offices will continue to be at the Forty-third Street address. The move gives the Witherbee company 30,000 sq.ft. of floor space, just about double the total of both old factories, and was made because of the increase in business during the fall and winter and the opportunity for manufacturing economy when all production is under one roof.

The company is engaged in the manufacture of radio and other types of batteries and parts and will devote the entire facilities of the new plant to this type of output. There has been noticed a large increase in demand for radio batteries, according to C. Meder, an official of the company.

Wire Plant at Capacity

Increased business is reported by the Marion Insulated Wire & Rubber Company, which has a plant at Marion, Ind. This plant is operating at full capacity at the present time and is adding a night working force for increased production.

Jeffery-Dewitt Receivership Dismissed—Reorganization Announced

The receivership of the Jeffery-Dewitt Insulator Company, Kenova, W. Va., which filed a voluntary petition in bankruptcy on Nov. 2, 1921, has been dismissed by the United States court at Huntington, W. Va., and the reorganization of the company has been completed. As explained by company officers, the receivership was obtained in order to facilitate the transportation of the company from being a subsidiary of the Jeffery-Dewitt Company of Detroit to a similiar relation with respect to the Champion Spark Plug Company, Detroit, which is the owner of both companies. In operation all three companies are independent of each other.

The new Jeffery-Dewitt Insulator Company is incorporated in West Virginia with a capital stock of $800,000. The engineering and operating organization of the old company has been taken over intact, but the executive personnel has been changed. R. A. Stranahan, president of the Champion Spark Plug Company, is also president of the insulator company. M. C. Dewitt is vice-president, as is J. A. Jeffery, while F. D. Stranahan is treasurer and W. W. Hoffman is secretary. J. F. Sinclair is general manager and will have his headquarters at the factory in Kenova.

Reorganization of Empire Company Announced

The business of the company for twenty years known as the Empire Engineering & Supply Company, Fourth Avenue and Twenty-eighth Street, Brooklyn, N. Y., has been reorganized and a new company incorporated under the name of Empire Switchboard Company, Inc. The new company will take over the entire business and personnel and will continue to operate in the factory, which was completed for the Empire Engineering & Supply Company in May, 1921. The plant has facilities for manufacturing a complete line of switches, switchboards and panelboards of all kinds and sizes, additions to machinery and equipment having been made when the new factory was completed. Norman P. Findley, manager of the old company, is president and treasurer of the new corporation. C. E. Schoninger is secretary.

The company finds an improvement in business since Jan. 1, according to Mr. Findley, and has not only had many inquiries but has closed a satisfactory number of orders. It is his belief that the tide of business has turned and that from now on it will improve.

Fixture Manufacturers, Dealers and Glassware Guild Hold Successful Conventions

Protective Tariff and Design Piracy Law Asked by Manufacturers—Dealers' Costs and Prospective Sales Discussed—Successful Fixture Market

The annual conventions of the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the Illuminating Glassware Guild, all held in Milwaukee, Jan. 30 to Feb. 4, together with the third annual Lighting Fixture Market, combined to make a memorable week in the lighting-ware industry. There was a total registration of 750 members of all the societies. Each association held separate meetings in the mornings during the week, but joint luncheons were held every day. The afternoons were spent in inspection of the fixture market. In addition the Electrical Development Association of Wisconsin sponsored a popular educational program in connection with the Milwaukee "Better Lighting Week."

One of the first actions taken by the manufacturers' association was to adopt a resolution favoring immediate passage of an adequate protective-tariff law, incorporating the principle of American valuation as a basis for imposing ad valorem duties. A telegram embodying this resolution was sent to the National Association of Manufacturers, in convention at Washington.

The Wednesday session of manufacturers was devoted to design matters. George Ainsworth of New York City led the discussion on the plans on foot to bring the design registration bill to the attention of the proper men in Congress with a view to its early passage. The bill is intended to stop design piracy. Mr. Ainsworth cited recent decisions handed down by the French courts in such cases and pointed out that these may have an important influence on American procedure.

At the same session Albert Wahle of New York City, in discussing the harmonization of lighting fixtures with home surroundings, declared that a higher standard of design was the crying need of the industry. He gave study of raw materials, home requirements, original design, prospective environment and popular taste as the factors to be considered.

Dr. M. Luckiesh of the National Lamp Works urged that fixture manufacturers familiarize themselves with standard types of bulbs now on the market when considering the design of new fixtures. He also discussed some developments in colored bulbs and said that smaller bulbs for decorative purpose were being perfected. He advocated a shaded lamp to make artistic lighting comfortable and said that it was more important to have a fixture produce soft and restful illumination than it was to have it artistically perfect.

Uniform cost accounting and its influence on modern business was the main topic of discussion on Thursday morning. H. S. Bartholomew said that with keen competition and many fluctuations in the cost of raw materials, labor and overhead a manufacturer should keep in closer touch with his cost of production from day to day. With a uniform cost plan unintelligent competition due to a lack of accurate cost data would be eliminated.

The Wednesday session of the Lighting Fixture Dealers' Society of America was devoted to a study of cost data. J. A. A. Hamilton urged that dealers obtain a better knowledge of merchandising and operating costs in order to raise the standard of the trade. Secretary Wolfe presented bulletins on cost data for hanging fixtures and told how these data were obtained.

That development of home lighting will be a fertile field for the retailer in 1922 was the main thought behind P. B. Zimmerman's paper. O. H. Caldwell, editor of *Electrical Merchandising*, presented statistics showing that 1,231,000 homes would be electrically equipped during the coming year. William L. Goodwin discussed the 1922 plans of the Society for Electrical Development.

R. A. Lundquist, chief of the electrical equipment division of the Department of Commerce, told of the changes made in gathering import and export statistics by the department to bring about better co-operation between the department and manufacturers. Instead of grouping exports under names of countries, as was formerly done, the total amount of exports on all commodities is listed together, thus facilitating a quick check on market conditions.

The following officers were elected for the National Council of Lighting Fixture Manufacturers: President, Robert Biddle, Philadelphia; vice-president, D. C. De Lancey, St. Charles, Ill.; secretary, Charles H. Hofrichter; treasurer, B. F. Klein.

Electrical Manufacturer Increases Wages

The McGill Manufacturing Company, Valparaiso, Ind., manufacturer of electrical supplies, has increased the wages of employees 5 per cent, this action to become effective at once. The plant of the company, which produces lamp guards, sockets, switches, etc., is operating at full capacity and is giving employment to about a hundred workers.

January Shows Increase for Greenfield Tap & Die

The business of the Greenfield Tap & Die Company, Greenfield, Mass., it is reported, showed a material increase during January. This is the second successive month in which volume of orders shows a gain over the same period the previous year. Orders received have been climbing steadily since last September, when it became evident that the tide was turning. This betterment was taken as an indication that surplus supplies had been worked off and that the trade was prepared to purchase once more, even though much more carefully than before. The developments of the last sixty days show the presence of a positive buying power. This increase in volume has appeared in the export as well as the domestic account, the export department having always been strong. It is the view of the company that jobbers' supply houses and retailers of the country must buy at least as much as they sell during 1922, for careful investigation has shown that they sold more than they bought during 1921 and started this year with small stocks. A better buying movement is looked for in the spring.

New Manufacturer of Lighting and Radio Apparatus

The General Lamp & Fixture Company, recently incorporated in Pennsylvania, is doing business at 6014 Center Avenue, East Liberty, Pittsburgh, Pa. The company manufactures and deals at wholesale in electric lighting fixtures and supplies and has a radio-manufacturing department under the name of the General Radio Manufacturing Company. The offices and showrooms of the company are at the Center Street address while the factory is on Houston Street, adjoining the office building. Frank H. Roseman, who conducted the business under his own name for two years prior to the incorporation, is president and treasurer, Henry D. Fulton is vice-president, and Arthur C. Mack is secretary.

The field of the radio business is unlimited, according to a statement made by Mr. Roseman to the ELECTRICAL WORLD, and those who look on it as only a "fad" are failing to see all its angles. The past records of any new industry, he said, show that the same public opinion in regard to it prevailed as is being expressed regarding the radio industry. Present demand, Mr. Roseman stated, is far greater than production.

Keen Competition to Feature 1922, Says Trumbull

Prices are to go down in many lines during the coming year, according to the January *Trumbull Cheer*, the house organ of the Trumbull Electric Manufacturing Company, Plainville, Conn., and this must be equalized through thrift, elimination of waste and intensive sales work.

"For manufacturers," says the editorial, "there is to be the most highly competitive market and for distributers also. New establishments will spring up everywhere, all eager for business. Keen competition always means a careful watching of the price sheet, and there is likely to be a situation which will curtail high prices and make excess profits taxes very slim. The answer to this situation is not in cutting prices—most prices in wiring devices are about as low as they can go under present construction and methods of production—but in improved manufacturing processes and better and more economically constructed devices. There is bound to be a reaction against too cheaply made material seeking to beat competition by undercutting prices, and the real winner will be the man who can reduce price by inventive ingenuity."

Lightolier Company Leases New York Warehouse

In order to increase its shipping facilities and provide for immediate deliveries to New York and nearby points, the Lightolier Company, 569 Broadway, New York, has leased an entire warehouse at 379 West Broadway, that city. The company manufactures electric lighting fixtures. The new warehouse is five stories high and provides 60,000 sq.ft. of floor space. A large and complete stock of the fixtures produced by the company is to be stocked there, insuring immediate delivery on all quantities.

This step has been taken in preparation for the spring, according to officials of the company, as greatly increased sales are expected then. January proved to be a good month for the company, residential fixtures having sold well. The demand for commercial fixtures is increasing, it was stated, all sorts of retail and other concerns having large offices now being able to obtain money more easily and improve their establishments.

The William B. Young Company, 1733 North Sixth Street, Philadelphia, has succeeded the Young-Russell Company, formerly at the same address. The company manufactures portable lamps.

The Okonite Company, Passaic, N. J., has announced the appointment of S. H. Lanyon as San Francisco sales engineer.

The Centrifugal Fan Company, 9-15 Seventeenth Avenue, Newark, N. J., has appointed Alden L. Covill, 1224 Granite Building, Rochester, N. Y., as sales representative in that territory.

The Standard Lighting Fixture & Lamp Company, 237 Lafayette Street, New York City, is the name of the company formerly known as the Standard Art Glass Company. There has been no change in location or organization.

The Walker & Pratt Manufacturing Company, Boston, manufacturer of electric ranges, has appointed Burton Y. Gibson as factory representative on the Pacific Coast and in the Hawaiian Islands. He will have his headquarters at 680 Folsom Street, San Francisco.

Woolfenden, Wood & Weber, engineers, have removed their offices to 515 Ideal Building, Denver, Col.

The Keith-Landis Corporation, 332 South La Salle Street, Chicago, has been formed to manufacture electric clocks operated by a battery instead of a main spring. Elsworth Keith is president of the company and Reed G. Landis is secretary and treasurer.

The Cote Brothers Manufacturing Corporation, 1425 First National Bank Building, Chicago, has received the approval of the National Board of Fire Underwriters for its "Simplicity" refillable fuses. This fuse is of the plug type and the approval covers all capacities.

Foreign Trade Notes

THE STYRIAN WATER POWER & ELECTRIC COMPANY, LTD., Graz, Austria, has been organized to exploit the entire available water power of the country, which is estimated at 450,000 hp. The present plans provide for the construction of nineteen power stations, involving an expenditure of 225,000,000 pre-war crowns. Electricity is to be supplied not only to the province of Styria, but also to the city of Vienna. The capital of the company is to be provided by the province of Styria, leading Vienna bankers and the manufacturers of Styria.

EXTENSIONS TO PEKIN TRAMWAY SYSTEM.—Extensions involving 15 miles of track and the construction of an electric generating station are being planned by the Minister of Communications at Pekin, who is chairman of the board of directors of the Pekin tramways. Bids for material, equipment and trucks, Commercial Attaché Julean Arnold reports to the Department of Commerce, will be opened on March 20. The cars will be built in China.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN PALESTINE.—Advices from Consul A. E. Southard at Jerusalem to the Department of Commerce indicate that the Russian engineer who plans to use the waters of the Jordan and other rivers in Palestine to develop hydro-electric power has left Jerusalem for Germany and that he was expected to be in London in January and to leave for the United States about Feb. 1.

PROPOSED HYDRO-ELECTRIC PLANT IN ITALY.—The construction of a hydro-electric plant is under consideration, according to a report from Consul Young at Venice to the Department of Commerce, to utilize the water power of the upper Natisone River, between Udine and Julian Venetia. The central station would be located at Stupizza, on the Natisone, in the Province of Udine. Energy would be used for electric railway lines, public and private illumination and for industrial plants. The cost is estimated at 20,000,000 lire. There is no electric generating station in this vicinity at the present time.

ELECTRIFICATION OF SWISS RAILWAYS.—According to a report to the Department of Commerce from Consul Haynes at Berne, Switzerland, 57,000,000 francs has been credited to the Swiss budget of 1922 for the electrification of the Federal railways. The electrification of the Bellinzona-Lugano-Chiasso, the Erstfeld-Lucerne and the Goldau-Zug lines will soon be completed. The Amsteg power station, of 80,000 hp. capacity, will be ready to furnish energy about April, 1922, and the Lucerne-Zug-Zurich line will probably be equipped for electrical operation at the end of the year. Together with the St. Gothard, the Sion-Lausanne line is to be electrified and will be opened in the summer of 1923. Electricity will be supplied by the 60,000-hp. Barbarine station, which by that time will have been completed.

PROPOSED ELECTRIC PLANTS FOR AUSTRALIA.—Steps have been taken by the Orange Municipal Council, New South Wales, according to *Electrical Industries*, to raise a loan of £30,000 to finance an electric lighting system to serve the town. The equipment of the proposed plant includes two boilers, with auxiliary equipment, and two 200-kw. electric generating units. The Blue Mountains Shire Council, New South Wales, is considering an agreement covering the installation of systems at Springwood, Valley Heights and Faulcon bridge by the National Electrical Engineering Company of Sydney.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An engineer in Norway (No. 676) desires to secure an agency for the sale of copper wire for electrical use; copper plates and pipes, iron and steel wire, etc.

The purchase and agency are desired from manufacturers by a merchant in India (No. 681) for the sale of electrical novelties, etc.

An agency is desired by a commission merchant in Spain (No. 704) for the sale of electrical supplies, electric motors, railway supplies, etc.

A supervising engineer and architect in Italy (No. 713) wishes to purchase building hardware, including electric light plugs, etc., and desires to receive catalogs and price lists.

An electrical supply firm in Ontario, Canada (No. 715), desires to purchase electric light fixtures.

New Incorporations

THE PEN ARGYLE (PA.) ELECTRIC LIGHT, HEAT & POWER COMPANY has been chartered with a capital stock of $10,000. The directors of the company are Henry E. Stephens, Samuel Kent, Stockton Barton, John S. Jackson, Charles J. Koch, Charles J. Fitzgerald, A. C. Young, William Harding and William B. Messinger.

THE COLVILLE VALLEY ELECTRIC COMPANY, Colville, Wash., has been incorporated with a capital stock of $1,000 by T. C. Bell, L. P. Johnson and R. D. Kruckman.

New Apparatus and Publications

STEAM BOILER.—Bulletin No. 7 issued by the Wickes Boiler Company, Saginaw, Mich., describes and illustrates the latest development in the "Wickes" horizontal cross-drum water-tube steam boiler.

WASHING MACHINE.—An eight-page pamphlet distributed by the Altorfer Brothers Company, Peoria, Ill., covers its new "ABC Oscillator" electric washing machine.

COMBINED WATER HEATER AND STEAM GENERATOR.—The Motovic Products Corporation, Detroit, manufacturer of electrical appliances, has recently placed on the market the "Dual" electrically operated combination water heater and steam generator.

COMMUTATOR SLOTTERS AND STONES.—The Corte Engineering Company, consulting and sales engineers, 3412 Woolworth Building, New York City, is distributing a pamphlet describing the "Acme" commutator smoothing stone and the "Aurand" commutator slotter, manufactured by the Green Equipment Company, Chicago.

WIRING SUPPLIES.—The Parr Electric Company, 77 Warren Street, New York City, electrical jobber, has issued a new catalog No. 21, containing 559 pages. The catalog is clothbound and is thumb indexed both as to material and manufacturers' names.

EXPANSION JOINT.—The Ray Expansion Joint Company, Inc., 95 Liberty Street, New York City, has issued a booklet describing the "Ray" elastic disk expansion joint, recently developed by the company.

TELEPHONE INSTRUMENTS.—A new intercommunicating telephone instrument, known as the "Dialaphone," has been placed on the market by the American Electric Company, State and Sixty-fourth Streets, Englewood Station, Chicago.

OUTDOOR SWITCHING APPARATUS.—Bulletin 32 issued by the Delta-Star Electric Company, 2433-59 Fulton Street, Chicago, describes its complete line of outdoor high-tension switching and protective equipment of unit-type design.

ELECTRIC DYNAMOMETER. — The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, is distributing bulletin No. 48,716 covering the "Sprague" electric dynamometer, research type.

LAMP HANGERS.—A decorated hanger for either suspension or ceiling type lamps has recently been developed by the F. W. Wakefield Brass Company, Vermillion, Ohio, and is being put out as an addition to its "Red Spot" line.

ENGINEERING DATA.—Ford, Bacon & Davis, 115 Broadway, New York City, are distributing three booklets, entitled "U. S. Army Supply Base, New Orleans, La.," "Outline of Facilities" and "Your Profits," which give an outline of their facilities and work.

PORCELAIN INSULATORS.—The Federal Porcelain Company, Carey, Ohio, is distributing catalog No. 2, describing its complete line of porcelain tubes and insulators.

FLOOR-PLANING MACHINE.—The L. Power & Company, 20 South Twenty-third Street, Philadelphia, is marketing an electrically driven floor-planing machine.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 10, 1922)

1,402,769. Junction Box; Max Hirshfeld, St. Paul, Minn. App. filed April 23, 1920. For conduit.

1,402,772. Rheostat; Leonard Kebler, Bronxville, N. Y. App. filed March 14, 1919. Slide resistance box.

1,403,384. Pulse Amplifier; Sydney N. Baruch, San Francisco, Cal. App. filed May 24, 1917. To amplify human pulse.

1,403,394. Storage-Battery Plate; Rudolphe Drambourg, Brooklyn, N. Y. App. filed Sept. 25, 1916. Corrugated plate for large area.

1,403,409. Dry Cell; Clarence W. Hazlett, Lakewood, Ohio. App. filed May 9, 1919. Process of manufacture.

1,403,410. Dry Cell; Clarence W. Hazlett, Lakewood, Ohio. App. filed May 9, 1919. Porous wood between zinc and electrolyte.

1,403,432. Iron; John W. McGilvray and Joseph Wellersdick, Torrington, Conn. App. filed April 9, 1921. Electric iron with heat indicator.

1,403,462. Non-Fluid Electrolytes for Storage Batteries; Albert H. Williams, Worcester, Mass. App. filed April 27, 1920. Comprises silicate of soda.

1,403,463. Process of and Apparatus for Recovering Metals from Ores; John Allingham, Los Angeles, Cal. App. filed Sept. 26, 1919. Treating metals with acids to produce chlorides and sulphates, then retreating.

(Issued Jan. 17, 1922)

1,403,475. Vacuum-Tube Circuits; Harold D. Arnold, Maplewood, N. J. App. filed Nov. 11, 1920. Regulating tubes in cascade.

1,403,529. Electric Riveting Device; William O. Wentworth, New York, N. Y. App. filed Oct. 10, 1919. Magnetically operated coil for heating and upsetting.

1,403,538. Battery Hand Lamp; Charles F. Burgess, Madison, Wis. App. filed April 6, 1920. Reflector and lens detachable for open work.

1,403,544. Transmission Equalization Arrangement; Wirt E. Darrow, Brooklyn, N. Y. App. filed Jan. 29, 1920. Regulates current on telephone wires.

1,403,548. Lamp Vaporizer; Leo Gudeman, New York, N. Y. App. filed Sept. 10, 1920. Attached to electric bulb.

1,403,561. Electric Signal System; James D. Nelson, Cincinnati, Ohio. App. filed May 9, 1917. For automatic fire-extinguisher systems.

1,403,566. Vacuum-Tube Repeater Circuits; Harry S. Read, East Orange, N. J. App. filed July 11, 1919. Wireless amplifier.

1,403,577. Storage-Battery Separator; Godfrey Steerup, Chicago, Ill. App. filed Jan. 29, 1919. To permit circulation of the electrolyte.

1,403,592. Telephone Receiver; Albert E. Coy, Chicago, Ill. App. filed March 20, 1920. Amplifier for partly deaf persons.

1,403,593. Telephone Transmitter; Albert E. Coy, Chicago, Ill. App. filed March 20, 1920. Amplifier for portable use.

1,403,594. Apparatus for Heating or Vaporizing Fluids; Celio Duo, Buenos Aires, Argentina. App. filed Jan. 11, 1919. Hollow element with fluid both inside and outside.

1,403,611. Process of Manufacturing Bicycle Frames; Elmer M. Lewis, Dayton Ohio. App. filed Sept. 2, 1919. Electric welded joints.

1,403,626. Automatic Switch for Controlling Motor-Driven Automatic Machines; Louis M. Potts, Baltimore, Md. App. filed April 9, 1919. Gear system.

1,403,633. Process of Producing and Securing Products from Lignite; James H. Reid, Newark, N. J. App. filed Jan. 27, 1914. Hydro-carbons electrically obtained from lignite and calcium oxide.

1,403,639. Electric Heater; Joseph F. Roberts, San Francisco, Cal. App. filed March 22, 1921. Reflector with double walls.

1,403,640. Wireless Telegraphy; Henry J. Round, London, England. App. filed Feb. 20, 1920. Direction finder.

1,403,658. Transmission Gear; Thorsten von Zweigbergk, Lancaster, England. App. filed June 28, 1918. Electromagnetically operated.

1,403,671. Telephone System; William W. Dean, Elyria, Ohio. App. filed May 2, 1904. Combined manual and automatic.

1,403,700. Apparatus for Directive Transmission of Electromagnetic Waves; Frederick S. McCullough, Cleveland, Ohio. App. filed Oct. 30, 1916. Directive wireless sending.

1,403,717. Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 17, 1918. Strain or suspension.

1,403,726. Electric Discharge Device and Operating Circuits Therefor; William Wilson, East Orange, N. J. App. filed March 30, 1918. Electronic tube.

1,403,737. Detachable Post for Storage Batteries; Walter H. Crissley, Philadelphia, Pa. App. filed Sept. 15, 1919. Post screwed into grid strap.

1,403,743. Lighting Displaced Trolley Poles; Willie K. Dillard, Laurens, S. C. App. filed Sept. 19, 1921. Battery lamp on pole.

1,403,759. Ozone Generator; John Fitzpatrick, Niagara Falls, N. Y. App. filed Feb. 27, 1920. Plurality of hollow tubes.

1,403,767. Electromagnetic Step-by-Step Mechanism; Harold W. Goff, New York, N Y. App. filed Dec. 20, 1919. Ratchet system.

1,403,803. Resistance Material and Method of Manufacturing Same; Joseph P. Maxfield, Millburn, N. J. App. filed July 12, 1919. For telephone transmitters.

1,403,811. Telephonic Apparatus; Howard C. Pauly, New York, N .Y. App. filed Aug. 9, 1918. Hand set with cushions between elements.

1,403,822. Method for Forming Insulating Material; Johannes A. van der Nolle, Zaandam, Netherlands. App. filed July 7, 1920. From wooden or fibrous substances.

1,403,833. Telegraph System; John H. Bell, South Orange, N. J. App. filed Nov. 21, 1917. Regeneration of repeated impulses.

1,403,835. Frequency Control System; Otto B. Blackwell, Garden City, N. Y. App. filed Sept. 30, 1919. Fixes the frequency relation between a plurality of radio stations.

1,403,837. Trolley-Wire Splicer; Newton K. Bowman, Canton, Ohio. App. filed Feb. 3, 1920. Adjustable self-clamping.

1,403,844. Automatic Telephone System; Henry P. Clausen, Mount Vernon, N. Y. App. filed March 19, 1918. Prevents sending impulses caused by accident.

1,403,845. Telephone Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 19, 1919. Prevents loss of impulses on automatic.

1,403,861. Telephone Exchange System; Alben E. Lundell, New York, N. Y. App. filed Dec. 29, 1916. Control system for automatic.

1,403,862. Telephone Exchange System; Alben E. Lundell, New York, N. Y. App. filed Oct. 8, 1917. Party-line selective signaling.

1,403,866. Telephone Exchange System; Arthur Raynsford, New York, N. Y. App. filed Dec. 31, 1919. Combined manual and automatic.

1,403,891. Current Collector; Cyrus B. Buchanan and Charles C. Johnson, Richmond, Va. App. filed Aug. 1, 1921. Two-wire pantagraph for trackless vehicles.

1,403,903. Electroplating Carbon Articles; Victor C. Hanister, Cleveland, Ohio. App. filed Jan. 31, 1920. For electrical connection.

1,403,932. Electron Discharge Device; Richard H. Wilson, Newark, N. J. App. filed July 16, 1919. Electronic tube.

1,403,996. Selector; John H. Wheelock, Worcester, Mass. App. filed June 18, 1917. Disk and plunger system work by key.

1,404,024. Cell-Post Construction; Joshua C. Harris, Niagara Falls, N. Y. App. filed Sept. 20, 1919. Sealing compound between strap and post.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

PORTLAND, ME.—The Cumberland County Power & Light Company has awarded a contract to the Foundation Company, 120 Liberty Street, New York, for the erection of its proposed new generating plant to cost about $1,000,000.

BOSTON, MASS.—The Edison Electric Illuminating Company, 29 Boylston Street, has commenced foundation work for a power house, with turbine installation, at South Boston. Bigelow & Wadsworth, 3 Hamilton Place, are architects.

BRADFORD, MASS.—Steps have been taken by the Bradford Community Association to secure the installation of an ornamental lighting system on Main Street and several other streets in Bradford.

LOWELL, MASS.—The Boott Mills, Inc., will defer the construction of its proposed new hydro-electric generating plant on the Merrimac River until next summer. Arthur T. Safford, 66 Broadway, is engineer.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company, 170 Westminster Street, has plans under way and will call for bids early in March for the erection of a new power plant and buildings at Melrose and Longfellow Streets, consisting of a one- and two-story brick and concrete power plant, 40 ft. x 56 ft., with radial brick stack, 4½ ft. in diameter and 110 ft. high; one-story oil house, 37 ft. x 92 ft.; gatehouse, 10 ft. x 17 ft.; two storage buildings, three-stories, 101 ft. x 222 ft., and one-story, 120 ft. x 222 ft., respectively, the latter to be provided with two electric traveling cranes; machine shop and garage, 114 ft. x 172 ft.; and four-story office building, 42 ft. x 154 ft., with wing, 70 ft. x 114 ft. Jenks & Ballou, Grosvenor Building, are architects and engineers.

NEW HAVEN, CONN.—Plans have been completed for the construction of the Sterling Hall of Medicine at Yale College, to cost about $1,300,000. The plans include a separate power house.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company has approved an appropriation of $1,000,000 for the installation of a new 20,000-hp. turbo-generator in its local power plant, with auxiliary equipment. Charles S. Ruffner is general manager.

BINGHAMTON, N. Y.—The Board of Contract and Supply, City Hall, has prepared plans for the construction of an ornamental street-lighting system on certain streets. W. Weller, City Hall, is engineer.

CORNING, N. Y.—W. P. Gannon, 103 South Avenue, Syracuse, N. Y., and associates are negotiating for the purchase of the property of the Lamoka Electric Water & Power Company, operating in this district. The new owners plan for the construction of a 35,000-hp. hydro-electric plant on Lake Lamoka, near Corning, to be tied in and operated with the present system.

IONA ISLAND, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 21 for one surface condenser. (Schedule 9413.)

MIDDLETOWN, N. Y.—The new owners of the Orange County Public Service Corporation are considering the construction of a power plant in Mongaup Valley.

POTSDAM, N. Y.—The St. Lawrence Transmission Company has tentative plans under consideration for the construction of a 100,000-hp hydro-electric plant on the St Lawrence River. An application is before the Federal Power Commission, Washington, D. C., for authority to build the plant.

VERONA, N. Y.—George N. Wilson has been granted permission by the Public Service Commission to erect an electric lighting system in Verona.

ELIZABETH, N. J.—An electric power plant will be constructed in connection with the new high and vocational school, building contract for which has been awarded. The entire project will cost about $580,000. C. Godfrey Poggi, 275 Morris Avenue, is architect.

LANSFORD, PA.—Considerable electrical equipment, including a number of motors of 500 to 300 hp. capacity, will be installed at the new coal breaker at Coaldale, near Lansford, now being erected by the Lehigh Coal & Navigation Company. The cost of the plant with machinery is estimated at about $1,000,000.

PITTSBURGH, PA.—The West Penn Power Company has authorized an appropriation of $6,000,000 for extensions and improvements, to its system, including the installation of two 30,000-kw. turbo-generators at the Windsor plant, Beech Bottom, W. Va., and an extension to the Springdale plant on the Allegheny River. The proposed plans provide for increasing its total generating capacity to 188,000 kw. and line extensions beyond the present operating districts in the southwestern portion of the state.

SPRING GROVE, PA.—The P. H. Glatfelter Company has awarded a contract to the Aberthaw Construction Company, 27 School Street, Boston, Mass., for the erection of its proposed addition, 100 ft. x 500 ft., including electric power equipment for general mill and machinery operating service.

WILKES-BARRE, PA.—Plans are under way, it is reported, by the Wilkes-Barre Company for the erection of a high-tension transmission line from the Pennsylvania power plant at Harwood to a substation to be built in the vicinity of Ashley, then to the local plants on Bennett and North River Streets for distribution. Work on placing the wires on South Main Street underground will be started as soon as possible. W. H. Conyngham is president of the company.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company is arranging a schedule providing for $1,000,000 for the purchase of new cables, conduits, wires and general equipment, for line extensions to be made this year.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has arranged for the sale of $1,800,000 in capital stock, the proceeds to be used for extensions and improvements to plants and system. The company is taking bids for the erection of a new one-story service building on Belair Road.

ELKTON, MD.—The Northern Maryland Electric Company has acquired the property of the Havre de Grace Electric Company, Havre de Grace, Perryville, Aberden, Md., and vicinity, and will merge it with its system. Extensions and improvements are planned. The company is also said to be negotiating for the purchase of the property of the Gilpin Falls Electric Company, Elkton. J. H. Ware is president of the Northern Maryland company.

SALISBURY, MD.—Extensions and improvements contemplated during the present year by the Eastern Shore Gas & Electric Company, for which it has appropriated $300,000, will include a new generating plant at Laurel, Del., to cost about $160,000; a transmission line from Laurel to Denton, Md., $46,000; rebuilding the transmission line from Laurel to Salisbury, $14,000; a second circuit on the transmission line from Laurel to Cambridge, Md., $58,000; installation of new transformers, switching equipment at the Salisbury station and various distributing line extensions in this district, estimated to cost close to $40,000.

NORFOLK, VA.—Steps have been taken by property owners on Brooke Avenue to secure the installation of an ornamental lighting system on that thoroughfare.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until Feb. 15 for a motor-generator set and switchboard for the submarine base in Connecticut. (Specification 4570.)

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, will receive bids until Feb. 21 for fuses and fuse elements for Eastern and Western navy yards (Schedule 9396); until April 4, f.o.b. works, six experimental Diesel engines, about 15 b.hp. per cylinder; alternate bids are requested on two-cylinder, four-cylinder and six-cylinder engines. (Schedule 9131.)

North Central States

DETROIT, MICH.—The Aetna Portland Cement Company, 112 Union Trust Building, has preliminary plans under way for a power house and cement plant, at Bay City, Mich., to cost complete, about $[illegible]. Bids will be asked in the near future. Franklin R. Johnson is president.

YPSILANTI, MICH.—The Owen Sanitarium Company is preparing plans for the erection of a power house on Forest Street and will call for bids at an early date. F. N. Menefee and C. F. Streeter, 706 Marquette Building, Detroit, are consulting engineers.

MANSFIELD, OHIO.—A power plant will be installed in the new eight-story hotel to be erected at Walnut Street and West Park Avenue at a cost of about $600,000. E. B. Caldwell, Jr., 886 Main Street, Bridgeport, Conn., is architect in charge.

OWENSBORO, KY.—Extensions are contemplated to the municipal electric light plant, including the installation of a 500-hp. boiler, with stokers, pump and other necessary equipment. Bids, it is understood, are being received.

BLOOMINGTON, IND.—A power house will be constructed by the Bloomington Brick & Tile Co., in connection with its proposed new plant, about 10 miles from the city, to cost about $200,000. A. W. Beecher is president.

GOSHEN, IND.—The City Council has arranged a contract with the Hawks Electric Company for power supply for commercial service. The city is operating a municipal plant for local street lighting and is considering closing the station and securing the entire power supply necessary from the Hawks company.

SULLIVAN, IND.—The Wabash Electric Company has entered into a ten-year contract with the City Council which provides for the installation of a new street-lighting system in Sullivan. All the lighting units in the city are to be quadrupled and the number of lamps in the residence district tripled.

CHICAGO, ILL.—Bids will be received by the purchasing agent, Post Office Department, Washington, D. C., until Feb. 20 for furnishing six electric tractors, 400 trailers and 1,200 combination balance trucks and trailers, also eight additional batteries, for the United States Post Office mail terminal building, Chicago, Ill.

CHICAGO, ILL.—The City Council committee on gas, oil and electric lamps has decided to have a complete survey made of all overhead wires in the city with a view of placing all telephone, telegraph and electric wires underground.

PEORIA, ILL.—The Board of Local Improvements is considering the installation of ornamental lamps on several boulevards in Peoria.

ALBERT LEA, MINN. — The Southern Minnesota Gas & Electric Company has purchased a site on which it will erect a four-story office building. Frank D. Chase, Inc., Chicago, Ill., are architects and engineers. A. W. Higgins is president.

COLUMBIA, MO.—Bids will be received by the board of trustees of the University of Missouri until Feb. 24 for the construction of a power plant, including smokestack, tunnel, boilers and stokers, traveling crane, steam and water mains, piping, etc. Plans and specifications may be obtained from Edward E. Brown, business manager, Columbia.

HANNIBAL, MO.—Plans are being prepared by the Board of Public Improvements, City Hall, for an addition to the municipal power plant and a street-lighting system, to cost about $170,000. Arnold & Company, 105 South La Salle Street, Chicago, Ill., are engineers.

JEFFERSON CITY, MO.—A power house will be constructed by the Standard Crate & Filler Company in connection with a large addition to its local plant, to cost about $350,000. A. W. Happy is general manager.

WORLAND, MO.—The Worland Light & Power Company is having plans prepared for the construction of a 2,000-hp. plant.

WATERTOWN, S. D.—The Public Utilities Commissioners, George K. Burt chairman, will receive bids until Feb. 16 for the construction of a new electric distributing system, to cost about $100,000. E. D. Jackson, Endicott Building, St. Paul, Minn., is engineer.

HASTINGS, NEB.—Bids will be received by the city of Hastings on Feb. 27 for the installation of an additional steam turbine unit of 1,000-kw. capacity in the municipal power plant. W. S. Watson is engineer.

WOOD LAKE, NEB.—The power plant of the Wood Lake Electric Light & Power Company is reported to have been destroyed by fire, causing a loss of about $5,000. F. Jones is owner of the plant.

PARSONS, KAN. — A steam-operated power plant will be constructed by the City Council in connection with a new filtration plant at the municipal waterworks. Burns & McDonnell, 402 Interstate Building, Kansas City, Mo., are consulting engineers.

Southern States

LITTLETON, N. C.—Bids will be received by the Town Commissioners until Feb. 15 for the construction of an electric light plant, waterworks and sanitary sewerage systems. The plans include one 90-kva. uniflow engine generator unit, one 125-hp. boiler, two 500-gal.-per-minute pumps, 100,000-gal. reservoir, 60,000-gal. tank on 75-ft. steel tower, and moving and resetting one engine generator unit and one boiler. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

ATLANTA, GA.—The City Council is considering plans for the installation of an ornamental lighting system on the State Capitol grounds. R. C. Turner, city electrician, is in charge.

PELHAM, GA.—W. A. Drake of Pelham and others are reported organizing a company for the purpose of building a hydro-electric power plant on the Ogeechee River for furnishing electricity in Swainsboro, Midville, Wadley, Waynesboro, Millen, Statesboro, Garfield, Summit, Graymont and a number of other towns.

DELRAY, FLA.—Bonds to the amount of $62,000 have been issued for the construction of a 100-hp. electric light plant and a waterworks system.

FORT MYERS, FLA.—Plans are under way for the installation of an ornamental lighting system, covering about one mile of streets, to cost about $6,000. The plans provide for from four to eight posts to a block. C. P. Staley is city manager.

FORT PIERCE, FLA.—The City Council has approved plans for the construction of a transmission line to Jensen, Fla., about 15 miles, to furnish electricity at Jensen from the municipal power plant. A number of branch lines will be built along the route.

JACKSONVILLE, FLA.—The City Commissioners, Jacksonville, and the Common Council, Pablo Beach, Fla., are planning for the joint construction of a new transmission line between the two cities, a distance of about 18 miles, to supply electricity at Pablo Beach.

OCALA, FLA.—The Ocklawa Farms & Reclamation Company is planning the construction of a dam and electric power plant on the Ocklawaha River.

YBOR CITY, FLA. — A movement has been started by the Ybor City Business Men's Association for an extension to the ornamental lighting system on Seventh Avenue from Seventeenth Street to Twenty-third Street. The plans call for eight five-lamp cluster standards on a block. J. A. Mook is secretary.

ALEXANDRIA, LA.—The installation of an ornamental lighting system on King Street, to cost about $12,000, is under consideration.

NEW ORLEANS, LA.—Bids will be received by the Water and Sewerage Board, 526 Carondelet Street, until March 20, for 1,500 hp. to 1,800 hp. in boilers, centrifugal pumps and electrical machinery. A. G. Hoffat is secretary.

DALLAS, TEX.—The installation of a lighting system, consisting of thirty lamps, in the business district on Jefferson and Beckley Avenues is under consideration. E. H. Pratley is city electrician.

HITCHCOCK, TEX.—The construction of a municipal electric light, ice and cold-storage plant, to cost about $50,000, is under consideration.

LIVINGSTON, TEX.—At an election to be held Feb. 14 the proposal to issue $30,000 in bonds for purchasing electric light and power plant will be submitted to the voters.

VERNON, TEX.—The Texas Public Service Company is negotiating with the Council for the sale of its local power plant, to be owned and operated by the city. Bonds were voted recently for $100,000 for a municipal electric plant.

YORKTOWN, TEX.—The construction of an electric light plant in Yorktown is under consideration by the City Council.

Pacific and Mountain States

MEDFORD, ORE.—The California-Oregon Power Company has entered into an interconnection contract to supply power to the Mountain States Power Company for a period of thirty years. The company will erect a 115-mile, 110,000-volt electric transmission line from the Prospect plant of the California-Oregon Company, near Medford, through the Rouge River and Umpqua Valleys into the Upper Willamette Valley, where it will connect with the transmission system of the Mountain States Power Company at Eugene. Application has been made by the California company to the California Railroad Commission for permission to issue $1,000,000 in bonds for erection of the line and for additions and improvements.

REEDSPORT, ORE.—The Three Rivers Light & Power Company, recently organized by Stanley D. Chapin and others, has acquired the local electric power plant. The new owner is planning extensions and the installation of new equipment.

HOLLYWOOD, CAL. — The installation of an ornamental lighting system on Hollywood and Normandie Avenue is under consideration by the Council.

LOS ALAMITOS, CAL.—The local substation of the Southern California Edison Company, Los Angeles, was recently destroyed by fire, causing a loss of about $75,000.

LOS ANGELES, CAL.—The directors of the Southern California Edison Company have authorized an expenditure of $22,500,000 for additional water-power development and extensions to its transmission and distribution systems. Estimates of the expenditure call for $10,951,000 for hydro-electric development; transmission lines, $3,333,000; improvements and extensions to distribution lines and substations, $8,124,615, and advances to subsidiary companies, $125,385. The company has also been granted permission by the State Railroad Commission to begin work on the proposed Big Creek Power Plant No. 3, which will have an initial capacity of 65,000 hp., and, it is expected, will be completed early in 1923. Final plans call for six generating units having a total capacity of 200,000 hp. John B. Miller is president.

NEWPORT BEACH, CAL. — The City Council will soon advertise for bids for the installation of an ornamental lighting system on the new pier at Balboa.

RIVERSIDE, CAL.—The Southern Sierras Power Company, Riverside, is planning to extend its electric transmission line from Sedco for a distance of 11 miles.

SAN BERNARDINO, CAL.—The Southern California Edison Company contemplates the establishment of a transformer station at Third and H Streets, to supply electricity for all ornamental lamps.

SATICOY, CAL.—Plans have been prepared by the Southern California Edison Company, Los Angeles, for the construction of a new substation at Saticoy.

YELLOWSTONE PARK, WYO. — The Founders' Organization announces that, in connection with the Northern Bond & Investment Corporation, it has practically completed its survey from Columbus, on the main line of the Northern Pacific Railroad, into the New World mining district, at the northeast corner of the Yellowstone National Park, for the construction of a standard-gage electrically operated railroad, 83 miles long. Active construction of the road will be started April 1. Plans are under consideration also for the erection of an ore-reduction plant in the Divide and New World mining districts and for the development of power in this district. The organization will soon be in the market for complete railroad and shop equipment. All of the work is under the supervision of the Founders' Organization, 325 Plymouth Building, Minneapolis, Minn., of which J. P. Ernster and A. W. Barker are directing managers.

PEACH SPRINGS, ARIZ.—The Parklap Construction Corporation, 84 Pine Street, New York, is preparing plans for the construction of a hydro-electric generating plant on Diamond Creek near Peach Springs, this section. A dam 400 ft. high will be built and the initial plant will have a capacity of about 150,000 hp. With transmission system, the cost is estimated at about $10,000,000. Parsons, Klapp, Brinckerhoff & Douglas, 84 Pine Street, New York, are engineers.

Canada

BLUEVALE, ONT.—The town authorities are having plans prepared for the construction of an electric power distribution system, to cost about $28,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

PORT ELGIN, ONT.—The installation of an electric distribution system, to cost about $35,000 is contemplated. Prices, it is understood, are wanted on equipment. A. McLaren is Mayor.

SOUTHAMPTON, ONT.—Plans are under consideration by the town officials for the establishment of an electric distribution system in Southampton, to cost about $30,000.

STURGEON FALLS, ONT.—The Northern Ontario Light & Power Company, Cobalt, is considering the purchase of power rights on Sturgeon Falls, Mattagami River, held by the McIntyre-Porcupine Mines, which it is estimated are capable of developing 7,000 hp.

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Business and the Bonus

CONGRESS proposes to make a gift of money to the men who served in the armed forces of America during the war. They plan to add to our already blighting taxation a further load of from $1,560,000,000 to $5,250,000,000, according to varying estimates. But before this is permitted by the men and women who must pay the bill some pointed questions should be asked.

Who wants this bonus? Are the taxpayers demanding it? Is labor calling for it? Does business need it? Can we afford it? Why does Congress try to do it? Has it the right? Who is against it? And if these questions are answered truthfully in Washington, there will be no bonus! For the facts condemn it utterly when you look it squarely in the face.

This demand for a handout from the public treasury comes only from the faction in power of the American Legion, an organization numbering but 20 per cent of the men for whom the gift is asked. The rest of the ex-service men have not called for it. Nobody else urges it. But this command is made before election time and Congress is afraid.

THE Director of the Budget may strain every nerve to save a few hundred millions by better business methods in the government. The arms conference may declare a naval holiday to ease the burden on the people. Secretary Mellon may warn us of a three-hundred-million-dollar deficit ahead. But the politician, to preserve his puny power, will throw it all—and more—away, despite the fact that he has no possible right to take the money of all the people and present it to any favored class or group—votes or no votes.

There is no question of our obligation to ex-service men. No money or effort should be spared to relieve and restore disabled veterans and care for them. That is all clear, agreed and understood throughout the land. But a bonus—one billion or five billions—is something else, for it is cash-money that must be levied on the pockets of men and women at a time when the universal cry is for relief from throttling taxes and when every possible dollar is needed for the revitalizing of business.

THE United States Chamber of Commerce, the automobile industry, the farmers and many other interests are now fighting against the bonus bill. Surely it is no less vital to electrical men, and our united voice should speak to Washington with positive frankness. For business must be protected. Moreover, all thinking men in their hearts realize that we cannot go on exploiting the people of this country through colossal taxes or bond issues of this kind, directed to a wasteful purpose, or ultimately it will wreck this nation.

Charles Ezra Scribner

Telephone engineer and inventor who developed the multiple-unit switchboard.

FREQUENTLY the statement has been made that without the contribution of this one or of that widespread use of the telephone would never have become an accomplished fact. Without a doubt this is true. It simply means that the telephone art as we know it today is not the result of any one man's work, but of the co-ordinated effort of many. The man who was responsible for much of the work of co-ordination and perfection of the several parts of the telephone circuits, particularly central office apparatus, is C. E. Scribner, consulting engineer for the Western Electric Company. Not only did he guide the work of others, but he himself took a conspicuous part in the perfecting of telephone equipment. He has an inventive mind that has been unusually prolific of new ideas. His patents number more than five hundred. It is significant, however, that there never has been anything sensational or startling about his inventions. Complications arose as the natural result of a quickly expanding service, and it was on the practical solution of such problems that be brought his great inventive ability to bear.

While outside of the transmitter and receiver there is hardly a bit of telephone apparatus that has not directly felt the influence of his efforts, he probably made his most important contribution in the development of the multiple switchboard—the nerve center of the telephone system. As early as 1885 the switchboard had become cumbersome. For a few hundred subscribers it was adequate, but not for thousands. Thus arose the need for a better system, and the solution was the multiple switchboard, the crude idea of which had come from the brain of L. B. Firman in 1879. It was Scribner, however, who took the idea and perfected it. Thousands of wires now come into an exchange and each wire is tasseled into many ends, but, no matter how many operators there are, only one of these ends can be put into use at any one time. This is accomplished by another of Scribner's inventions, known as the "busy test." So well did he work that the central-office equipment which he devised has played a leading part in telephone operation not only in the United States but in nearly all the leading countries of the world as well. Not all of his work, however, has been on the telephone. In his earlier days he devoted fruitful efforts to other electrical devices, including generators and arc lamps.

This week Mr. Scribner celebrated his sixty-fourth birthday, having been born Feb. 16, 1858, at Mount Vernon, Ohio. He came into the industry in a most interesting way. When a lad of eighteen he had invented a telegraph repeater, and he went to Chicago to the Western Electric plant to have a model made. There by accident he met Enos M. Barton, founder of the company. Mr. Barton's interest being aroused, he prevailed upon young Scribner to take employment with another company in which Mr. Barton was interested, the Gold & Stock Telegraph Company. Here young Scribner started work in 1876, inspecting telegraph apparatus. Next year found him in the laboratory of the Western Electric Manufacturing Company, assigned to research and development work in electric lighting and telephony. His first invention, the "jack-knife" switch, was made in 1878. He remained at Chicago until 1908, when he went to New York as chief engineer in charge of development and experimental work. In the fall of 1916, after forty years of continuous service with the Western Electric Company and its predecessor, Mr. Scribner at his own request was relieved of his executive duties and appointed consulting engineer. He is a fellow of the American Institute of Electrical Engineers and has taken an important part in the deliberations of that body, having been a vice-president in 1913. He has also served as a trustee of the United Engineering Societies.

Editorial Comment

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Number 7

Exit the Water Power League of America

REPRESENTING no industry and having nothing but debt to show from an activity covering two years, inevitable doom has overtaken the Water Power League of America. Failure was written across its face a year ago when interest began to wane and when the opportunity for service was permitted to slip by ungrasped. By many the Water Power League of America was looked on just as another of those numerous organizations which are started with good intentions and are tolerated for a time, but, having no mission and performing no useful function, gain no support and die naturally from anemia. There is no escape in times of stress from the law of the survival of the fittest. Work there was for the Water Power League to do, but the interests it represented were too conflicting to permit of even co-ordinated effort.

So far as the electric light and power industry is concerned, the league contributed very little. It was organized just as the federal water-power law was enacted and hence played no part in obtaining that much-needed legislation. Thereafter such work as it engaged in duplicated rather than augmented the efforts of already existing organizations. We suffer from a surfeit of associations and shall not greatly miss one of the least of them, although even the smallest, if it can justify its existence, will not lack support.

Classified Costs of Service Must Be Known

PUBLIC utility companies have reached a position where the managements can no longer afford to be ignorant of the cost of service to any group of consumers representing a distinct class. Time was when rates were made on a "hit-or-miss" basis because experience had not been sufficient nor practices well enough developed to permit of establishing classified costs of service within fairly close limits. Unfortunately the practices prevailing at that period of central-station development are still allowed to dominate many rate schedules. The industry has passed from the period of development, in which the technical phases naturally predominated, into the permanent period, where the aspect that presents itself to the consumer is a purely merchandising affair.

No longer will the consumer be content with the assurance that a rate per kilowatt-hour is fair. Whether he realizes it or not, he is buying a service in which the cost per unit may be high or low, depending on the extent to which the service is actually utilized. In his ignorance of the fundamental merchandising features involved in the sale of the service, the customer is vainly trying to determine its value by the only standard he knows, the cost per kilowatt-hour. He has been misled by the ignorance of the central-station operators themselves into a belief that this is the only standard of comparison.

Not only must the central-station operator educate himself in the costs of doing business, but he must educate his customers to understand that cost before some one else does the job for him in an unwelcome way. The fundamental in this educational work is a complete knowledge of his own costs of doing business, comparable to the knowledge that every other business is seeking to obtain of its own affairs.

The public utility manager who cannot meet the situation and employ methods to obtain the knowledge that will make him a real merchant is doomed to find himself replaced by some one who can. The old excuse that it costs money and cannot be satisfactorily done no longer carries weight. Whatever the cost may be, it is a legitimate cost of doing business and one that no fair-minded customer will dispute. The time will soon come when the information will be demanded more forcibly than ever by the commissions and individually by the consumers. Will the industry be found ready and confident, or hesitant and fearful because unprepared?

Co-operation by Classes Among Electrical Men

IT HAS long been the pleasant practice of electrical men to talk of the co-operation which exists within the electrical industry. But, after all, it has been hardly more than a half truth, for the co-operating electrical men have done has been almost exclusively by classes. Central-station men have been organized. Several different groups of manufacturers have worked together. There has been an association of jobbers and one of contractors and dealers. But these co-operative activities—by classes—have never really been co-ordinated. Central-station men have continued to think as central-station men. Manufacturers have gone on looking at the electrical industry through a manufacturer's eyes. And jobbers and contractor-dealers have kept their several ways, absorbed in their own work.

The result of all this is that the different classes of electrical men have not been molding their different ideas and aims into a common purpose and a plan that can embrace them all. And there we stand today, unsatisfied with present conditions in the industry, which, despite spectacular progress and tremendous achievements, have not yet welded the different kinds of electrical men together.

The cure is not so simple as the course is clear, and yet the way is plain. A common understanding can only come out of a freer interchange of thinking that will establish a deeper insight into the other fellow's problems. When manufacturers as a class begin to talk more *to* the jobbers as a class, there will be less to say and less said *about* each other. When central-station men as a class speak more freely *to* the contractor about more of the things that must concern them both, there will be far more harmony and more good work between the individuals. And when all four kinds of electrical men—that is, the men engaged in these four prime divisions of the industry—are more interested in the general problems, they will see more clearly the interdependence that exists and feel more strongly the common obligation to serve the industry, as well as the immediate ends of the day's desire. And they will find many of the solutions that today, working alone, they seek without much progress.

Civilization has built up as a medium for the interchanging of men's thinking the institution of the press. To carry a message beyond the ears within a room the words are printed on a page and sent out broadcast to the community, the industry, the nation or the world. For the function of the press is more than just to find things out and tell the tale. The news is vital, but more fundamental than the news is what men think about the news and the common purposes and plans that grow out of this thinking when it is freely interchanged. The press is therefore an essential instrument in the development of the evolutionary process, and the publication of good thinking is an important factor in the upbuilding of any industry.

As a further impulse to the effecting of a closer co-ordination within the electrical industry there has been set apart in this issue of the ELECTRICAL WORLD a new section to which has been given the heading "Manufacturing and Distributing." It will continue to serve each week as a place for the discussion of production, distribution and market development, the business and economic problems of the manufacturer, jobber, agent, contractor and dealer. In it the thinking of these electrical men will be freely expressed on a diversity of topics in which the entire industry has an interest as well as the jobber or manufacturer who speaks. The value of all this, we believe, will show itself in the number of these presumably class subjects which will show themselves of definite concern to all kinds of electrical men.

Regulation Must Be Progressive Rather than Merely Corrective

THIS was the happy conclusion arrived at by M. H. Aylesworth, executive manager of the National Electric Light Association, in a recent address before the Ohio State University. Why this must be so was amply demonstrated in his address, and if "judgment must begin at the house of God," his choice of the place for his address is to be commended. We naturally look to our universities and institutions of learning for wisdom and guidance, but while they excel in knowledge, they are apt to err in vision in matters of public policy because of the inexperience of professors and the assurance and rashness of youth. Regulation is a new thing, an undemocratic thing to many, and if it is to be effective, it is expedient that it be understood by the coming generation of college graduates. They will be the mainstay of our institutions, and it is well that they shall comprehend the genesis and development of those newly born.

Mr. Aylesworth traced the growth of the electric public utilities, their evolution and the necessity for their regulation by the state. He argued most convincingly against so-called "home rule" and showed how inapplicable that doctrine is when applied to interconnected networks whose very existence is predicated on economy and efficiency. Superpower systems we must and shall have, if industry is not to be handicapped and rural communities are not to be deprived of all hope of economical and dependable electric service; but if individual enterprise and initiative is to be conserved and the withering hand of officialdom stayed, the regulation of such enterprises must be along progressive and not reactionary lines. Mr. Aylesworth has done well in calling the attention of colleges to this point and giving the necessary background for honest judgment.

Michigan Company a Pioneer in High-Tension Transmission

FEW men in the central-station industry realize not only that one of the higher-voltage transmission systems of the United States, and a large one at that, lies in the Middle West, but that this system also has been one of the pioneers in such transmission. The Consumers' Power Company operates in its Michigan system more than 500 miles of 140-kv. transmission lines, the first unit of which went into service in 1912. Previous to that—in 1907—a section of line to operate at 110 kv. was undertaken and operated at that voltage. Transmission distances now range from 40 miles to 250 miles, and loads up to 25,000 kw. per circuit are handled. These facts entitle the company to rank with the pioneers in high-voltage transmission and also with the large systems of the country.

The system is built upon a combination of hydro-electric and steam generation which is unusual, particularly in the Middle West. Some of the hydro-electric developments are particularly interesting to the utility engineer of that section because they were made and are operated under conditions that are typical of most if not all the factors that govern Middle Western hydro-electric development. While high for the Middle West in some cases, the heads are all of the sort that would be generally classed as low. Dams have had to be built on sand or an equally bad foundation, just as many possible dams in other sections of the Middle West must be built if built at all. Transmission-line construction has undergone an interesting evolution. Elsewhere in this issue attention is directed to some of the important lessons that have been learned on the system of the Consumers' Power Company. Their bearing on the problems that engineers on other systems have to face can be readily seen and the results of the practice profitably studied.

Rural Service Problem Must Not Be Ignored

A STRONG disinclination is developing among some light and power men to talk about the rural service problem, on the ground that the utilities are not in a position to do much toward handling the business. The attitude displays a tendency to play the ostrich's trick of burying its head in the sand and fancying that it thus becomes invisible. The central-station company is no longer in a position to say whether or not the problem shall be considered. The farmer wants service and is going to get it.

Now, as a matter of fact, there are a number of rural-service methods that have been more or less successful from the standpoint of the light and power company. In the most successful ones financing has been done by the farmer, and there is ample support for the claim that under the conditions that existed this was the proper method. However, regardless of its justification, it is inevitable that this method will be called into question by the farming interests. Whether it will be convenient for the central-station company to face the issue is not a question that will receive consideration from the rural customers.

The rural-service problem is here, and some means of successfully handling it in all its phases must be found. The central-station manager is still in a position to have a large voice in the determination. On the other hand, if he turns his back on the problem and attempts to ignore it, he will wake up to find the farmer backed by the most powerful political elements in the country dictating the settlement.

Inductive Interference Viewed by an Attorney

DEFINING the highways on which high-voltage power lines are constructed as "'rivers of electricity'—broad and mighty streams that fill the highways from fence to fence and beyond," David F. Hall, division attorney for the American Telephone & Telegraph Company, in a paper recently presented before the Illinois Telephone Association at Chicago, made a strong plea for the priority theory of highway occupancy. Mr. Hall's first contention was that in many cases separation is the only way wholly to remove inductive interference. A table of limiting lengths of parallels was given by him for voltages of 11,000 to 100,000 in which the least separation is 40 feet and the others range from 100 feet to 1,000 feet. His statement in regard to the ground-return telephone lines would lead many to believe that he had in mind the possibility that this type of construction can be established legally as an approved type for certain kinds of service. This statement was followed by an enunciation of the priority theory which wound up with the assertion that a principle of law well established in the United States is that "as between two companies having equal rights to the use of a highway, priority of occupancy carries superiority of right, and if conflict or interference is unavoidable, the later company must give way."

Such a treatment of engineering matters, making use of poetical figures of speech, does not readily check with scientific facts. The comparison of electricity to a river, with its implication that the analogy applies to the power circuits only, is far from correct. Rivers in their travels act in accord with the law of gravity, while the electrical forces around any circuit act in accord with laws of a different character. Inductive interference, so called, is not a manifestation peculiar to power circuits, but is the result of a lack of control, to a certain degree, of forces that have proved extremely useful in all types of electrical activity. A familiar, and perhaps the oldest, manifestation of this lack of control is the familiar cross-talk that has excluded the ground-return telephone line from important communication circuits. Means were found for controlling it in the use of other forms of construction, involving extensive measures for obtaining balance and counteracting the forces set up inductively by one circuit in another. Essentially the engineering problem in dealing with inductive interference is nothing more than the finding of methods by which electrical forces acting along certain lines can be controlled and their incidental harmful manifestations reduced to a negligible quantity. This applies to all characters of electrical circuits in varying degree, and not only are the characteristics of circuits that exert a strong influence to be scrutinized, but the sensitivity of other types of construction to inductive influences must be limited.

Mr. Hall's statement of the status of the ground-return line and the legal priority claim, if followed to its logical conclusion on the suggested basis of separation, would in many instances give the telephone industry an absolute monopoly of the highways and deprive the public of the right to other classes of service. The public cannot be ignored in the argument, nor can it be assumed that the consumers must be forced in some cases to choose the class of service they will have and to do without others.

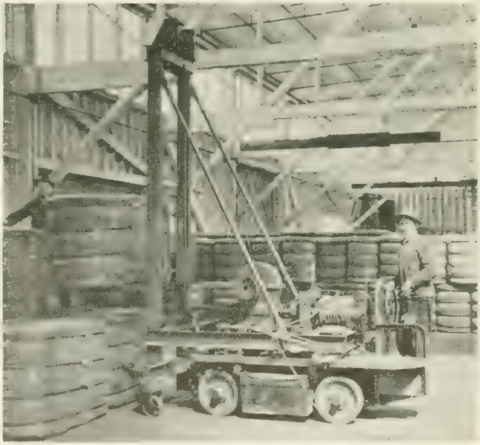
It is time that such views of the subject as those presented in Mr. Hall's paper be relegated to the scrap heap. Public utilities exist for the purpose of giving the public certain classes of service. Their occupancy of public highways is based on their ability to find means of giving this service without barring any other legitimate use of the highways. The sooner the talk about legal rights is abandoned and a sincere effort made to find the actual remedies and then decide on their application to the various systems involved, the better it will be for all. Courts were not established to decide technical questions of the character fundamentally involved in the inductive-interference problem, and they can only muddle the matter if it is put up to them.

A Budget of $22,500,000 and What It Means

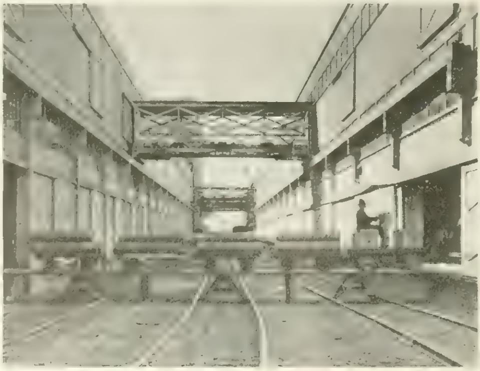
THE 1922 budget of the Southern California Edison Company, which has just been announced, is remarkable for two reasons: It includes an item for the reconstruction of its famous 150,000-volt, 240-mile Big Creek lines to operate at 220,000 volts, which in technical circles is news of the first order, and it provides for a program of continued expansion that should be reflected in a wave of renewed confidence throughout the industry. This is not the only Western company that is starting with an enlarged budget for the year. From Canada to Mexico the power companies are expanding and co-ordinating their efforts. Only a week or so ago the announcement was made that by an interconnection in southern Oregon there would be a continuous transmission line from north central Oregon through California to the Mexican border and into Nevada and Arizona. The Pacific Gas & Electric Company has a budget about equal to that of the Southern California Edison Company, and the combined budgets of the other California companies would add another $20,000,000 to the expenditures for the year.

The significant fact, however, is that for every dollar spent by the power companies in expanding their systems two dollars is spent for utilization devices. Thus in California alone the market for electrical and associated material will this year reach the enormous total of $195,000,000, which is more than $65 per capita. This is inspiring evidence not only of strong confidence in the industrial and business prospect of the immediate future, but of a broad vision of the increasingly greater part which electricity is to play in the life of the people in the years ahead.

Terminal Freight Handled Electrically at Seattle



THE problem of material handling at terminals is one of the vital issues that must be worked out in the broad study of distribution that confronts the economic world today. Great convenience and flexibility of operation must be developed if more goods are to be moved more economically. These pictures show how electricity is being employed in the port of Seattle in the effort to speed up freight traffic and reduce cost. Similar equipment is now at work at the Cleveland terminal and the Bush terminal in Brooklyn. Experience here and elsewhere may go far toward the solution of this aspect of the problem when it is made available.



Indiana Industries 60 per Cent Electrified

More than Half of the 654,812,000 Kw.-Hr. Consumed by Industrial Plants and Mines in 1920 Purchased from Central Generating and Distributing Systems—Voltages and Frequencies Less Varied than in Some States

By ROBERT M. DAVIS
Statistical Editor ELECTRICAL WORLD

THE industries of Indiana have adopted electrical energy as a source of motive power to an extent that is probably equaled by only a few other states in the Union. Almost 60 per cent of the primary horsepower of the state is electrical, and more than 650,000,000 kw.-hr. of electrical energy is consumed annually by its industrial establishments.

During the past year and a half the ELECTRICAL WORLD has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. This survey has been undertaken by states, and Indiana is the fourteenth state in the series. A detailed analysis of the industrial load of California appeared in the ELECTRICAL WORLD for Aug. 28, 1920. A similar analysis of the industrial load of the Southern States appeared in the issue of June 25, 1921, and the industries of New York and Pennsylvania were covered in the issues of July 30, 1921, and Dec. 31, 1921, respectively. Returns are now being received from Massachusetts, Ohio and Illinois, and the analyses of the industrial load of these states will appear in early issues of the ELECTRICAL WORLD.

The survey to ascertain the use of electrical energy by the various industries of Indiana involved the sending out of about 1,200 questionnaires to the larger manufacturing plants and mining companies. A summary of the replies received and estimates of the total operations are presented in the accompanying tables.

The Census of Manufactures for 1919 indicates that Indiana ranks with California and Connecticut as an industrial state, with a total capital investment of $1,335,851,000. Up to the present at least Indiana has been termed an agricultural state, and in 1914 it was ranked fourteenth in value of mineral products. But with the 1919 census Indiana has taken its place as

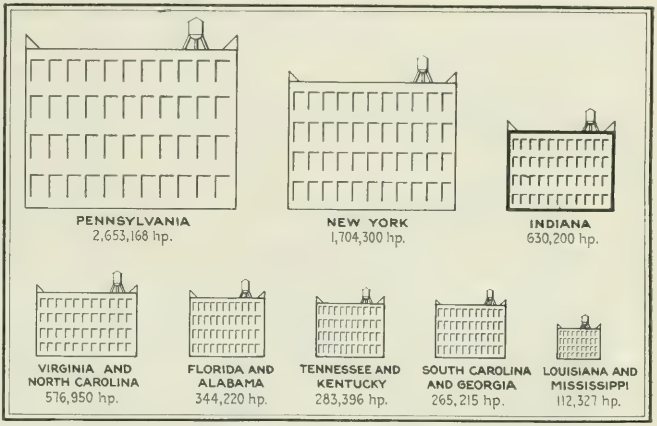


FIG. 1—HOW INDIANA COMPARES IN ELECTRIFIED POWER WITH OTHER STATES COVERED TO DATE BY THE "ELECTRICAL WORLD" SURVEY

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF INDIANA

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the editorial departments of the ELECTRICAL WORLD and *Power*, and cover plants in all industries employing more than fifty operatives

	Companies Reporting		Electric Generators				Electrical Energy Consumed		Motors Installed			Distribution of Drives		
			Direct Current		Alternating Current									
Industry	Total Number	Number Using Electrical Energy	Number	Total Rating, Kw.	Number	Total Rating, Kw.	Privately Generated, Kw.-Hr.	Purchased, Kw.-Hr.	Number	Total Rating, Hp.	No. Under 5 Hp.	Belt	Chain	Directly Connected
Bituminous coal mining	20	13	17	2,815	2	700	4,141,500	3,829,500	368	12,058	335	95	16	257
Chemicals and allied products	14	8	10	1,610	5	4,000	18,145,775	880,931	1,143	11,070	526	838	36	269
Electrical equipment and machinery	7	7	8	1,865	1	60	2,360,882	9,266,700	3,808	21,527	3,166	2,345	109	1,354
Food and kindred products	47	35	11	718	11	1,118	3,454,520	4,529,634	659	6,053	327	349	45	265
Iron and steel and their products	116	98	58	10,323	30	42,382	90,927,884	39,862,433	7,957	130,944	2,835	4,787	226	2,944
Lumber and its products	73	51	22	1,468	20	2,394	8,452,740	3,388,058	1,514	12,843	640	950	52	512
Metals and metal products other than iron and steel	7	7	5	1,620	1	85	8,236,438	2,322,351	270	2,580	62	100	10	151
Paper and printing	21	14	6	2,525	3	1,427	5,021,260	2,504,198	397	3,414	314	330	12	55
Stone, clay and glass	37	30	14	950	5	750	2,715,165	7,799,950	549	7,006	189	246	54	249
Textiles	26	15	7	760	3	900	2,012,400	6,496,432	606	4,272	359	304	55	207
Vehicles for land transportation	15	12	3	550	5	2,865	5,870,120	11,571,190	2,399	33,146	552	1,285	61	1,053
Miscellaneous	41	23	17	1,980	3	550	2,225,920	2,158,555	714	5,303	247	457	34	223
Totals for all industries of Indiana	424	313	178	27,134	89	57,231	153,564,604	94,609,932	20,384	250,216	9,552	12,086	710	7,539

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN THE INDUSTRIAL PLANTS OF INDIANA DURING 1920

Industry	Electric Generators: Direct Current No.	Direct Current Total Rating Kw.	Alternating Current No.	Alternating Current Total Rating Kw	Electrical Energy Consumed: Generated in Private Plants, Kw.-Hr.	Purchased from Public Utilities, Kw.-Hr.	Total Electrical Energy Consumed, Kw.-Hr.	Total Motors Installed: No.	Total Rating Hp.	No. Under 5 Hp.	Distribution of Drives: Belt	Chain	Directly Connected
Bituminous coal mining	114	18,920	13	4,690	27,750,000	12,570,000	40,320,000	1,224	61,000	1,124	316	53	855
Chemicals and allied products	11	1,830	6	4,540	20,600,000	14,600,000	35,200,000	2,120	20,520	980	1,553	67	500
Electrical equipment and machinery	9	2,200	2	70	2,787,000	10,430,000	13,217,000	4,340	24,500	3,610	2,675	124	1,541
Food and kindred products	54	3,540	54	5,520	17,050,000	33,650,000	50,700,000	4,180	38,430	2,070	2,215	286	1,679
Iron and steel and their products	81	14,430	42	59,300	127,000,000	54,600,000	181,600,000	11,070	182,100	3,940	6,650	314	4,106
Lumber and its products	23	1,560	21	2,540	9,000,000	20,220,000	29,220,000	3,730	31,660	1,570	2,340	128	1,262
Metals and metal products other than iron or steel	6	1,770	2	93	9,000,000	7,260,000	16,260,000	420	3,970	100	156	30	234
Paper and printing	7	3,140	4	1,770	6,240,000	14,200,000	20,440,000	1,080	9,270	850	897	33	150
Railroad repair shops	54	3,560	19	10,230	23,650,000	8,225,000	31,875,000	1,730	40,680	190	310	60	1,360
Stone, clay and glass	184	12,520	66	9,880	36,300,000	90,300,000	126,600,000	6,600	84,180	2,270	2,960	650	2,990
Textiles	26	2,860	11	3,380	7,570,000	10,430,000	18,000,000	1,280	9,040	758	641	200	439
Vehicles for land transportation	4	600	6	3,100	6,350,000	14,530,000	20,880,000	2,870	39,600	660	1,535	73	1,262
Miscellaneous	253	29,420	45	8,180	33,100,000	37,400,000	70,500,000	11,480	85,250	3,960	7,350	545	3,585
Totals for all industries of Indiana	826	96,350	291	113,293	326,397,000	328,415,000	654,812,000	52,124	630,200	22,082	29,598	2,563	19,963

one of the nine most important industrial states in total value of manufactured products, and it must henceforth be classed as an industrial as well as an agricultural state.

LARGE INCREASE IN CENTRAL STATION INDUSTRIAL LOAD

The use of electrical energy by industrial works in Indiana has shown a remarkable growth since 1914. In 1914 the connected industrial load of the central generating and distributing companies of the state, exclusive of the lighting load, was only 119,700 hp. In the five succeeding years this load increased 91.0 per cent, or to 228,900 hp. The increase in electrical energy sold to power customers, exclusive of railroads, by central generating and distributing companies operating in Indiana during this period was also marked, the total rising from 100,760,000 kw.-hr. in 1914 to 273,900,000 kw.-hr. in 1919, an increase of 174 per cent. No statistics are available as to the increase in the operations of private electric generating plants in Indiana during that period.

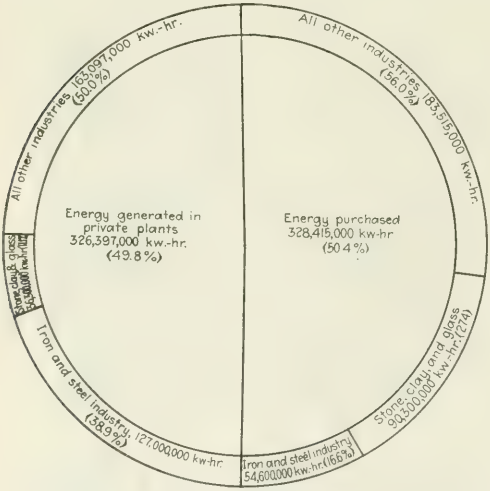


FIG. 2—ALMOST HALF OF THE ENERGY USED IN INDUSTRIAL PLANTS AND MINES OF INDIANA IS GENERATED IN PRIVATE GENERATING STATIONS

The returns received from the survey have been grouped under sixteen general industries, as indicated in Table I. The data are for the year 1920. Complete returns were received from 424 mines and factories employing fifty or more operatives each, and the companies reporting represented every industrial section of the state. Of these plants, 313 reported the use of electrical energy as their main source of power. The works using electrical energy reported private generators totaling 84,365 kw., of which direct-current generators totaled 27,134 kw. and alternating-current generators totaled 57,231 kw. The output in 1920 of these private generating plants was 153,564,604 kw.-hr. The electrical energy purchased by the works and mines reporting was 94,609,932 kw.-hr. A close study of the census data indicates that, taking the total installed motor rating of the industrial plants of the state as a whole, about 47 per cent of the works and mines generating all or a portion of their electrical energy reported to the ELECTRICAL WORLD, and that only about 29 per cent of the plants and mines purchasing all or a portion of their electrical energy made such reports. On this basis the indications are that about 50.4 per cent of the electrical energy used by the industrial works and mines of Indiana is purchased from central generating and distributing companies. The surveys of Pennsylvania and New York which were completed last fall indicated that about 50.3 per cent and 79 per cent respectively of the electrical energy which was used by the industries located in these states is purchased from central generating and distributing companies.

Table II gives the ELECTRICAL WORLD estimate of the total use of electrical energy in the industrial plants of Indiana during the year 1920, based upon the returns received from the survey, supplemented by federal and state census data. It is estimated that there

TABLE III—DIRECT-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN INDIANA

Industry	Number of Companies Reporting Various Motor-Operating Voltages (Voltages) 110	115	120	125	220	230	240	250	440
Chemicals and allied products		1				1			
Electrical equipments and machinery					2	1			2
Food and kindred products	6								
Iron and steel and their products	8	1	1	2	23	7	1		10
Lumber and its products	2	1			2			1	2
Metals and metal products other than iron or steel					1				
Bituminous coal mining					1			8	1
Paper and printing	2	1			2				
Stone, clay and glass	1				4			2	2
Textiles	3				1				
Vehicles for land transportation					1			1	2
Miscellaneous	5	1			5			1	
Totals for all industries of Indiana	27	5	1	2	42	9	1	13	19

TABLE IV—ALTERNATING-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN INDIANA

Industry	Number of Companies Reporting Various Motor-Operating Voltages (Voltages) 110	220	230	240	250	440	550	2,200	2,300
Chemicals and allied products	1	1				2	1	1	..
Electrical equipment and machinery		5				2			.
Food and kindred products	2	11	1	1	1	4			
Iron and steel and their products....	5	43	3	1	1	15		2	
Lumber and its products		21			2	8	1		.
Metals and metal products other than iron and steel		5			.	..		.	.
Bituminous coal mining		1			1	1			..
Paper and printing		2				1	..		.
Stone, clay and glass		10	.	.		5		1	1
Textiles	.	4			..	1	.		..
Vehicles for land transportation		5		1		1		..	1
Miscellaneous	4	4			1	2			..
Totals for all industries of Indiana	12	112	4	3	6	42	2	4	2

are 52,124 electric motors installed in the factories and mines of Indiana, with a total rating of 630,200 hp., which is about 58 per cent of the total primary horsepower of all the industrial plants in Indiana. Of these motors, 22,082, or 42.4 per cent, are under 5 hp. About 56 per cent of the machines are belt-driven, 39 per cent are directly connected, and only 5 per cent are chain-driven.

PRIVATE ELECTRIC GENERATING PLANTS HIGHLY STANDARDIZED

The returns indicate that nine voltages are in use in Indiana mines and factories for the operation of direct-current motors and that nine voltages also are used in the operation of alternating-current motors. It appears from these figures that voltage standardization plays a much greater part in Indiana than in Pennsylvania, where seventeen voltages are used for the operation of direct-current motors and twenty-one voltages are in use for the operation of alternating-current voltages. The returns indicate that 35 per cent of the direct-current motors in Indiana are operated at 220 volts, but large percentages are operated at 110, 250 and 440 volts respectively. Iron and steel works particularly reported a high percentage of direct-current motors operating at 440 volts. Almost 60 per cent of the alternating-current motors are operated at 220 volts, and over 22 per cent are operated at 440 volts. The details of motor-operating voltages will be found in Tables III and IV.

Almost 82 per cent of the companies reporting on types of motor control use knife or safety switches exclusively or in conjunction with other types of motor control. Figures received from the other thirteen states which have been covered by the industrial survey of the ELECTRICAL WORLD indicate that 82 per cent is very close to the degree to which knife or safety switches are now used by the industrial works of the country as a whole. About half of the mines and factories of Indiana use automatic starters, and about 55 per cent have installed circuit breakers. The detailed figures on types of motor control will be found in Table V, tabulated according to industry.

TABLE V—TYPES OF MOTOR CONTROL USED IN INDUSTRIAL PLANTS OF INDIANA

Industry	Number of Companies Reporting on Motor Control	Number of Companies Reporting Various Types of Motor Control: Snap Switches	Knife or Safety Switches	Auto Starters	Magnetic Switches	Remote Control	Circuit Breakers
Chemicals and allied products.....	5	2	4	4	2	1	4
Electrical equipment and machinery	5	1	5	4	1	1	3
Food and kindred products........	25	5	19	10	3	3	9
Iron and steel and their products...	72	20	57	42	12	15	41
Lumber and its products	34	6	30	14	10	4	14
Metals and metal products other than iron or steel	6	1	6	4	2	1	2
Bituminous coal mining	9	4	6	3	2	2	7
Paper and printing	9	2	9	2	2	2	9
Stone, clay and glass.............	20	1	17	7	5	5	10
Textiles	10	2	9	5	1	3	6
Vehicles for land transportation	11	3	10	8	2	3	9
Miscellaneous	17	5	10	6	4	3	8
Totals for all industries of Indiana	223	52	182	109	46	43	122

Refillable fuses were reported in use by 148 out of 169 companies reporting on fuses, as against sixty-nine companies using standard fuses. A large number of companies reported the use of both standard and refillable fuses. It is estimated that the stone, clay and glass industries use 5,660 fuses per month, of which 96 per cent are of the refillable type. The returns received indicate that 7,690 standard fuses and 27,055 refillable fuses are used each month by the factories and mines of Indiana.

A high degree of generator standardization is indicated by the reports on frequencies used in the various works of the state. Only five different frequencies were reported by the 185 Indiana companies reporting, as against nine frequencies reported by the plants of Pennsylvania. About 86 per cent of the Indiana plants and mines use three-phase, 60-cycle service in the operation of their motors, and 8.6 per cent reported the use of two-phase, 60-cycle service. Only ten companies reported the use of other frequencies. The high degree of frequency standardization in Indiana as against the large extent to which odd frequencies are used in Pennsylvania is probably due to the fact that industrial growth in Indiana is comparatively recent, especially when compared with the industrial growth of Pennsylvania, where a large number of the private electric generating plants were installed many years ago. Table VII shows the use of the various frequencies by the plants and mines of Indiana.

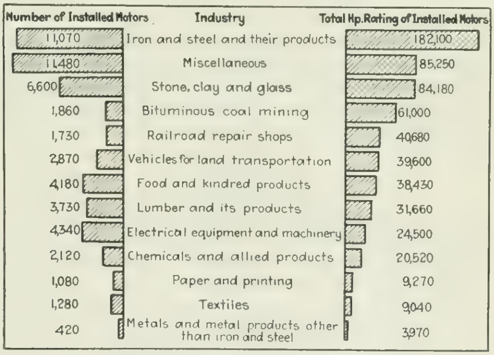


FIG. 3—DISTRIBUTION OF INSTALLED MOTORS AMONG THE VARIOUS INDUSTRIAL GROUPS OF INDIANA

That the steam turbine is rapidly overtaking the steam engine is indicated by the figures in Table VIII. It must be understood that these data include only the prime movers and boilers installed in private generating plants. It is probable, however, that a large portion of these prime movers operate other machinery than electric generators and that the boilers are used to a large extent in furnishing steam heat to factories.

The iron and steel industry, which includes steel

TABLE VI—TYPES OF FUSES USED IN INDUSTRIAL PLANTS OF INDIANA.

Industry	Total Number of Companies Reporting on Fuses	Standard Fuses: Number of Companies Using This Type	Standard Fuses: Fuses Used per Month: Number	Standard Fuses: Fuses Used per Month: Number per Motor	Refillable Fuses: Number of Companies Using This Type	Refillable Fuses: Fuses Used per Month: Number	Refillable Fuses: Fuses Used per Month: Number per Motor	ELECTRICAL WORLD Estimate of Fuses Used per Month by All Industrial Plants in Indiana: Standard	ELECTRICAL WORLD Estimate of Fuses Used per Month by All Industrial Plants in Indiana: Refillable
Chemicals and allied products	3	2	34	0.266	2	114	1.300	335	1,122
Electrical equipment and machinery	5	3	420	0.698	4	3,357	1.055	1,982	1,585
Food and kindred products	16	4	132	1.403	13	228	0.695	1,304	2,260
Iron and steel and their products	59	32	286	0.623	53	1,765	0.473	754	4,670
Lumber and its products	30	9	262	1.506	29	1,200	1.080	760	3,480
Metals and metal products other than iron or steel	5	3	16	0.696	5	62	0.538	49	188
Bituminous coal mining	5	2	53	0.855	3	103	0.845	535	1,040
Paper and printing	6	4	77	0.762	5	129	0.652	278	467
Stone, clay and glass	12	2	12	0.240	11	270	0.968	240	5,420
Textiles	6	3	9	0.529	4	38	0.139	30	170
Vehicles for land transportation	10	1	6	0.353	10	504	0.212	7	604
Miscellaneous	12	4	23	0.291	9	178	0.543	650	5,025
Railroad repair shops	.	..	284	0.684	.	380	1.680	766	1,024
Totals for all industries of Indiana	169	69	1,614	0.728	148	8,328	10.180	0.674	27,055

works and rolling mills and blast furnaces, ranks first among the industries of Indiana. The development of large steel works and rolling mills at Gary accounts in large measure for the magnitude of the industry in the state. This industry is by far the largest user of electrical energy in Indiana, and, as indicated in Table II, about two-thirds of the energy consumed is generated in private plants. The number of installed motors is hardly a fair criterion of the use of electrical energy in this industry, as a large portion of the energy consumed is used for industrial heating. Notwithstanding this fact, however, it is estimated that 11,070 electric motors are installed in the various iron and steel mills of the state, with a total rating of 182,100 hp. About 36 per cent of the installed motors are under 5 hp. The private electric generating stations in the iron and steel industry of Indiana have a total generator rating of 73,730 kw., of which 59,300 kw. is in alternating-current generators.

MINING INDUSTRIES LARGE USERS OF ELECTRICAL ENERGY

Indiana ranks high in mineral production and the manufacture of minerals into products, especially coal, cement, clay products and stone. Considering mining and manufactures from minerals as one industry, almost 175,000,000 kw.-hr. of electrical energy was used by these industries during 1920. It is estimated that 1,224 motors are installed in the bituminous-coal mines of Indiana, with a total rating of 61,000 hp., and that 6,600 motors are installed in the limestone quarries, cement mills, glass factories and other mineral-products works in the state. The returns indicate that over 92 per cent of the motors installed in the coal mines of the state are under 5 hp. Returns received from the bituminous and anthracite coal mines of Pennsylvania indicated that only about 37 per cent of the installed motors were under 5 hp. This variance is probably due to the dissimilarity in the types of coal mined in the two states.

TABLE VII—FREQUENCIES USED IN INDUSTRIAL PLANTS OF INDIANA

Industry	Total Number of Companies Reporting on Frequency	Number of Companies Reporting Various Frequencies Used. (The first figure gives number of phases; the second figure, the number of cycles.) 1–25	3–25	1–60	2–60	3–60
Chemicals and allied products	5	..	..	..	1	4
Electrical equipment and machinery	7	..	..	.	.	7
Food and kindred products	21	..	..	3	2	16
Iron and steel and their products	63	..	.	2	6	55
Lumber and its products	34	1	1	1	2	29
Metals and metal products other than iron and steel	6	..	..	1	..	5
Bituminous coal mining	2	..	..		..	2
Paper and printing	3	..	.	..	..	3
Stone, clay and glass	15	..	1	..	1	13
Textiles	7	..	..	..	1	6
Vehicles for land transportation	10	..	..		1	9
Miscellaneous	12	..	..	..	2	10
Totals for all industries of Indiana	185	1	2	7	16	159

There is 464,776 hp. of primary power in Indiana which is not electrified at the present time. This unelectrified power, plus such industrial growth as the state will experience in the next few years, represents the field for industrial power growth by the central light and power industry of that state. It is probable that not all this primary power is feasible of electrification, but nevertheless it presents a rosy picture for future growth in the industrial load of the central station industry of Indiana.

TABLE VIII—PRIME MOVERS IN PRIVATE GENERATING STATIONS OF INDUSTRIAL PLANTS IN INDIANA

Industry	Number of Companies Reporting on Prime Movers in Private Generating Stations	Power Equipment in Private Electric Generating Stations of Companies Reporting in Survey: Water-wheels Rating, No.	Water-wheels Rating, Hp.	Int. Combustion Engines Rating, No.	Int. Combustion Engines Rating, Hp.	Steam Engines Rating, No.	Steam Engines Rating, Hp.	Steam Turbines Rating, No.	Steam Turbines Rating, Hp.	Boilers Rating, No.	Boilers Rating, Hp.	Estimate of Total Power Equipment in Private Electric Generating Stations of Industrial Plants in Indiana: Steam Engines Rating, No.	Steam Engines Rating, Hp.	Steam Turbines Rating, No.	Steam Turbines Rating, Hp.	Boilers Rating, No.	Boilers Rating, Hp.
Chemicals and allied products	5	0	0	0	0	22	5,209	3	2,730	33	11,970	25	5,910	4	3,100	37	13,580
Electrical equipment and machinery	4	0	0	0	0	6	3,000	1	125	18	3,850	7	3,545	2	148	21	4,550
Food and kindred products	31	0	0	1	65	28	4,239	5	1,370	61	8,975	138	20,900	25	6,750	301	44,300
Iron and steel and their products	53	1	100	10	914	108	20,155	14	28,603	222	55,264	151	28,200	20	40,000	310	77,300
Lumber and its products	44	0	0	0	0	56	9,537	6	1,700	91	14,475	60	10,180	6	1,810	97	15,400
Metals and metal products other than iron or steel	5	0	0	0	0	7	3,100	2	50	13	2,805	8	3,385	3	55	14	3,060
Bituminous coal mining	12	0	0	0	0	23	5,931	1	700	56	9,350	154	39,700	7	4,680	374	62,600
Paper and printing	8	4	450	1	25	46	6,457	1	1,340	31	9,440	57	8,030	2	1,663	39	11,730
Stone, clay and glass	18	0	0	2	14	29	3,545	3	12,000	50	9,315	199	23,700	20	80,250	670	124,400
Textiles	9	5	1,250	0	0	20	3,380	1	750	26	7,540	75	12,700	4	2,820	98	28,350
Vehicles for land transportation	7	0	0	0	0	9	2,450	3	3,200	30	8,150	10	2,650	4	3,460	32	8,800
Miscellaneous	19	0	0	1	25	29	3,689	0	0	50	7,206	432	55,000	20	6,560	745	107,200
Totals for all industries of Indiana	215	10	1,800	15	1,043	383	70,692	40	52,568	681	148,340	1,316	213,900	117	151,296	2,738	501,270

Evolution of Interconnected Power Lines and Effect on Utility Regulation

Rapid Growth of Public Service Commissions Justified by Their Attitude and Rulings—State-Wide Regulation, Not "Home Rule," Is Essential—Ratio of Expense to Income Is Too Large

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THE advantages of interconnection of large power systems which are in themselves self-sustaining and whose generating plants are already interconnected by tie and distribution lines or independent economical operation are many. Interconnection not only increases the reliability of operation, it reduces the total reserve capacity required for an interconnected system over the aggregate amount required in separately operated systems and utilizes that reserve capacity to better advantage. Moreover, in cases of hydro-electric plants, it enables the company to take advantage of the diversity of the natural stream flow between drainage areas and to reduce the amount of reserve steam power necessary to guarantee continuous service. By means of interconnection the most efficient plants may be operated at a maximum to supply any great amount of steam power required in the combined system from the viewpoint of economy and coal transportation. Newly constructed plants may also be loaded in a shorter time and may be located at more judicious sites, such as coal-producing centers and points accessible to condensing water. Not the least of the many advantages of interconnection is the fact that water powers otherwise unavailable are made serviceable for the use of man.

SUPERPOWER DISTRICTS ALREADY IN EXISTENCE

Already great strides have been made in interconnection, and striking examples of superpower districts are to be found in the Middle West, on the Pacific Coast, in the New England States and in the Southern and Southeastern districts. In California physical interconnection has made possible the interchange of electricity by companies operating between Vancouver, British Columbia, and a point below the Mexican border.

In the history of zone physical interconnections two outstanding facts appear—first, the service has been improved or maintained at the highest point of efficiency without the necessity for proportionately increased rates, and, second, ability to furnish service which otherwise would not be possible has resulted in increased demands with increased benefits to those receiving the service. As these zone networks come into being they bring electric light and power closer and closer to the farm. They make it possible for companies operating in one or more communities and physically interconnected with properties operated in other communities to extend a distribution system into suburbs and even into rural centers where the demand for service is sufficiently great to justify it and the construction cost is within reason.

From these facts it may readily be seen that the electric light and power industry is no longer a local one, in that it serves only the people residing within the boundaries of any one community, but, on the contrary, is an actual or potential state-wide industry, serving a multiplicity of communities and extending sooner or later to every farm and every ranch. When this comes to pass it will not only benefit the farmer and his family and hired help, but it will also benefit the communities upon which the farm and farmers are dependent for their markets and which in turn are dependent upon the farm and farmers for the necessities of life.

With the gradual recognition on the part of the public that electric service to be efficient and economical must be monopolistic came the necessity for some control which, while protecting the monopoly, would guarantee service at rates that were reasonable and just to all concerned. This gave rise to administrative bodies charged with the enforcement of specific laws and endowed with regulatory and sometimes quasi-judicial powers—or, in other words, public service commissions.

Although the formation of these commissions might seem at first sight a step away from popular government, the closeness of their relation with the interests put in their charge enables the public feeling and the public wishes to be expressed clearly and forcibly to those who have authority to act. Upon the whole, their creation has been very happy since it enables improvements to be effected with a minimum of friction and with a promptness almost impossible of attainment by any other means. The granting of such powers by the legislature does not imply any hostility on the part of the government to public utility organizations. On the contrary, it is the expressed duty of the commissions in administering their office to conserve the interests of both the stockholder and the public.

FORMATION OF PUBLIC COMMISSIONS

Public utility regulation in the United States dates from the establishment of the Massachusetts Gas and Electric Light Commission in 1885. Unfortunately that commission had relatively little power at the outset, although its authority was materially strengthened with the passing years. The first public utility commissions of wide scope and power date from the establishment of the Public Service Commission of New York State in 1907 and the enlargement of the power and duties of the Wisconsin Railroad Commission the same year. The example set by these two states and the success attained by their commissions led other states to create commissions or enlarge the powers of old ones. At the present time there is only one state in the Union which does not possess a public regulatory body of some sort.

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*Abstract of address delivered before Ohio State University.

As a rule these commissions exercise supervision over the quality of the service and the rates to be charged therefor. In order to safeguard the investing public and to prevent unduly high charges to consumers for service on the ground that the companies have to earn a fair return on their capitalization, the commissions in some states also have control over the issuance of securities. Full power of review of state utility commission rulings and orders is vested in the courts, and, to the credit of the commissions be it said, nearly all of their decisions when attacked have been sustained by the courts, the exceptions centering around constitutional provisions against taking property without compensation and due process of law.

Of course, respect for utility commissions and confidence in their effectiveness, protection and security depend on the manner in which the commissions comport themselves and on the degree to which they are responsive to the public will. It was inevitable that a revolutionary move such as was involved in bestowing regulatory powers on a commission should meet with opposition at first. Experience shows that people do not take kindly to changes from forms to which they are accustomed. Every movement of this kind has a genesis, history and development quite its own, and few reforms in government have ever been successful or permanently established otherwise than step by step and by slow degrees. The history of public utility regulation offers no exception. Normally our institutions are regarded as essentially practical, formed to meet actual human experiences and human needs under existing conditions, and they ought, therefore, to be free from doubtful political innovation or speculative experimentation.

THE BUGABOO OF HOME RULE

Although in some quarters regulation is still looked upon as an experiment, fifteen years of it and the regularity with which commission decisions have been sustained in the courts indicate that public service commissions have established themselves as permanent American institutions. It is true that in many cities there has arisen from time to time strong objection to state regulation of public utilities on the ground that it violates the principle of municipal home rule. But so long as the state remains sovereign over municipalities it is bound to exercise a greater or less degree of control over that which is commonly known as local service, regardless of whether such service is rendered by private corporations or by the municipality itself, and the courts have invariably sustained this position.

The legal interpretation of the popular expression "home rule" is the right of the municipality to regulate and control local and municipal affairs under grant by legislative or constitutional provision. The courts have held almost unanimously that a grant of authority by the state to the municipality (a political subdivision of the state) to control its local and municipal affairs does not include the regulation of public utilities operating wholly or partly within the municipality unless the grant goes beyond the general expression and expressly names public utilities and the rates and service thereof. The highest courts of the land have held repeatedly that the police power of the state should be jealously guarded and have always held that anything not falling within the specific or expressed delegation of authority to the municipality shall be decided in favor of the state. Time after time the learned judges have commended the legislative body for its wisdom in providing for a regulated monopoly in public utility service and have reasoned, it would seem with great wisdom, that the public welfare demands the greatest expansion of electric service at reasonable rates, linking together the city and country, ultimately bringing to the home, whether mansion, cottage, tenement or farmhouse, and to industry regardless of size or location, whether store, factory, farm or mill, the great benefits of electric service at the lowest cost consistent with expansion of service and the proper protection of the million and a half security holders of the electric light and power companies of the country.

LOCAL RULE STIFLES SUBURBAN DEVELOPMENT

Another and strong argument for utility control through the state rather than the municipality is that very few cities can command the necessary legal administrative and engineering staff for effective control, whereas this can readily be done by state commissions, which at the same time accumulate valuable data and gain a broad and varied experience, both essentials in efficient regulation. Thus regulation, to be fair to the public and to the electric light and power companies, must be more than local. It must be state-wide. Local regulation and control, commonly known as home rule, necessarily stifle suburban and rural development because the authority of the regulating power does not extend beyond the city limits. State regulation takes into consideration all elements and all factors, whether urban, suburban or rural, and fixes rules and practices, service, standards and rates which should be fair and beneficial to all. It encourages the growth of the utility and the extension of its service to all points where that service is demanded, whenever and wherever such growth and extension is financially and physically possible and economically sound.

REGULATION SHOULD BE PROGRESSIVE AS WELL AS CORRECTIVE

There is no doubt that the future success of utilities clearly depends on greater economy and efficiency and upon a large reduction in the ratio of expense to income. Much has already been done toward reducing expense by consolidations and interconnections of systems. During the war there were those who favored compulsory interconnection of properties, but they received little comfort in the shape of popular support, because the public is desirous that the capital required to provide the facilities for the electrical demands of the future should come from private investors, and it is generally clear to any one that only as economic conditions are favorable to consolidations will they take place, and then they will come about naturally as an evolution in the industry.

During the next few years the electric utilities will have an opportunity to consolidate still further by voluntary action, and it will depend entirely on their financial condition whether the process be fast or slow. Under normal conditions the country may look to its electric public utilities to reach agreements and conclusions among themselves respecting the co-ordination of facilities and service or the introduction of economies essential to guaranteeing the most efficient administration and methods of distributing electricity nationally under private management. Such an achievement is essentially possible under a rational and sympathetic system of commission regulation.

For more than a decade now the American people have experienced the effects of regulation by public utilities. While particular questions to be solved change with variations in economic conditions and with the evolution of political ideals and institutions, the basic question of how best to guarantee adequate and efficient service at just and reasonable rates may be said to be fairly understood. Upon numerous questions of public policy there may be marked differences of opinion, but as to the desirability of private ownership and operation of public utilities there is no longer any confusion in the minds of the public because political ownership has proved a dismal failure.

On the other hand, if public utilities are to function efficiently in private hands, they must be put on a stable and paying basis. They must have adequate equipment, funds for expansion to meet the growing needs of the communities they serve, and their securities must become attractive to the small investor as well as to the large banker. Any policy intended to stabilize the credit of utilities must involve a broader policy of rate regulation. The commissions, if they are to determine the revenues of the utilities and sit in judgment upon the security issues, must establish rates that will enable the utilities to render efficient service and provide the country with a system of electrical supply capable of progressing with the development of the country. Any policy of rate control that stops short of this degree of responsibility on the part of the state would be inimical to the best interests of the utilities and of the communities they serve. It is a truism that no community can develop faster than its utilities. Henceforth regulation must be progressive and efficient rather than merely corrective and negative in character.

Semi-Automatic Substation Serves Coal-Mine Load

A SEMI-AUTOMATIC substation recently installed at the Drifton (Pa.) colliery of the Lehigh Valley Coal Company solved an operating problem that is liable to arise in other industries of similar nature. The workings of the colliery had extended to such a degree that it was impossible to serve all of them with 250 volts from the existing substation. By locating a substation 3,000 ft. from the nearest slope having an engineer on duty all day, however, it was found possible to give the desired service without extremely large feeder capacity. To save the wages of a station attendant and secure uniform starting the station was made semi-automatic and controlled from a pilot switch in the slope engine house. The station consists of one 200-kw., 250-volt, General Electric synchronous converter, with the necessary alternating-current and direct-current control apparatus.

Power at 11,000 volts, three-phase, 60 cycles, is received at an outdoor substation near the slope, where it is stepped down by three transformers to 4,600 volts. The 4,600-volt line is tapped at the substation through a pole-top disconnecting switch, a lightning arrester, choke coil, and fuse. From the fuse it runs in conduit to an incoming oil circuit breaker operated by a magnetic contactor. From here the line goes to transformers installed just outside the building, the low-tension leads of which run to the converter through the starting and running contactors.

The starting and stopping automatic control system with the method used for the protection of the converter is noteworthy. To start the converter a control switch in the slope engine house is closed, energizing a voltage relay in the substation, which closes only if the alternating-current voltage is high enough to insure proper operation. The closing of the relay contacts energizes a main control contactor which starts up the motor-driven controller if all protective devices are in proper position. This closes the incoming oil circuit breakers and then the converter-starting contactor, and the machine comes up to synchronous speed. As it comes up to speed its field is flashed across the terminals of a small direct-current generator operated by the motor of the drum controller to make sure the converter builds up with the correct polarity, after which the main field contact closes. The controller now opens the starting contactor and closes the running contactor, throwing full voltage on the machine. The direct-current side is controlled by a generator-type automatic reclosing circuit breaker, which closes when the polarity relay acts. After a predetermined interval the feeder breaker closes.

THIS CONTROL TAKES THE PLACE OF AN ATTENDANT IN THE SUBSTATION

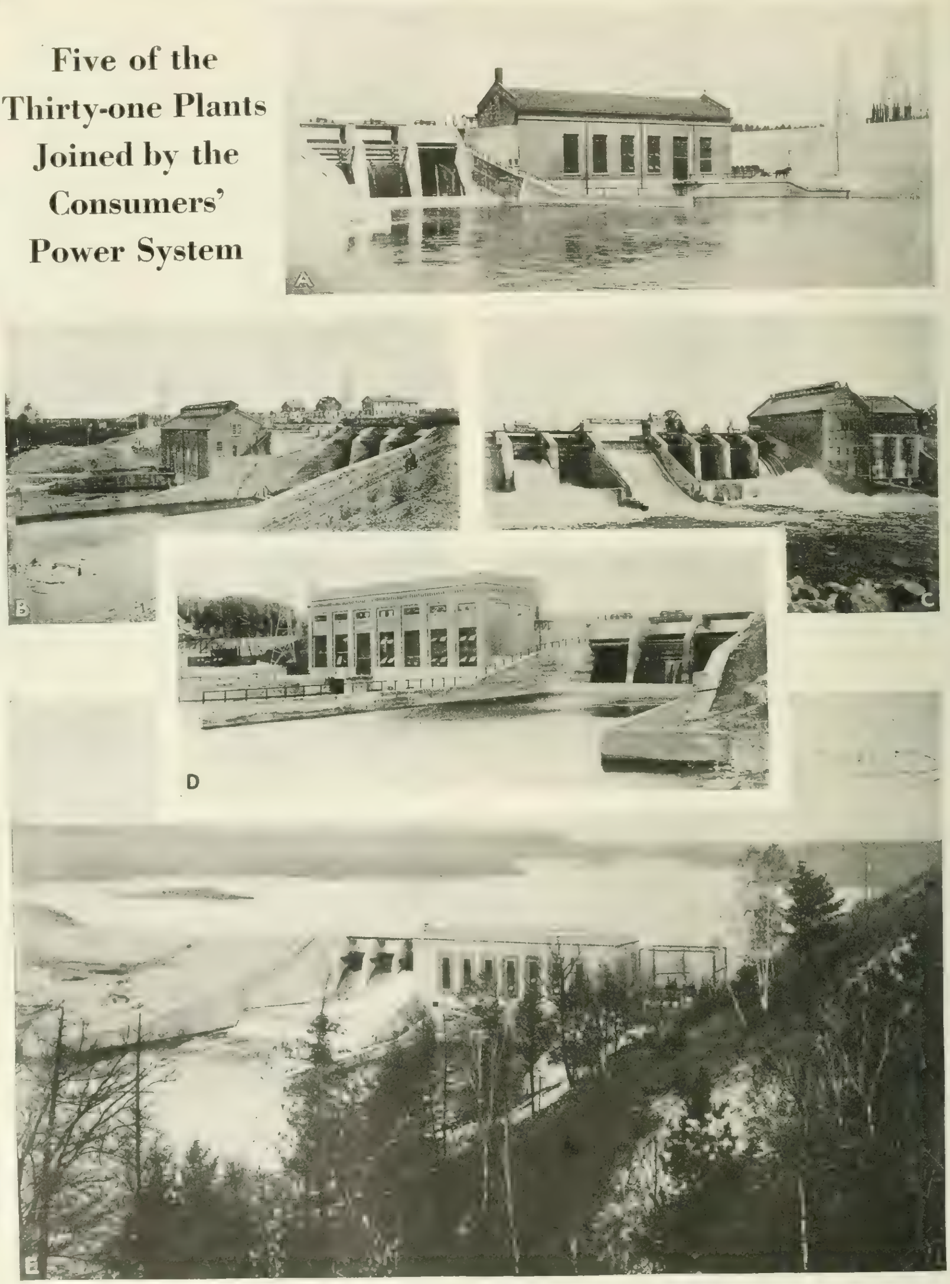
To stop the set the control switch is opened, causing the voltage relay to drop out and trip the main control and running contactor. It also starts the motor-driven controller, which trips out the incoming oil circuit breaker and starts the brush-raising motor. When the brushes are up, both motors stop and the set is ready to start again.

Single-phase starting is prevented by relays which hold the main control contactor open until three-phase is supplied. If single-phase occurs while running, it will continue to supply power unless the load current is high enough to cause overheating. In this case a temperature relay will open the main contactor circuit, stopping the unit until three-phase is restored.

On a flashover a current relay actuates a notching relay, which in turn shuts the machine down, causing a new start to be made. If three successive flashovers occur, a lockout relay operates, causing a permanent shutdown until it is reset by hand.

Thermostats mounted on the bearings shut down the machine when they are overheated, and overspeeding is prevented by a centrifugal trip. Both of these must be manually reset. Any short circuits in the substation wiring actuate induction relays which trip the main oil circuit breaker. If this occurs while the converter is running, the lockout relay operates, causing a permanent shutdown.

Five of the Thirty-one Plants Joined by the Consumers' Power System

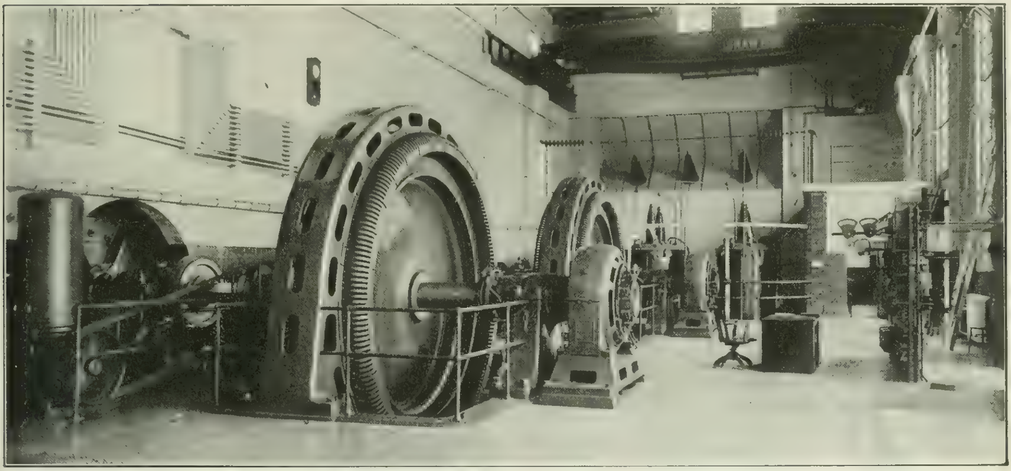


THE first four hydro-electric stations shown are respectively Five Channels (A), Cooke (B), Croton (C) and Loud (D). Their ratings are shown by the accompanying table. Junction Dam (E) is the largest and finest of the plants and is typical of many of the plants which will be necessary if the water-power resources of the Middle West are to be developed. The nominal head is 50 ft. and the dam is constructed on soil foundation. Features of the system involving these plants are discussed on the following pages.

Michigan a Leader in Interconnection of Hydro and Steam Plants

Twenty Water Power and Eleven Steam Stations Joined by the Consumers' Power Company's 140-Kv. Transmission System—Bearing of Hydro Experience on Middle Western Developments—How Some Problems Have Been Solved

By **HARRY J. BURTON**[*] and **WILLIAM W. TEFFT**[†]
Consumers' Power Company, Jackson, Mich.



TYPICAL INTERIOR OF HYDRO-ELECTRIC STATION ON MICHIGAN SYSTEM
Observe the step-up transformers at the far end of the station and the method of running high-tension lines through wall. All high-tension switching is outdoors.

EXTENDING along the eastern, western and southern boundaries of the lower Michigan peninsula in the form of a huge "U," the system of the Consumers' Power Company, with its 1,300 miles (2,090 km.) of transmission lines, is a Middle Western system that compares in its methods and problems with the Far Western systems about which most of the public discussion of transmission problems has revolved. Not only does it compare in physical dimensions, but its 526 miles (846 km.) of 140-kv. transmission lines, of which the design was begun in 1910 and a large portion put in operation in 1912, mark it as a pioneer in the application of extreme high voltage to the commercial transmission of electric power. In addition to this the company in 1907 designed and built the Croton-Grand Rapids line for operation at 110 kv., utilizing the then newly developed Hewlett suspension-type insulator. This was the highest voltage transmission line in the world.

In addition to its high-tension development hydro-electric plants play a large part in its operations. Of more than 200,000 hp. in generating capacity, approximately half is in hydro-electric power. Of the half-billion kilowatt-hour output last year nearly 55 per cent was generated hydraulically. There are thirty-one hydro-electric and steam generating stations, and, exclusive of the substations in the small communities requiring no attendance, there are approximately fifty substations. The company also owns 60,000 acres of land with twenty-eight undeveloped dam sites. The territory served by the system covers a large portion of the richest industrial district in the state. The ten largest cities in the state outside of Detroit are included in the territory. Among the consumers served are some of the best-known American manufacturers.

Some of the problems that have been met and solved in the development of the power supply and high-tension transmission system should be of particular interest to the central-station men who have developments of this character to undertake.

HYDRO-ELECTRIC DEVELOPMENTS INVOLVE TWENTY PLANTS

The hydro-electric developments are on the Manistee, Au Sable, Muskegon, Grand and Kalamazoo Rivers. Table I gives a list of the plants, with their capacities and heads. The stream flow of the rivers in Michigan, particularly the Manistee and the Au Sable, is almost constant throughout the year.

A large increase in annual kilowatt-hour output has been effected without cost by the lapping of heads on a series of dams—that is, by building a given dam in such a position and of such a height that it raises the tail-water of the dam next upstream 3 ft. or 4 ft. (about

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[*] Director of educational department.
[†] Consulting hydraulic and civil engineer.

1 m.), the method being carried out through an entire series of dams. This method of head lapping has provided a surprising amount of storage for handling routine loads without the evaporation that will ordinarily be experienced with a reservoir. The storage is instantly available at every dam in the series without the delay that may be necessary if regulating reservoirs are provided at considerable distances from the operating plants. The entire storage is usable without any loss of head if the upstream is not lowered, and the cost of storage reservoirs is avoided. The daily load fluctuations can also be taken care of at all the hydraulic plants in the series without any loss of head. This would ordinarily amount to about 8½ per cent.

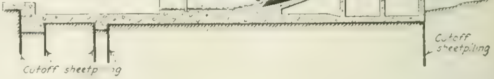
TABLE I—TWENTY HYDRAULIC PLANTS, WITH A COMBINED RATING OF 76,110 KW., ON CONSUMERS' POWER COMPANY'S SYSTEM

	No. of Units	Rating of Units (Kw.)	Rated Capacity of Plant (Kw.)	Nominal Head (Ft.)
Junction	3	5,500	16,500	50.0
Stronach	2	400	800	18.0
Rogers	2	2,250	4,500	38.0
Croton	2 2	4,500 1,450	11,900	40.0
Lowell No. 1	2	300	600	30.0
Grand Rapids, West Side	2	200	400	....
Allegan	2	200	400	9.0
Trowbridge	1	1,500	1,500	21.0
Otsego	1	1,500	1,500	15.0
Plainwell	1	960	960	13.0
Battle Creek	1	150	150	9.0
Ceresco	2	300	600	14.0
Albion	1	150	150	12.0
Webber	1	3,000	3,000	26.0
Shiwassee	1	150	150	10.0
Cooks	3	3,000	9,000	40.0
Foote	3	3,000	9,000	35.0
Five Channels	2	3,000	6,000	35.0
Loud	2	2,000	4,000	26.0
Mio	2	2,500	5,000	29.0
Total rating of hydro-electric plants	.	....	76,110	....

The design of the plants involves most of the difficulties that arise from the soil and river conditions of the Middle West, where sand and clay rather than solid masses of rock are found. The plant known as Junction Dam, on the Manistee, is not only the largest and best-equipped plant on the system, but has the finest and largest dam in the southern peninsula of the state. The plant has three vertical units with an aggregate capacity of 18,000 kw., operating at a static head of 50 ft. (15 m.). An efficiency of slightly under 93 per cent is attained with the turbines, a rather high figure for a plant of this size. Each unit is protected by a Tainter headgate and stop logs in the tailrace, permitting it to be isolated from the rest of the plant for inspection and repairs. The dam itself is built on a foundation largely of earth with some mixture of clay. Sheet-steel piling and a thin reinforced-concrete core wall were used to make the dam watertight. In addition cement grout was forced into the foundation soil at critical places, which were determined by a thorough drilling investigation. The grout was forced into each hole until it appeared at the top of the adjacent hole. In this way there was assurance of a continuous cut-off wall across the valley. The embankment was sluiced and is entirely free of sand. It is believed to be the highest dam in the world built on sand and of sand and containing a spillway. There has been less leakage through it than was anticipated. The 61-ft. (18.5-m.) embankment is held by concrete retaining walls that are believed to be the highest ever built.

The Croton plant, built in 1906, is notable in many ways. It is at the generating end of the old 110-kv. line and has two units of 4,500 kw. capacity each. Each unit is made up of eight runners directly connected to a horizontal shaft set at right angles to the direction of the stream flow. This shaft is directly connected to the generator. The dam has a spillway controlled by eight large Tainter gates. These are mounted in two sets of four with a bear-trap spillway between them through which ice, logs or any other débris may be passed. This form of gate has proved extremely satisfactory for this purpose and has operated since the construction of the plant without any difficulties of any kind. It is used to prevent the abrasive action that the débris would have on the Tainter gate sills if sent through them. The earth embankment was made by sluicing in the earth from an adjacent hill of higher elevation at the extremely low cost (in 1906) of 7 cents per yard (9 cents per cu.m.). The embankment is made tight by means of interlocking steel-sheet piling and a reinforced-concrete core wall. This form of construction has been used on all the embankments built since that time by the company, and none of them has failed or permitted serious leakage. An example of this form of construction is found at Mio, on the Au Sable River, where there is the first modern vertical-shaft plant built by the Consumers' Power Company. The foundation material is sand of the "hourglass" variety and the embankment is of the same material. The core-wall and sheet-piling construction is used to make the construction watertight. The most interesting feature of the plant is the so-called conduit type of spillway (Patent No. 1,281,706). It has proved a distinct success.

The Plainwell plant was rebuilt in 1919 because of the destruction of the old power house by fire. The head is 13 ft. (3.9 m.) and there are three vertical directly connected units of 320 kw., each running at a speed of 164 r.p.m. This high speed is permissible because of the use of the Nagler type runner. These runners have the advantages of extreme simplicity in construction and freedom from clogging by the débris that is more or less of a problem in this river at various times of the year. The result is a gain in reliability and a very high specific speed that not only gives a flatter efficiency curve for wide head fluctuation but materially decreases the cost of the generator. Since the percentage of head fluctuation on low heads like this is bound to be much greater than on the high plants, these characteristics are a real advantage on low-head installations. To prevent air entering the turbines because of the shallow head of water, the penstocks above the turbine are made airtight and the air is ejected from the penstocks by means of a small hydraulic ejector in the draft tube. The hydraucone draft tube is also used in the plant.



One of the interesting developments in connection with the hydraulic plants is the use of the directly connected hydro-electric units as synchronous condensers. The charging current on the long high-voltage lines required considerable generator capacity on the lines at all times even when there was little load. The use of several turbines at low gate openings resulted in efficiencies of as low as 30 to 35 per cent as against in the neighborhood of 90 per cent when carrying normal loads. It was found by experimenting that several units could be "phased in" on the line and the water shut off from all but those needed to carry the actual load at the best possible efficiency. Air is admitted to the draft tubes of the machines running as synchronous condensers to avoid loss of power. It is believed that the Consumers' Power Company was first to do this.

TABLE II—ELEVEN STEAM GENERATING PLANTS ON THE SYSTEM HAVE A COMBINED RATING OF 85,150 KW.

Stations	No. of Units	Rating of Units (Kw.)	Rated Capacity of Plant (Kw.)
Grand Rapids, Wealthy Street	1	4,500	22,000
	1	7,500	
	1	10,000	
Grand Rapids, Market Avenue	1	......	3,600
Kalamazoo	1	......	3,000
Battle Creek, Elm Street	1	7,500	27,500
	1	10,000	
	1	10,000	
Jackson	1	7,500	9,000
	1	1,500	
Flint	1	3,000	13,500
	1	3,000	
	1	7,500	
Saginaw No. 1	1	......	2,500
Bay City	1	......	1,500
Manistee	1	......	500
Cadillac	1	350	700
	1	350	
Pontiac	1	650	1,300
	1	650	
Total rating of steam plants	..	......	85,450

The Elm Street steam plant at Battle Creek represents the last word in steam-plant design. The boilers are equipped with Taylor stokers provided with variable-speed direct-current motors and alternating-current motors and mechanical speed-varying devices for driving the clinker rolls. Coal and ash handling inside the boiler house is carried on in inclosed rooms to prevent dust in the boiler room tending to make it dirty and costly or impossible to keep clean. Good air for the men employed in ash handling is provided by wall-type, motor-driven fans. The boilers have forced-draft and induced-draft fans. The boiler-feed system, consisting of a combination feed line and loop system, gives two entirely distinct ways of feeding any given boiler. Idle boilers may be filled with cold water without interfering with the water supply to other boilers in operation. Superheaters and baffled economizers are provided, and the make-up water is supplied through duplicate evaporator units with a capacity of 10 per cent of the full-load feed water required by the plant. The steam-plant piping has been arranged so that exhaust steam can be used through indirect radiation to preheat air for the stokers and the feed-water temperature kept to as low as 150 deg. to give the economizers a higher range. Chain-belt mechanical screens have been installed to remove débris from condenser circulating water. A steam-driven emergency house service and fire pump operating at 1,500 gal. (5,678 l.) per minute and starting automatically protect all the water service in the plant except the transformer cooling water. The other steam plants with their capacities and locations are shown in Table II.

Iron Wire Versus Copper as an Electrical Conductor*

Construction and Mechanical Difficulties of Changing from Iron to Copper Conductors—Practicability of Iron Lines—Comparative Cost

BY W. E. RICE
Division Engineer United Light & Power System, Larned, Kan.

DURING the period of high prices a company in the western part of Kansas erected several iron-wire lines. Later the company found it expedient to change to copper. In nearly every case the change was necessary because it was desired to extend the line or take on additional load. The lines were constructed along public highways with the object in view of possible extensions. Observations in the case of other companies will show that the practice of this Kansas utility is a general and proper one; but the fact that the lines were occupying the highways on which it would naturally be expected to make extensions necessitated the removal of a conductor that was not suited to handle additional load because of its limited carrying capacity. Five or six amperes was found to be the maximum current which could be carried without excessive line loss over a line 5 miles or more in length. This current on a three-phase, 60-cycle circuit of 80 per cent power factor meant that the load at 4,000 volts (at receiving end) was about 35 kw. and at 33,000 volts 250 kw.

SPAN LENGTH IMPOSED OBSTACLE

To increase the load and maintain the necessary voltage was impossible without a change in conductors. An obstacle arose, however, in the span length, which was greater than if the line had originally been constructed of copper, owing to the fact that iron has a greater tensile strength. There were possible alternative methods—to set additional poles or to lengthen those already in use so that a small-size copper wire sufficient to carry the load could be strung and have the proper clearance from earth. Since the iron was strung with a small sag and great tension, it had been elongated in some places and become almost a size smaller. This, of course, would account for part of the losses in the conductor as well as for some failures in the line. Such a condition is not unusual, because in four out of five cases the line foreman and linemen prefer to make a tight line, or a so-called "good-looking line" as tight as a trolley wire, instead of one properly sagged, or one looking like a "clothes-line," as expressed by linemen. Not until engineers or superintendents personally investigate and check the sags they authorize will this great fault be corrected.

In the tightly strung lines there were many breaks. In some instances it was found the iron wire had crystallized near the insulator tie, it being assumed that the more rapid oscillations when winds caused the wires to swing had hardened the conductor at the point of the tie, causing an early failure. More than a hundred failures from just this cause occurred in less than four years on the iron-wire lines of the Western Light & Power Company, Boulder, Col., according to one of its engineers.

Many high-resistance joints were found because cheap iron wire did not warrant sleeves. It was easier and quicker to make joints without sleeves than with them, and less consideration was given to such joints or splices.

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*Subject discussed before N. E. L. A. at Hutchinson, Kan.

The small sizes of stranded iron conductors did not show such long life as did solid conductors of the same cross-sections. This was attributed to the fact that the stranded conductor had a larger surface exposed to the elements. Since strands when rusted would have a greater percentage of the total cross-sections affected than would be the case with a solid conductor, one or more strands would break, eventually causing failure of the entire conductor.

Several cases of unusual failure resulted from short circuits. When such a disturbance occurred several miles from the source of power the protective devices apparently could not clear before the line wire would overheat from the sudden rush of current, thereby becoming annealed and finally breaking.

COMPARATIVE COSTS OF STEEL AND COPPER FOR TRANSMISSION LINES

STEEL-WIRE LINE:	
Thirty miles steel, at $63 per mile	$1,890
Stringing 10 miles of steel, at $30 per mile	300
Interest on investment for twenty years at 5 per cent	2,190
Total	$4,380

Energy loss, twenty-four hours per day for 360 days per year, at 0.5 per cent per kilowatt-hour, with a line current of 5 amp. (resistance 6 ohms per mile), equals $3,700; therefore the total cost at end of useful life of line equals the sum of these two amounts, or $8,080.

COPPER-WIRE LINE:	
Thirty miles copper, at $65 per mile	$1,950
Stringing 10 miles copper, at $20 per mile	200
Interest on investment for twenty years, at 5 per cent	2,150
Total	$4,300

Energy loss, twenty-four hours per day for 360 days per year at 0.5 cent per kilowatt-hour, with a line current of 5 amp. (resistance 2 ohms per mile), equals $1,500; therefore the total cost at end of useful life of the line equals the sum of these two amounts, or $5,800, for the copper, as against $8,080 for the iron, or a difference of $2,280. There will also be a salvage value for the copper of approximately 5 cents per pound, or $630 additional, making a total balance of about $3,000 in favor of the copper wire. A very low generating cost (0.5 cent) has been used. If the generating cost is higher, the advantage of copper over iron will be in direct proportion.

No one expects to use iron wire for lines having large current densities. A No. 6 B. & S. gage medium hard-drawn solid copper wire will serve the purpose from an electrical standpoint as well as or better than No. 4 iron. The cold resistance of the iron is three times that of the copper. A copper wire smaller than No. 6 should for mechanical reasons not be used. It might be well, therefore, to compare the cost of the two at present prices for a 10-mile, three-phase, three-wire line of the same general construction.

The cost of No. 6 copper is about $15.50 per 100 lb. f.o.b. central Kansas. The cost of No. 4 EBB solid iron is about $7 per 100 f.o.b. same point. The same general construction is considered because it is expected some day to replace the iron wire with copper. It is the general opinion that twelve years is a fair average life of iron wire for transmission purposes, but to give every advantage possible a life of twenty years will be assumed. No. 6 copper wire will weigh just one-half as much as the same length of No. 4 iron, therefore the cost of stringing the heavier wire would be somewhat higher than that for the lighter wire, though not in proportion to the weight as some maintain.

It may be seen from the accompanying table that it is not so much a question of whether lines of some length should be constructed with iron wire as a question of what operating conditions will make it more economical to replace existing steel conductors with copper. In our efforts to save investment and first cost, we are blind to the real loss sustained in power lines using iron conductors. Now, with copper at a low level, is the time to consider the change and save the energy loss. The labor cost to change from iron to copper is about 4 cents per pound of iron, or approximately $25 per mile.

On short branch lines (one mile or less) where the load is light and the current to be carried does not exceed a few amperes it might be worth while to consider iron; however, if the line is to be erected cheaply and carelessly, just because iron wire is cheap and will be used, then it will be better not to use it, for the maintenance will in a few years offset the difference in the first cost. There is practically no salvage value in solid iron wire. Another point not to be lost sight of is that what is so often expected to be a branch line at the time of construction may develop into a main line, and the cost of changing to copper will often exceed not only the interest but the whole additional cost that would have been used in place of iron at the outset. In all cases future growth on any line should be taken into consideration. This in itself is likely to eliminate iron wire from the list as a suitable conductor, regardless of first cost.

When iron branch lines are built and tapped to copper lines there is always room for precaution in making the connection between the iron and copper conductors because electrolytic action will be set up between the two dissimilar metals at these junctions.

Some engineers assert, in justification of iron-wire construction, that copper could not be had a few years ago, or that the revenue on the line proposed did not justify paying the high price of copper. None the less many engineers either did get copper or did not build at all. It seems that those men did the proper thing, because we find that the prohibitive factor has proved to be, not the cost of copper, but the energy loss experienced with iron. This loss will not diminish but will increase slightly, and there is no better time than now to change to copper conductors.

Styria, Austria, Expects 450,000 Hp. from Water-Power Development

A COMPREHENSIVE plan for the development of the water powers of Styria, Austria, has been made by the engineer of the Public Works Service. In this province the chief Austrian water-power sources are situated. The scheme, according to the London *Engineer*, is that a combined working of all the valuable water powers should be arranged in such a manner that plants on rivers of variable flow will be supplemented by storage plants in the mountains and further reserves be supplied by steam plants in brown-coal pits. The total development should provide 450,000 hp., or about a quarter of the possible output of the usable water powers in Austria. The building of the plant will take fifteen years, and a market for the energy is thought to be assured in the iron industry and for railway operation, as well as in Vienna and the other large cities. The provincial government reserves the right of granting concessions and will be a shareholder in the enterprise. The financial operations will be the first on a large scale in Austria since the close of the war.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Cash Discount as a Factor in Distribution

To the Editors of the ELECTRICAL WORLD:

I have read with great interest the editorials that you have recently published on the subject of distribution. They are excellent articles and display a very clear conception of the distributer's function. One of them calls attention to a practice on the part of certain manufacturers that has caused me and a number of other jobbers much concern; that is, the failure of the manufacturer to protect and promote distribution through logical jobbing channels. This applies not only to appliances but to staples, such as wiring devices and similar lines.

Today the properly financed jobber with sufficient capital to discount his bills has no advantage over certain alleged jobbers who are really dealers owing to the fact that manufacturers are seeking outlets through these concerns, giving them jobbers' costs and going even further by making them terms of three, four and five months. In a number of cases consigned stocks are given.

If the electrical industry wants to maintain an economical distribution, it is necessary, in my opinion, for manufacturers to discontinue this practice. If manufacturers would increase their cash discount to distributers, this might help the situation. The jobber financially able would avail himself of all cash discounts as he is doing today, but if he were receiving 3 or 4 per cent additional discount for prompt payment, he would be that much better off than the alleged jobber who was unable to avail himself of this privilege. The manufacturer would, I think, soon realize that a customer who did not take advantage of a prompt payment discount of 5 per cent or more was a poor credit risk.

The B-R Electric Company, F. M. BERNADIN,
Kansas City, Mo. President.

Tree Stumps Hogged for Fuel

To the Editors of the ELECTRICAL WORLD:

While tree stumps are usually left lying about to rot, or at the best are given over to private initiative among the lumberjacks, serious attempts have been made in Sweden to reclaim their fuel value. Special uprooting machinery has been designed, portable motor-driven choppers are built, and even a special explosive, caresonite, has been made for the work. It is realized that only under extreme conditions can this fuel compete with coal, but enthusiasts claim that one man with a stump-breaking outfit produces more units of heat per year than a miner in an English coal mine, and in many places the stumps have proved to be at least a valuable reserve fuel supply.

In the 30,000-kw. steam-electric power station at Västeräs, which is operated by the Swedish Water Power Administration, a good deal of stump fuel was used during the fuel crisis as a substitute for coal. The stumps were taken directly from the barges to a chopper and chopped into 8-in. pieces, which were dropped directly into tip cars. The cars were cabled up behind the boiler, where a door was available for charging the grate, an ordinary chain grate being used, although it was run backward.

The fuel gave excellent operating results, very little ashes and soot being formed and clogging of the grate being out of the question. The greatest difficulty was to keep the cost of handling the fuel within reasonable limits, since the stump takes about eight times the space of the corresponding amount of coal and thus cannot be used in ordinary automatic stokers.

EDY VELANDER.
Luginbühl, Davos-Platz, Switzerland.

Cost of Automatic Hydro-Electric Plant

To the Editors of the ELECTRICAL WORLD:

Possibly some of your readers may be interested in the cost of the automatic hydro-electric station described in the Dec. 17, 1921, issue of the ELECTRICAL WORLD. The hydraulic equipment, including waterwheels and governors, cost $19 per kilowatt, the generating equipment $28 per kilowatt, and the switchboard and protective equipment $12 per kilowatt. The cost of the structure is not included because so many conditions affected its cost that any figures would be of little value.

As may be recalled, this station contains a 625-kva. generator which is remotely controlled from the main station on the system. The unit is protected against high bearing and generator temperature, overspeeding, failure of field or governor oil pressure, high voltage, low load, etc.

ROBERT E. BARRETT,
Holyoke Water Power Company, Treasurer.
Holyoke, Mass.

Specific Suggestions Desired

To the Editors of the ELECTRICAL WORLD:

In the news item which you published on Feb. 4 regarding tests of motor-operated steam valves it was stated that another set of tests would be conducted in three or four months if sufficient suggestions for obtaining other information of value to the industry at large are contributed. We should like to amplify this statement by saying we should be pleased to have specific suggestions from your readers regarding types of equipment that might be tested and the data desired. Facilities are available for measuring friction drop, steam flow and related data at high rates of flow.

For example, tests could be conducted to determine: (1) Friction drop through elbows, straight runs of pipe and nozzles; (2) capacity of safety valves; (3) accuracy of steam-flow meters at varying rates of flow; (4) practicability of making electrically operated valves close automatically when a main steam line bursts, and (5) experimental data that will guide valve manufacturers in designing quick-closing valves. These possibilities are cited merely to stimulate suggestions of tests that would be of general interest.

This invitation for suggestions is extended to scientific men as well as operating engineers.

Public Service Production Co., T. W. STINSON,
Newark, N. J. Mechanical Engineer.*

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*Formerly mechanical engineer Public Service Electric Company.

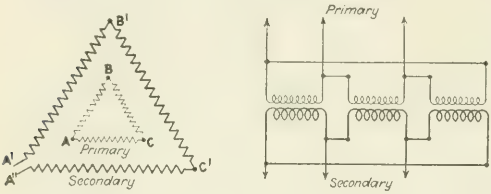
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Two Methods of Checking Transformer-Bank Connections

WHEN a bank of transformers is connected in delta the connections should always be carefully checked before putting the bank across the line. If the connections are wrong, it is possible that a transformer may be burned up, or at least the transformers will be subjected to excessive stresses which will not do them any good.

To check the connections by tracing the leads is not absolutely reliable as such a check does not tell whether the transformer polarities are all similar. If the transformers are all of the same manufacture and bought at the same time, there is very little chance that their polarities are not alike, but it is possible that one of them may be reversed, so that a general check on their polarity is desirable.



LEFT, SECONDARY LEFT OPEN FOR CHECKING VOLTAGE A'A". RIGHT, STANDARD DELTA-DELTA CONNECTIONS

There are two methods that can be used for making a check which are both reliable and which will not hurt the transformers. One method is to connect up the transformers completely except that the secondary delta is left open at any one of the three points as *A′A″* in diagram. If the primary is energized and the connections are correct, then the voltage measured across *A′A″* should be zero. If the connections are incorrect, then the voltage across *A′A″* will be twice the normal secondary voltage. For measuring this voltage either a voltmeter or a proper number of lamps in series can be used. If the secondary voltage is high, then it will be necessary to connect a potential transformer across *A′A″* and to measure the secondary voltage of this transformer. Even if two secondaries happen to be reversed, the result will be the same. Either there will be zero voltage if the connections are correct or twice normal voltage if the connections are incorrect.

Another method is to apply low voltage to the primary winding with the delta closed. About 5 per cent of its rated voltage will be sufficient. For instance, in the case of transformers with a 7,800-volt primary and a 440-volt secondary, 440 volts can be put on the primary through a low-capacity fuse—say 5 amp. for a 1,000-kw. bank. If the connections are incorrect, then the fuse will blow. The first method is to be preferred, as if the voltage is low and the fuse happens to be a little too large it may not blow. The connections should also be traced in addition to checking by one of these methods.

To minimize possible trouble it is always best to have a standard connection, as shown in diagram, and adhere to it whenever possible. This connection is chosen because of its simplicity and will be found to be the connection in most general use. Of course, where an additional bank is connected to operate in parallel with another bank then the connections of the second bank must be the same as the first bank, assuming all the transformers to have the same polarity. However, it may be advisable and is preferable to use the standard connection and change the connections of the old bank to correspond.

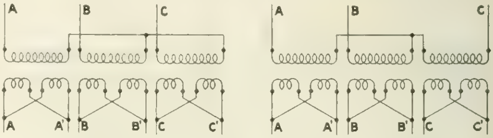
EUSTACE C. SOARES,
Electrical Engineer.

Ophuls, Hill & McCreery, Inc.,
New York City.

Reconnection for Half Voltage Causes Rotary Trouble

RECONSTRUCTION of a rotary and its transformers for use on 250 volts in place of the original voltage of 500 resulted in some perplexing troubles at a paper-mill substation in southern Ohio. There were two sets of transformers, one of two 500-kw. units connected star-delta on a 33-kv. circuit to furnish 440-volt power service and the other of the same size and number of units that had been connected in delta to a 19-kv. circuit and in star-diametrical for 424 volts to supply a six-phase rotary converter. The rotary was reconnected to supply 250 volts, and the secondaries of the transformers, consisting originally of two coils in series in each phase, were reconnected in multiple, as in Fig. 1, to insure 186 volts. The primaries were raised to a higher tap to get the proper star voltage and connected in star to the 33-kv. line.

As the taps were all the same, the voltage across the rings of the rotaries should have been equal. In measuring the voltage with the secondaries open it was found that the values across phases *A*, *B* and *C* were respectively 180, 182 and 195. Apparently the taps were wrong and they were shifted, *A* and *B* being changed to obtain 185 volts and *C* to secure 190, which was considered close enough to close the secondaries in delta. After trying every combination, the lowest voltage that it was found possible to measure across the open delta was 200. It was thought that one phase was



FIGS. 1 AND 2—ORIGINAL CONNECTIONS OF ROTARY TRANSFORMERS AND THE CHANGE THAT WAS MADE WITHOUT REMEDYING TROUBLE

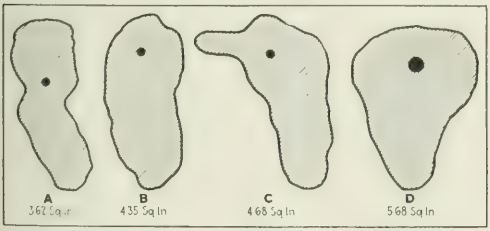
reversed, and the transformers were reconnected as in Fig. 2, with the result that the lowest voltage measured across the open delta was 340 volts, showing that the connections were wrong, one coil being reversed. The transformer manufacturers were called in, and after a considerable amount of experimenting the transformers were reconnected as in Fig. 1 and the delta connected up through a water rheostat. As soon as this path for the circulating currents was provided the phase voltages balanced perfectly. The delta connections were then removed and the connections to the rotary made, and the outfit was put into service without further trouble.

The trouble was attributed to the presence of triple-frequency currents caused by what was essentially a star-star connection that produced unbalance. When the transformers were first connected to the 33-kv. line with the secondaries open one set of insulators that were smaller than the others broke down under the effect of high-voltage surge set up. It was found necessary to issue instructions that the transformers should not be put in circuit unless the converter were started as the surge would occur and possibly cause damage.

Chicago, Ill. R. L. Rowlin.

Abnormal Ice Loadings on Transmission Wires Caused by Sleet Storm

In severity and duration the sleet storm of November, 1921, surpassed previous records in New England, causing interruptions of service to nearly all public utilities operating overhead lines within the storm area. Some of the sleet formations on the steel-tower, 66,000-volt line of the Connecticut Power Company near Goshen Hills are shown herewith, the sketches being from outline tracings made in the field. This line was built in 1913 and consists of two circuits of No. 2 B. & S. gage solid hard-drawn copper three-phase power conductors and a No. 6 B. & S. gage copper-clad telephone line. The power conductors are supported by suspension insulators and the telephone wires by pin-type insulators. Square steel towers about 57 ft. high with an average span of 400 ft. are used. The line and towers were designed for N. E. L. A. class B standard loading. The ice which formed on the line greatly exceeded the maximum loading for which it was designed, but only three towers failed on the entire line between Falls Village and Hartford, notwithstanding the fact that the failure of a number of line spans due to ice formation further increased the tower strains by unequal loading.



ICE FORMATION ON WIRES CAUSED BY THE RECENT NEW ENGLAND SLEET STORM

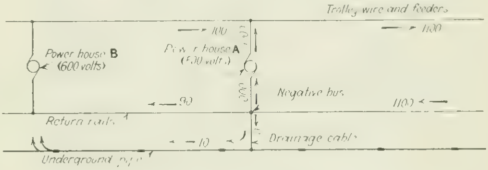
A, B and C—Cross-section of coating on telephone wires
D—Cross-section of transmission wire.

Stone & Webster, Inc., S. P. Melville.
Boston, Mass.

An Odd Case of Underground-Current Drainage

In making some tests recently to drain an underground pipe of its current near the power house, a temporary connection was made from the pipe directly to the negative bus, and the surprising result was that the current at times flowed from the negative bus to the pipe, the reverse of which was to be expected. This means that while a current was flowing from the positive bus to the trolley wire feeders a current, though a much smaller one, was also flowing from the negative bus to the pipe; that is, a positive current was simultaneously flowing out from both the positive and the negative busbars. Instead of draining the pipe, the drainage connection was actually sending more current from the negative busbar into the pipe at those times, thus making the conditions even worse.

This apparent paradox required an explanation. The question arose, How can current flow out from both busbars at the same time? How and where does it get back to its source? Where is the emf. generated which gives rise to this anomalous current? If this reversed emf. could be made exactly equal to that which caused the normal drainage current into the negative busbar, the resulting drainage current would be zero, which suggested to some that the pipe current might then be zero also, a result which was greatly desired.



CONDITIONS AS THEY APPARENTLY EXISTED
(Figures next to arrows indicate the assumed current)

The writer concluded that the explanation was as described below, and a subsequent test under exaggerated conditions proved the theory to be correct. The fact that there were several power houses some distance apart connected in paralled to the same trolley-wire feeders and to the same return track suggested the solution. If they were not operating at the same voltage and if no cars were running, the generators at the higher-voltage station would reverse those at the lower-voltage station and drive them as motors. This would explain the reversed current in the drainage cable, but it was found that none of the generators were being reversed; all were generating current normally, and current was flowing normally into the trolley wire.

Assuming the exaggerated conditions in the adjoining diagram and that cars are running both on the right-hand and left-hand side of station *A*, the tendency of station *B* would be to reverse the current through *A*, but 1,000 amp. is being delivered normally by *A*. Assuming 100 amp. to arrive at *A* from *B*, on the left, over the trolley wire, it will evidently join the 1,000 amp. of *A* and will run cars to the right of *A*, returning through the rails from the right to the negative busbar of *A*. From here this 100 amp. must get back to its station *B*. As the pipe paralleled this part of the track for many miles, a part of this current, say 10 amp., would naturally tend to flow through the drainage wire to the pipe, hence would flow away from the negative bus, the other 90 amp. flowing through the rails from the lower-voltage station *A* to the higher-voltage station *B*.

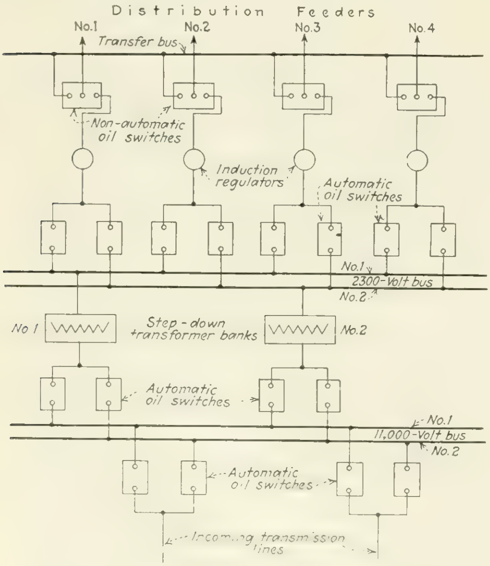
This the writer considers the correct explanation of the observed anomaly of a current flowing out from both busbars simultaneously. It emphasizes the importance of accurately adjusting the voltages when several stations are feeding into the same network—one in which there are no insulated joints.

An apparent anomaly is that these odd currents flowing out of the negative bus are found to be at the station where the voltage is too low and not where it is too high. These drainage currents may therefore be used as indicators to adjust the relative voltages of the several generating stations, as the best working conditions are not always those when the voltages are exactly equal.

CARL HERING,
Consulting Engineer.
Philadelphia, Pa.

Hasty Station Operation Often Results in Accidents

SOME operators do not take full advantage of their time to study the details of the substation in which they are working. The operator who does not know his switching layout is likely to get into difficulties in time of station trouble. The following incident, a mild example of such occurrences, might have resulted more disastrously. From the standpoint of the effect on the service alone it would have had serious effects had the incoming transmission lines to the substation been operating from generating stations not in synchronism.



CAREFUL STUDY OF SUBSTATION EQUIPMENT AVOIDS CARELESS MISTAKES

This substation, with seven 2,300-volt feeders, four of which are shown in the diagram, contained duplicate high-voltage and low-voltage buses and a transfer bus. No. 1 feeder being overloaded, it was put on the transfer bus with No. 3 feeder, the two regulators thereby splitting the load. The two regulators were both on No. 1 main bus. A cable on the overloaded circuit failed, and as the oil switches on the transfer bus were non-automatic, No. 1 main switch tripped; but as No. 3 switch had stuck, the oil switch on No. 1 transformer opened, thus killing that bus. The operator immediately tried to close the transformer switch, but it would not hold as the ground was still tied in through the transfer bus. He then began to throw all the oil switches of No. 1 bus to No. 2, and as soon as No. 1 feeder switch was closed the other transformer tripped out, disconnecting the entire load. The operator was so upset that another man had to be sent for to restore the service.

The first operator successively blundered in not pausing to study the circumstances surrounding the initial interruption, in attempting to energize the transformers under load by not clearing the 2,300-volt buses, in not separating the two feeders paralleled on the transfer bus, and in tying the 2,300-volt buses and transformers through the transfer bus by closing the No. 2 bus switch of No. 1 feeder while No. 3 feeder, with which it was paralleled, was still connected to No. 1 bus. The severity of the disturbance in tripping the transformer should have warned him that the failure causing it was serious. Further thought would have shown him that since No. 1 feeder tripped with the transformer, the trouble must have been on either the No. 1 feeder or the No. 3 feeder in parallel with it. By trying these feeders separately on the main bus the defective one could have been isolated and further interruptions avoided.

Philadelphia, Pa. FRANK GILLOOLY.

Covering of Cement Used to Protect Conduit in Coal Bunker

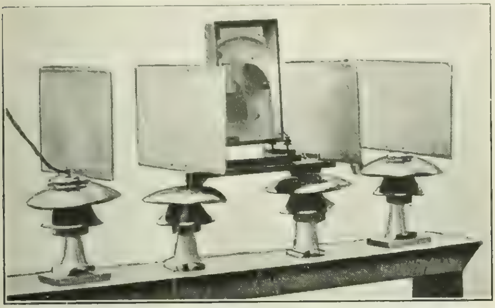
IT WAS found that where conduit was run through a coal bunker in a New York power plant it rapidly deteriorated owing to abrasion and corrosion. To avoid this a covering was made of cement that completely inclosed the pipes.

This conduit was run from an electric generator to a switchboard 50 ft. away. To avoid crossing the pipe trenches in the engine-room floor, it was thought best to run the leads through the coal bunker, which ran parallel with the engine room and was separated from it by a concrete wall forming a part of the building foundation. Accordingly, three 2-in. circuit pipes (one above the other) were run along this wall supported by wall hooks about 3 ft. from the floor. It was soon found that the abrasion of the coal destroyed the paint on the pipes and that they had to be cleaned and repainted at frequent intervals. It was also discovered that the chemicals in the coal were corroding the pipes badly. To prevent this it was finally decided to cover the pipes with concrete. Holes were drilled in the wall, and short pieces of ¾ in. pipe were driven in about 10 ft. apart to support the weight of the concrete; the wall was roughened with hammer and chisel, and a form was built around the pipes, leaving a space of 2 in. outside the pipes for the concrete. Chicken wire was fastened to the pipes to act as a binder. A grout was then made, consisting of one part Portland cement, two parts sand and four parts cinders from the furnaces. This was poured in a mold to form a cornice on the wall. The work was done eight years ago and is still in good order.

M. M. BROWN.
Camden, Me.

Phase Rotation on Two Lines Determined by Static Voltmeter

A 10,000-VOLT static voltmeter in conjunction with a condenser multiplier has been used successfully by the Kansas City Power & Light Company, to determine the phase rotation between two 33,000-volt lines coming from separate transformer substations but from the same generating plant. The 10,000-volt static voltmeter with the condenser multiplier were mounted on standard line insulators all secured to a laboratory bench as shown in the illustration. Since this device has the advantage of entirely insulating the testing leads, there was little danger while running this experiment and the test functioned satisfactorily. In making the test it was necessary to level the bench so as to get a proper zero reading and to avoid wiping the glass front of the meter, which would produce a static charge.



USE OF 10,000-VOLT STATIC VOLTMETER IN DETERMINING PHASE ROTATION

D. D. Clarke.

Kansas City Power & Light Company,
Kansas City, Mo.

Annunciator Panel Indicates Which Oil Switch Opens

TO INDICATE the opening of oil switches an annunciator panel was recently installed in connection with a new ten-panel power and light switchboard of a plant in New Britain, Conn. As any switch could trip without the handle changing position, it was evident that with the noise of the running machinery in the engine room it would be impossible to tell when a switch was suddenly opened by a short circuit or overload. In seeking a plan to make a switch give an alarm when it tripped out it was found that each oil switch had spring signal contacts on the moving element. These contacts were connected with a ten-drop annunciator that was located near by.

Damp-proof office wire, all of one color except the common return, red, was carried along the floor behind the switchboard in $\frac{1}{2}$-in. conduit, with short runs to each switch spring contact. The conduit was run all the way to the annunciator to avoid any possible contact with the light or power lines. The annunciator is a common type with a continuous-ringing contact and a 6-volt red lamp of about 12 cp. which lights when any one of the drops falls. A 10-in. gong is also connected in the circuit. The current is supplied by a four-cell Edison battery of the 30-amp. truck type which had been discarded for tractor use. Each branch circuit to the annunciator has a small one-point switch to be used when a circuit is purposely left open, and the common return has a switch which shuts off the whole system when needed.

H. S. Rich.

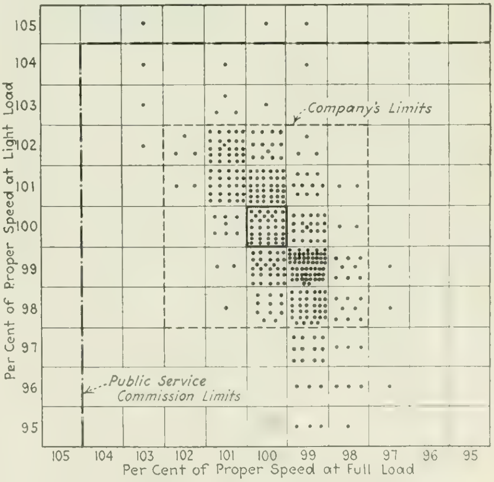
Little River, Conn.

Chart for Studying the Accuracy of a Large Number of Meters

A MEANS of determining the most desirable frequency at which to test meters is afforded by the accompanying chart, which gives a visual indication of the relative accuracy of a number of meters which have been tested. This chart may also be used to compare the relative accuracies of different types of meters used by the company.

As each meter is tested a dot is placed on the chart in the position which indicates the accuracy of the meter. If the meter tests within 0.5 per cent of accurate, the dot is placed inside the small center square. If it is running above 100.5 per cent of correct speed on full load, the dot is placed to the left of the center square. If the speed on full load is below correct speed, the dot is placed to the right. This determines the vertical column in which it is placed. The height of the dot above or below the center square depends on whether the meter is fast or slow, respectively, on light load. This locates the dot definitely in one of the squares. The dots were arranged in symmetrical shape in each square in order to give a more easily studied chart.

The chart shown indicates the result of tests made on 394 meters with a three-year period between tests. It can be seen that 3 meters, or 0.76 of 1 per cent, were outside the Public Service Commission requirements for accuracy, while 354 tests, or 90 per cent, were within the company's limits of 2 per cent fast or slow.



A CHART OF THIS KIND SHOWS THE GENERAL TREND OF ACCURACY OF A COMPANY'S METERS IN SERVICE

H. W. Peck,
Vice-president.

Adirondack Power & Light Co.,
Schenectady, N. Y.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

On Talking Direct to the Public

Utility Men Should Take Every Opportunity to Tell People About Their Companies' Aims and Problems

"BE FRANK, and spread inside information of interest to the public," said Walter P. Schwabe to the New England Division of the N. E. L. A. at a recent public policy meeting. As chairman of the public-speaking committee of the division, Mr. Schwabe enthusiastically advocated going straight to the people with the message of central-station service, good will and possibilities of development. Believing that the average utility man talks too little in public, Mr. Schwabe drove home these points:

W. P. SCHWABE

"It has been said that 85 per cent of the value of advertising, which also means publicity, is received through the eye and only 15 per cent is received by ear, but I believe that more credit should be given the spoken word since much of the printed matter worth while is a reproduction of the spoken word. Talk! Say something of interest to the public, and if it has any real value it will automatically get into print.

"Every utility, through its local manager or other qualified employees, should take advantage of every opportunity to address chambers of commerce, boards of trade, Rotary clubs, scientific meetings or other gatherings in its territory, so that the people will understand what public utilities really are. The average citizen, although he may not realize it, is interested in public utilities more than in any other industry because he is directly concerned as a consumer, taxpayer or investor, or all three. Utility men do too little talking in public, often on account of fear of being attacked. This is all wrong and only invites suspicion.

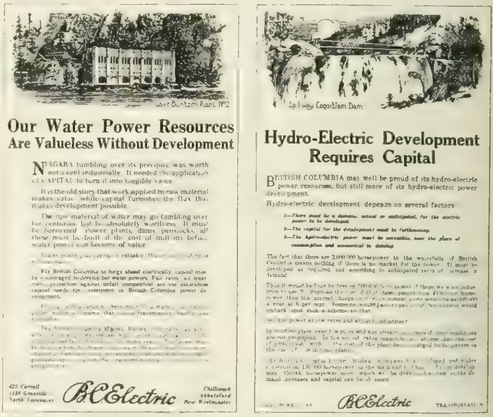
"Make a serious effort to get the good will of the public. Most people are reasonable, and whether their thoughts and actions are fair or unfair depends on whether their information is right or wrong. We must do everything we can, by personal contact if possible, to give the people correct information about our business, which is also their business.

"Explain that in the usual meaning a utility makes no profit, but merely earns an amount sufficient to cover expenses, upkeep of property in public use and a fair return or wages for the capital invested. Tell people why a utility must constantly have additional capital to meet the demands of the community for extensions of lines and mains, and that rates must be sufficient to yield a return that will attract this capital in a competitive money market. Tell them the salient facts about the different utility problems; give them accounts of the task and cost of restoring service after storms (the recent New England sleet storm offered a remarkable opportunity of this kind), and show them that the progress and the very existence of their communities is measured by the character of their utilities.

"Show how the utilities are the most democratic of all commercial institutions. Electricity of equal voltage and price is delivered to mansion and cottage. The wife of the factory worker is supplied with service of the same quality as the wife of the banker. In this way you can create friendly relations and interest in your affairs that will lead to moral and financial support on the part of your customers and the public."

Constructive Publicity Helps Defeat Municipal Ownership

WHILE the British Columbia Electric Railway took no part in the political campaign it played an interesting part in a setback to municipal ownership of electric utilities at a recent municipal election in Vancouver when the candidate for Mayor on such a platform was defeated. Prior to the election the company published an interesting and constructive series of advertisements designed to counteract municipal ownership propaganda.


Lake Buntzen Plant No. 2
Spillway Coquitlam Dam

Our Water Power Resources Are Valueless Without Development

NIAGARA tumbling over its precipice was worth not a cent industrially. It needed the application of CAPITAL to turn it into tangible value.

It is the old story that work applied to raw material makes value while capital furnishes the flux that makes development possible.

The raw material of water may go tumbling over for centuries but be absolutely worthless. It must be *harnessed*. Power plants, dams, penstocks, all these must be built at the cost of millions before water power can become of value.

For British Columbia to forge ahead electrically capital must be encouraged to develop her water powers. Fair rates, fair treatment, protection against unfair competition are the assurances capital needs for investment in British Columbia power development.

425 Carrall
1138 Granville
North Vancouver

BC Electric

Chilliwack
Abbotsford
New Westminster

Hydro-Electric Development Requires Capital

BRITISH COLUMBIA may well be proud of its hydro-electric power resources, but still more of its hydro-electric power development.

Hydro-electric development depends on several factors:

1—There must be a demand, actual or anticipated, for the electric power to be developed.

2—The capital for the development must be forthcoming.

3—The hydro-electric power must be accessible, near the place of consumption and economical to develop.

The fact that there are 3,000,000 horsepower in the waterfalls of British Columbia means nothing if there is no market for the power. It must be developed as required and according to anticipated rates of increase in demand.

BC Electric

TYPICAL ADVERTISEMENTS WHICH HELPED DEFEAT MUNICIPAL OWNERSHIP

By picturing in the advertisements the extent of the company's development work and showing how its rates for service compared favorably with the rates in other larger communities the sentiment favoring municipal ownership was considerably lessened. In none of the advertisements was municipal ownership mentioned, but the company's service in its relation to the industrial growth of the community was emphasized. Two advertisements of the series of eight are shown here.

Utica and Dayton Companies Hold a Joint Meeting

For the purpose of interchanging ideas and to discuss present-day operating and management problems the officers of the Utica (N. Y.) Gas & Electric Company and the Dayton (Ohio) Power & Light Company, of which Frank M. Tait is president, have planned a series of joint meetings. The first meeting was held recently at Dayton, where preferred stock sales, stores and transportation and the rural line problem were discussed.

General Manager O. H. Hutchings of Dayton and General Manager F. B. Steele of the Utica property opened the meeting, and the second day was spent in inspecting the Miller's Ford power plant and in visits to the various departments of the Dayton company for the interchange of ideas. So much benefit was derived from the meeting that the tentative program for the next meeting, which is to be held at Utica, was outlined.

MEN OF THE UTICA AND DAYTON COMPANIES WHO RECENTLY HELD A JOINT MEETING IN DAYTON

"Collier's" Measures Country's Growth by Progress of Utilities

"No ONE factor, except the human factor, is contributing more to get this great nation back on its financial and economic legs than is the factor of electricity." This statement was made in an editorial in *Collier's* magazine recently and is a further recognition of how closely the entire country's development is tied up with and dependent upon the prosperity of the electric light and power companies. The editor points to the increasing signs of fairness in the attitude of the American public toward the utilities and says:

"It is a hopeful sign when a review of the past year shows the public-utility question as a whole receiving sane and businesslike treatment at the hands of the regulatory bodies in the different States.

"Electric energy is everlastingly on the job to reduce costs, to cut overhead, to shorten distances, to eliminate loss of time, to make one machine (whatever that machine produces) do the work of many hands, to increase the comforts and lighten the burdens of the nation.

"We pass to something more important: The growing need of the country for homes. House building lags. Whatever increase in homes we make is more than kept pace with by the increase in population. The need must be met, and it will be; but we should remember that every home that is built is a 'prospect' for electric energy. It will need a telephone, or electric lights, or gas, or all three—and it will need transportation close by it, the closer the better.

"The public-utility companies, to meet this great demand, must develop and must finance the development. The financing is done either by selling securities directly to the holders or to the same holders indirectly through the insurance companies and banks. The spirit of fair play, already mentioned, will make this financing possible on a basis that is fair and just to the companies and the public.

"Hand in hand with the development of transportation will go this giant, electricity, to cut down the cost of railroad operation, to give better street-car service, to turn more wheels, to carry more messages over telephone and telegraph lines; in plain words, to lift this country up and on."

What Other Companies Are Doing

Wichita Falls, Tex.—The itinerant crew of salesmen employed by the Texas Power & Light Company to cover its rather widely scattered property in Texas recently completed a five weeks' campaign in the Wichita Falls district. In that time the crew sold fifty-six electric washers, cleaned out the entire stock of Hoover sweepers and sold various other appliances which brought the total sales for the period up to $11,128.

Providence, R. I.—A 14 per cent saving on the cost of getting new lighting business was accompanied by a net gain of 7,102 customers in 1921 compared with 6,657 in 1920 on the system of the Narragansett Electric Lighting Company. The saving included every item of expense from postage to salaries chargeable to the cost of getting new business. Of the total meter gain in 1921, 3,309 were acquired through the company's house-wiring campaign. There were 126 store-wiring contracts taken during the year. F. A. Gallagher, Jr., is manager of the company's lighting division.

Passaic, N. J.—Through the co-operation of the local office of the Public Service Electric Company, pupils of one of the Passaic schools were able to listen to a talk by A. B. O'Day of the Edison Lamp Works on Jan. 26 on "Lighting Values to the Present Generation." After the lecture the children were given the opportunity to ask Mr. O'Day questions, and the intelligence of the questions and the apparent understanding of the topic were a pleasant surprise to the lecturer. The local utility officials were greatly pleased and expect the lecture to bring real results in better understanding of the progress of the electrical industry.

San Francisco, Cal.—The Pacific Gas & Electric Company has just issued a new booklet containing several individual articles on "The Story of the Magic Pool" which deal with the power resources of the Modoc lava beds and the hydro-electric projects that the company will construct along the Pit River.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Let the Electrical Manufacturer, Jobber and Dealer Stick to His Trade

By W. C. Bryant
President Bryant Electric Company, Bridgeport, Conn.

ONE of the results of after-the-war conditions has been the not altogether successful expansion of some retailers into jobbers or wholesalers. In the scramble for business immediately after the armistice it was perhaps but natural that a man in one particular line of business should cast envious eyes upon some kindred line in which, on the surface, the profits seemed to be greater and the conduct of the details easier. In the electrical industry this may explain why many houses which were originally organized and successfully conducted as dealers or contractors desire to become jobbers. The effect, as a whole, has been unsatisfactory, and in individual cases this broadening process has reduced the efficiency of organizations so that, while a larger volume of business may be shown by their books, much of it has been handled at a loss due to inexperience in the particular class of business last taken on. It seems to be generally recognized that the houses which have stuck persistently to their own particular branch of the industry have weathered the readjustment period. They are on a better basis to proceed as conditions more nearly approach normal than those houses which have lost their identity more or less and which are exhausting themselves by a series of efforts in different directions which cannot be handled easily—if at all—by the same kind of an organization.

W. C. BRYANT

Manufacturer Needs Jobber's Service

Virtually none of the manufacturers of electrical material make lines large and complete enough to justify their establishing more than a few distributing centers for themselves in the largest cities. This function of distribution, however, can be and is taken care of satisfactorily by the jobber who consolidates a large number of non-competing lines and builds up a profitable business where a manufacturer could not possibly maintain a branch, thus solving the distribution problem on a mutually satisfactory and profitable basis. The manufacturer could not get the wide distribution that he requires without the co-operation of the jobber. The jobber, on the other hand, must look to the manufacturer for good materials and real service, or he will have nothing to build on.

Manufacturers, jobbers and dealers are all responsible for present unsatisfactory conditions. Manufacturers who seek new channels of distribution have not been careful to select as distributers houses which can, under any possible stretch of imagination, be considered jobbers. The newly appointed distributer, in his turn, in order to develop a sufficiently large volume of business to retain his position with his manufacturer, desires to sell a large quantity of goods on a very small margin, thus creating a difficult competitive condition with other near-by jobbers, and in some cases he will turn the material over to his customers at no profit in order to enlarge his volume of business. While this may be helpful to his customer for the time being, it creates a price condition throughout the entire locality which no manufacturer or legitimate jobber can look upon complacently.

Obstacles to Combining Jobber-Dealer Functions

The electrical supply business has been conducted for many years along well-recognized lines. The elements which constitute a jobbing house are well known. A jobber should be able to obtain and hold a reasonably large volume of business continuously; he should have a suitable warehouse with facilities for prompt shipment of a reasonably large stock of material, and he should have a well organized selling force covering territory lying within easy reach of his office and stock. As soon as he begins to go into the contracting or retailing business he ceases to be a satisfactory source of distribution for the manufacturer. He has become a competitor of his own customers and not only loses their good will himself but loses their good will for the manufacturer whom he represents as well. A good illustration of this is found in the fact that the majority of the established jobbers, having seen the evil of serving two masters, have given up contracting and retailing.

It is just as difficult to graduate over a contracting house into a jobbing business. The same conditions apply. The newly organized jobber immediately desires to sell to his former competitors, but he is almost certain to retain at least some of the customers that he formerly had. While the effect is to broaden the manufacturer's distribution for the time being, the result is that both the jobbers and the dealers in the territory in question are suspicious, an unsatisfactory condition is brought about, and nothing new is created—only a further division of what already existed takes place.

Present conditions may lead a manufacturer to depart from his established policy and appoint jobbing representatives almost at random in order to obtain greater distribution and increase his sales for the moment, but the manufacturer who is building substantially for the "long pull" and the future is the one who is not going to abandon the policy which has meant success for him heretofore and which may still be considered sound and practical for the future. His distributers must be selected with as much discrimination as ever, and he must not be led into upsetting the entire fabric of the industry, because of the promise of an attractive volume of business, probably temporary, from houses not otherwise suitably constituted for a jobbing business.

A Problem Confronting Manufacturers of Transmission-Line Materials

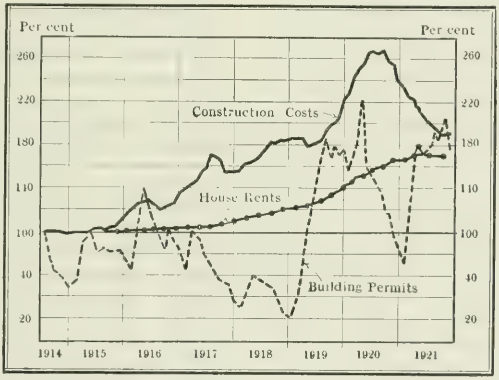
By C. M. Semler
General Manager
Pittsburgh High-Voltage Insulator Company, Derry, Pa.

AN INTERESTING problem faces the manufacturers of high-tension insulators and other equipment which will be required in the construction of the central-station transmission lines that will be built as soon as the quickening of general business restores full confidence. That there are many such lines to be built, and before long, is becoming increasingly evident. For some months manufacturers in the field have been receiving requests and making quotations. Many of these inquiries are now ripening into negotiations, which, of course, is always a sign of serious purpose and a strong indication that the work will soon be done.

It is becoming the general belief, I feel, that the opening of spring is to see a considerable improvement of general business. It will come gradually, the expectation is, but by summer will have gained materially in strength and by the fall will have assumed a volume that will be really substantial. And 1923, they say, is to be a "good year." To meet this greater activity power companies have their plans well made. Requisitions are all figured out, but they delay the actual placing of the orders. The result will be that when the visible acceleration of business, the increased building activity and the generally improved conditions have brought us all to the realization of the fact that good times are really here, all the orders will be placed at once and considerable disappointment is sure to follow. The problem is how to carry this message to the country so that material that beyond all question will be needed may be ordered earlier and ahead of the demand which will clog deliveries for a while when everybody is buying.

The consumption of porcelain lines is usually very stable. Even in the panic of 1907 production never fell below 75 per cent of normal; therefore porcelain manufacturers have not been in a position of idle waiting and cannot carry a sudden large abnormal demand without delay in deliveries. The manufacturers of poles, crossarms, wire cable and other material face the same condition, and it is none too soon to bring this situation frankly before all those who are contemplating construction in the spring and summer.

Building Increases with Declining Costs



MANUFACTURERS, jobbers and dealers who have been wondering when the building program is going to get in motion will find encouragement in this bit of information. With the steady recession in construction costs there has been a corresponding increase in building activity as shown in the above chart from the New York "Evening Post." The curve of construction cost is based on the wholesale prices of fifteen principal building materials and wage rates in the building trades.

Pioneering Needs a Balanced Plan to Make It Pay

By W. R. Herstein
Vice-president and General Manager
Electrical Supply Company, Memphis, Tenn.

ALTHOUGH it is possible for a jobber to warehouse and distribute electrical supplies at a nominal cost, the exploitation of new devices is usually almost as expensive as production itself. Whether the expense is borne by the manufacturer, the jobber or the retailer, the price must be paid and past experience shows that ultimate profit seldom accrues to the pioneer.

Since entering the electrical supply jobbing business eighteen years ago I have always preferred to be simply a warehouseman and distributer. Circumstances sometimes necessitated my becoming an exploiter or pioneer, and each time it has cost money unless I was fortunate enough to have a manufacturer or retailer pay for it. Experiences during and immediately after the war rather upset this theory because many articles which plainly are specialties almost got into the staple class. But that was during the "seller's market," and since present circumstances have thrown them back into the specialty class, they must be marketed as such.

I believe that a frank admission on the part of all concerned will bear out the statement that pioneering does not pay. The tribulations of the Pilgrims, the "Forty-niners" and other picturesque but unfortunate characters in history are interesting examples of the small reward to be gained by the pioneer. For an industry to progress new ideas and new devices must be exploited and somehow the cost of development must be paid, but I do not believe that any one branch or group in an industry should carry the entire burden. The work of pioneering the larger domestic appliances, for instance, has got to be distributed just as the opportunity and the profit is distributed to the men who do the work of producing and selling, but the man who sells must be paid for his work as he does it.

The spread on appliances does not permit the jobber to function as a pioneer, and therefore that work must fall upon the manufacturer and retailer. Unfortunately some manufacturers do not figure this adequately into their plans, and the retailer is often left without either the support or profit that he needs to do the job right. Since there is much pioneering still to be done we must face the facts and get a clear understanding of the division of responsibility.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Locating Short Circuits in Direct-Current Armatures—Repairing Faults.—B. A. BRIGGS.—Methods are given for locating short circuits in coils and commutators. Different ways of cutting out a short-circuited coil and of making temporary repairs are described.—*Power,* Jan. 17, 1922.

The Mathematical Theory of the Induced Voltage in the High-Tension Magneto.—F. B. SILSBEE.—A discussion of the period in the cycle of operations in a magneto between the moment of interruption of the primary current and the moment when the spark gap breaks down. During this period the magnetic energy stored in the primary inductance is in part transferred to electrostatic form and charges the primary and secondary capacities. Methods are described for the measurement of the various electrical constants entering into the different types of magnetos.—*Scientific Papers of the Bureau of Standards,* No. 424.

Induction-Type Synchronous Motors.—LAURENCE H. A. CARR.—This type of motor has been developed to the state where it possesses the good starting characteristics of a slip-ring induction motor, while at the same time retaining the advantages of a synchronous motor as regards its properties of power-factor correction. The article compares this motor with other types of machines, and discusses its theory and construction, starting and synchronizing characteristics, overload, reliability, excitation voltage, control apparatus and efficiency.—*Engineer (London),* Dec. 30, 1921.

Lamps and Lighting

Electric Lighthouse to Aid Aërial Navigation.—CH. DANTIN.—The Technical Aëronautic Service of France has just constructed a lighthouse with a rating of 1,000,000,000 beam candlepower—declared to be more powerful than any now existing—on the top of Mont Afrique, near Dijon, in northeastern France. This lighthouse is intended to facilitate night flying from Paris to Algiers, the Mediterranean, Italy, Switzerland and other destinations. Although in maritime navigation lighthouses of from 30,000,000 beam cp. to 40,000,000 beam cp. have been found adequate, the height from which a lighthouse should be discernible by the pilot of an airship (2,500 m. at the least) and the quickness of an airship's flight (200 km. an hour) have rendered ordinary lighthouses, which have had a projective radius of only 40 km. or 60 km., far too feeble. The new lighthouse will in ordinary weather be visible at 150 km., and this distance will be increased to 300 km. or possibly 400 km. under favorable atmospheric conditions. The structure has three stories, of which the upper two are occupied by eight optical apparatus of Fresnel type, each composed of a panel containing seven dioptric and ten catadioptric elements. At the center of each of these lenses, which have a focal distance of 50 cm., a continuous-current arc lamp with horizontal carbons is installed, the crater of the positive carbon being turned toward the lens. These eight optical sets, arranged on two platforms in groups of four and composing the movable part of the installation, are contained in a lantern with an interior diameter of 5.5 m. and are rotated by a 4-hp. motor. The rays from each group of four lenses converge at a certain distance into a single beam. The arc lamps are of a new type, entirely automatic, the positive carbon having a continuous rotative movement. Each lamp is rated at 120 amp. and 65 volts maximum.—*Le Génie Civil,* Dec. 24, 1921.

Generation, Transmission and Distribution

A Small Hydro-Electric and Steam-Generating Plant.—G. FISLER.—A great number of small watersheds were brought into use in Switzerland during the war on account of the unreliable coal supply. Little has been published about those small plants, yet their aggregate output, as far as Brown-Boveri installations are concerned, amounts to 4,000 kva. The author selects as a typical example a small station containing two 220-kva., 150-r.p.m. vertical-shaft generators, supplying a textile manufacturing establishment. Of special interest in this installation is the use of an electro-boiler, for which a maximum energy of 300 kw. is available outside of working hours. A steam accumulator has therefore been provided large enough to store 3,600 kg. of steam at a maximum pressure of 14 atmospheres. The electric boiler itself measures only 750 mm. in diameter and 2,500 mm. in height and is equipped to operate directly on 2,100-volt, three-phase, 50-cycle current from the generators. Its electrodes are adjustable to the load either by hand or by remote control from the power house.—*Brown-Boveri Mitteilungen,* December, 1921.

Electrification of Russia.—P. GUREWITSCH.—Based upon official Russian statistics, the author describes the various power stations built since the war, with special emphasis upon the hydro-electric stations and the planned electrifications of railroads. While the author claims that these plans are technically justified and will ultimately be undertaken, it is impossible to imagine the electrification of Russia amid the present general chaos of the country. The total undeveloped water powers of Russia are estimated at 20,000,000 hp. For the first step of a general electrification there would be required 1,100,000 kw. in turbo-generators, 640,000 kw. in water turbines, 131,000 tons of steel, 41,000 tons of copper (exclusive of machines), 150,000,000 bricks and 6,000,000 barrels of cement. The cost of this first step is estimated to be 833,000,000 gold rubles. Almost all the material would have to be imported.—*Elektrotechnische Zeitschrift,* Dec. 15, 1921.

Hydro Report on the St. Lawrence River.—Conclusion of the engineering report of the International Joint Commission on the power development of the St. Lawrence River. This report covers details of the two storage developments of power at Aysler and Barnhart

Islands, describing methods for diverting navigation around these two developments. A summary of all proposed developments with their relative costs is given.—*Canadian Engineer*, Dec. 15, 1921.

Traction

Electric Traction on Heavy Traffic Lines.—GEORGE GIBBS.—A paper prepared for the International Railway Congress covering electric railway electrification in America. The author thinks that it is too early to standardize, but believes that alternating-current equipment is more promising than other kinds in this field. The advantages and disadvantages of the third-rail system and of overhead conductors are given in tabular form. Among the different types of drives discussed are gearing motors directly to the axles, mounting motors on or around axles and geared or gearless drive by means of cranks and rods.—*Electric Railway Journal*, Jan. 28, 1922.

The Chilean Railroad Problem and Its Solution.—DAVID C. HERSHBERGER.—A very complete description of the 115-mile electrification of the steam railroad between Valparaiso and Santiago in Chile. One of the advantages that will be derived is an increase in the capacity of the present trackage to provide for future traffic by means of faster schedules and heavier trains. Others are the reduction in fuel costs, locomotive maintenance costs, crew costs and track maintenance costs, and the elimination of coaling and watering stations.—*Railway Electrical Engineer*, January, 1922.

Installations, Systems and Appliances

Inspection and Maintenance Practices.—ARTHUR J. WHITCOMB.—Inefficient and defective apparatus in any plant means loss of production, high cost of repairs, excessive attention to machine operation and a menace to continuity of operation. The insurance against such troubles is adequate inspection. In the steel and tube mill referred to in this article inspection methods have been worked out and tabulated that are both simple and effective.—*Electrical Review and Industrial Engineer*, January, 1922.

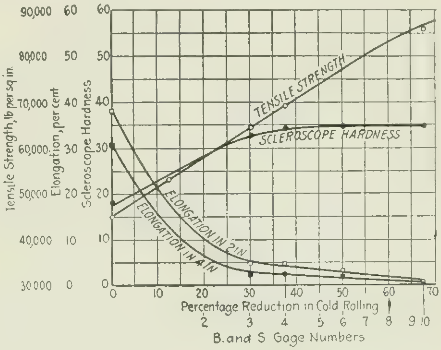
Ash Handling in Large Generating Stations.—L. R. LEE.—This article deals with the handling and disposition of furnace ash. Several designs of ashpits are discussed and attention is drawn to the provisions that must be made in case of failure of the ash disposal system employed.—*Power*, Jan. 17, 1922.

Units, Measurements and Instruments

Shadow Meter.—DR. NORDEN.—A measure of the intensity of illumination is given in the comparative blackness of shadows cast. The author built a shadow meter three years ago consisting of a circular disk with fourteen differently shaded sectors painted on it and a short vertical bar casting a shadow upon the disk. By matching this shadow with one of the graduated sectors a certain shadow intensity was obtained, which was used for comparisons. The instrument has been recently much improved, permitting of much more accurate measurement. Besides the shadow-casting bar a central needle mark has been added to count the number of individual shadows cast as the result of a multiplication of illuminants. The instrument enables the operator to measure direct, indirect and diffused light with equal accuracy.—*Zeitschrift für Beleuchtungswessen*, Nov. 15 and 30, 1921.

Electrochemistry and Batteries

Electrolytic Iron a Commercial Product.—BRADLEY STOUGHTON.—The method of the manufacture of boiler tubes of electrolytic iron at Grenoble, France, by the process of the Société "Le Fer" is described. In this process the electrolyte is ferrous chloride; the anode is iron in the form of cast iron; the cathode is a revolving mandrel upon which the pure iron is deposited in the shape of a tube. A briquetted form of pulverized electrolytic iron is made for magnet cores at Hawthorne, Ill., by employing the very ingenious expedient of utilizing the hardness and brittleness of electrolytic iron from which the hydrogen has not been eliminated in order to get the material into a finely powdered condition and compress it into magnet cores which will have high electrical resistance because the particles are not soft enough to crush together into a unit mass. Remarks on leaching iron from sulphide ores with subsequent electrolysis are included. Properties of this electrolytic iron are discussed.—*Iron Age*, Jan. 5, 1922.



CHARACTERISTIC CURVES OF ELECTROLYTIC IRON

Telegraphy, Telephony and Signals

The Amplification of Weak Alternating Currents.—H. BARKHAUSEN.—The first of a series of articles discussing the application of the electronic valve to the amplification of weak alternating currents, this issue dealing with the anode circuit and output transformer.—*Radio Review*, January, 1922.

Duplex Balancing of Long Submarine Cables.—E. S. HEURTLEY.—In cables of this type it is very important that a stable balance be maintained. Two methods are described to this end.—*Electrician (London)*, Jan. 13, 1922.

The Radio Direction Finder and Its Application to Navigation.—F. A. KOLSTER and F. W. DUNMORE.—The radio direction finder that is described is designed to be installed over the ship's binnacle carrying the magnetic compass, and an additional scale is attached to the top of the binnacle and marked with the corrections obtained by calibrating the radio direction finder. The electrical features have been made such that the only operation necessary when taking a radio bearing are one adjustment in the radio receiving set and the rotating of the direction finder coil. Tests were made and the results are given. Numerous photographs of the installed radio direction finder are included in the article.—*Scientific Papers of the Bureau of Standards, No. 428.*

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **Prof. Vladimir Karapetoff**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

THERMOCOUPLES, RARE METAL, IMPROVEMENT IN.

Some platinum-rhodium thermocouples on the American market were found subject to large changes in indication after long-continued exposure to very high temperatures. Chemical and spectroscopic tests revealed the fact that the trouble was due to the presence of several tenths of a per cent of iron in the platinum-rhodium alloy wire. These facts were communicated to the firms engaged in refining the metals, and as a result much improved alloys have been produced.—*Bureau of Standards, Washington, D. C.*

RADIO TELEPHONY, DIFFERENT METHODS OF MODULATION.

Studies have been made of the phenomena of modulated radio-frequency waves, and the relative advantages of different methods of modulation and different circuits. The apparatus used in radio-telephone transmitting sets employing plate modulation has been analyzed as consisting of four units—the source of direct current, the modulator unit, the generator unit and the radiator unit. Oscillographic studies have been made. Results of these studies are contained in Scientific Paper No. 423.—*Bureau of Standards, Washington, D. C.*

INDUCTANCE OF CIRCULAR COILS OF COMPLICATED CROSS-SECTION.

Tables are now available for the calculation of the inductance of a circular coil of rectangular cross-section. An important application of the tables is found in the cases of coils of more complicated shapes, where the inductance may be obtained by combining the values of the inductance of elements of rectangular cross-section. The tables do away with all confusion as to the proper formula to be used and reduce computations to a minimum.—*F. W. Grover, Union College, Schenectady, N. Y.*

KVA. RECORDING METER.

A meter has been developed which records on a paper chart kilovolt-amperes in a two-phase or three-phase circuit, independent of the phase displacement between the current and the voltage. The meter is of the usual induction type, the series and the shunt fields acting upon an aluminum disk, but an additional movable element always keeps the phase of the shunt flux in the air gap in time quadrature with the current field. The torque on the disk is therefore the same as if the power factor were maintained at unity, and the instrument measures volt-amperes instead of kilowatts.—*Esterline-Angus Company, Indianapolis, Ind.*

RAIN, PRODUCED ELECTRICALLY.

Promising experiments have been made in an Australian arid region, the method consisting in ionizing strata of the atmosphere so as to facilitate the formation of drops of water around these ions. (See *Electrician*, Vol. 80, 1917, page 303; *L'Industrie Electrique*, Vol. 26, 1917, page 445; and *Physical Review*, Vol. XI, 1918, page 445.) Further work in the same direction might prove to be of great economic value for some parts of this country, besides being a new application of electricity.

DRY CELLS, STANDARDIZATION OF.

An important meeting was held at the bureau at which seventeen sizes of dry cells were considered and seven of these sizes standardized. Eight sizes and kinds of flashlight batteries and two sizes for use with radio apparatus were also standardized. It is expected that the elimination of many sizes for which there is little demand will result in considerable saving in the cost of manufacturing. The conference also standardized the performance for the sizes which were accepted.—*Bureau of Standards, Washington, D. C.*

VITREOUS ENAMELING BY ELECTRICITY.

The Industrial Electric Heating Division of the N. E. L. A. is collecting data on the possibilities and advantages of vitreous enameling by using electric heat.

PLATING SOLUTIONS; ZINC OXIDE.

It was found that satisfactory zinc-plating solutions can be made by using zinc oxide to replace part or all of the zinc cyanide formerly employed for this purpose. Exact formulas and the best current density have been found and the mode of procedure developed. The presence of large amounts of carbonate causes rough or striated deposits. Carbonates should therefore be removed from the solution at intervals by precipitation with barium cyanide or hydroxide, or by cooling the solutions to low temperatures.—*William Blum, F. J. Liscomb and C. M. Carson, Bureau of Standards, Washington, D. C.*

OSCILLOGRAPH, DOUBLE-VIBRATOR, FOR PLOTTING HYSTERESIS LOOPS.

A double-vibrator oscillograph has been devised for the plotting of hysteresis loops in rectangular co-ordinates. It has two mirrors with their axes at right angles so that two variable electric currents may be traced simultaneously upon a stationary film. The beam of light is reflected from one mirror to the other and thence to the recording film. Numerous curves have been made and investigations are being conducted toward the improvement of the accuracy of the apparatus.—*Massachusetts Institute of Technology, Cambridge, Mass.*

CLOCK, ELECTRICALLY WOUND.

Tests have been made on a clock which consisted of a watch movement with an electrical winding attachment. This test included the temperature compensation between —25 deg. C. to +50 deg. C., the effect of continuous vibration and the current consumption.—*Bureau of Standards, Washington, D. C.*

BRIGHTNESS RATIO, GOLD-POINT, PALLADIUM-POINT.

In a paper on "The Effective Wave-Length of Red Glasses," published in the *Astrophysical Journal* in November, 1915, appeared a note on some results on the gold-point, palladium-point brightness ratio. These data were obtained by measurements with an ordinary disappearing-filament optical pyrometer with a red glass in the eyepiece. Since that time additional data have been obtained by the same method and also by means of a spectral pyrometer. Several different black-body furnaces have been used. The sample of gold or palladium that was melted was mounted between platinum wires supported by two porcelain tubes in such a manner that the central part of the sample could not touch either of these two tubes. As a result of this work the laboratories of the General Electric Company have decided, for the time being, to accept 1,828 deg. K as the palladium point.—*E. P. Hyde and W. E. Forsythe, Nela Research Laboratory, Cleveland, Ohio.*

Suggestions for Research

TRANSFORMERS, TERTIARY WINDINGS IN.

More exact physical knowledge is desired regarding the functioning of tertiary windings for the suppression of undesirable triple harmonics of current or voltage in banks of single-phase transformers. The action of the core in suppressing triple harmonics in Y-Y-connected, three-phase, core-type transformers also deserves further study.—*J. C. Clark, Stanford University, Cal.*

DIELECTRICS.

The mechanism of leakage and dielectric breakdown in insulation should be investigated. A collection of the dielectric constants of standard types of insulated materials is needed. Our knowledge of actual values of specific inductive capacity, for example, is relatively very limited.—*C. E. Skinner, East Pittsburgh, Pa.*

ELECTROSTATIC DISTURBANCES IN AIR, STUDY OF.

Valuable information bearing on the relation of electrical phenomena to storm areas could be obtained if a group of six or eight radio stations situated within a radius of 300 miles of one another were to take simultaneous measurements of the audibility of static strays two or more times each twenty-four hours. If one reading were taken daily at 11 a.m. and the other at 9 p.m., the relative sensibilities of the instruments at the various stations could be determined. A modified form of the blanks got out by the British Association for the Advancement of Science in pre-war days might be used to insure uniformity.—*J. C. Jensen, Nebraska Wesleyan University, University Place, Neb.*

INDUCTION MOTOR, PERFORMANCE FROM ACCELERATION TEST.

When an induction motor is accelerating from standstill to no load the vector of its primary current passes in succession over all the values of the corresponding part of the circle diagram. The inertia of the rotor takes the place of an external mechanical load. Thus the performance characteristics of the motor could be obtained by a direct test if all the indicating instruments could be read simultaneously and at brief intervals while the motor is coming up to speed or pulling out of step. This probably can be done photographically. Knowing the losses in the motor, the output could be computed for each input. A development of experimental technique for such a test is desired. If such a test is practically feasible, it would mean that data for a complete set of performance curves of an induction motor could be obtained in about a minute, and without any brake, so that very large motors could be tested in this manner.

CONTACTOR FOR SMALL CURRENTS.

Lines of drawing ink on paper are sufficiently conducting to be used in the oscillographic recording of motions. The ease of preparation and small inertia of such contactor are often advantageous. The small contact pressures required and the slight projection of the conductor above the insulator permit the recording of rapid and weak motions. Added graphite will improve the conductivity of the ink, which should then be compacted on drying. Particular lines can be emphasized on the oscillogram by increase of width of the ink line. When very narrow lines are essential for definition, a direct-current amplifier may be interposed. By arranging for the brush to pass along the lines it may prove possible to obtain space-time curves directly.—*F. J. Schlink, East Orange, N. J.*

AUTO-TRANSFORMERS AND INDUCTION REGULATORS, VOLTAGE DROP IN.

In technical literature the methods for calculating the voltage drop in ordinary transformers are numerous, but those for the same calculation in the case of auto-transformers and induction regulators are almost totally lacking.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Less Danger of Coal Strike on April 1 Seen

LESS danger of a general coal miners' strike on April 1 is seen as a result of the action of the special wage committee in recommending to the convention this week of the United Mine Workers of America that no increase in wages be asked, but that the miners should insist that present schedules in the bituminous fields be maintained. Previously the miners had insisted on an advance in the scale when the present contract runs out.

There was an expression of opinion at the convention that the government would intervene should a general strike appear imminent. This idea gained strength when it was learned that Senator Kenyon of Iowa had introduced a bill on Tuesday to provide for the settlement of disputes between coal miners and operators and to establish a board of adjustment. While the bill is essentially the outgrowth of the Senate investigation into the West Virginia disturbances, still, coming as it does at this time, it is unusually significant.

The board of adjustment proposed in the bill would be composed of nine men appointed by the President and representing labor, the operators and the public equally. Decisions, which must be given within sixty days from the time the board assumes jurisdiction, are to depend upon public sentiment for enforcement.

Patent Office Bill Now Awaits Signature of President

THE Patent Office relief bill passed the Senate Feb. 14 without the necessity of a roll call. The bill already had passed the House, and it now goes to the President for signature. The measure provides substantial increases in the salaries for the technical specialists at the Patent Office and also enlarges the personnel of that bureau.

Advisory Board of Superpower Survey Soon to Meet Again

AMPLE time having been given to ascertain the response of the electrical industry to the report on the Atlantic Coast Superpower Survey, the members of the advisory board are to be called together in the near future, the exact date being still unfixed, for further discussion of the project.

Dr. George Otis Smith, the director of the United States Geological Survey, under whose direction the superpower report was prepared, believes that the showing of economies presented has stimulated interconnection between existing systems throughout the country. The nation-wide interest that has been taken in the report is indicated by the fact that the entire edition of 10,000 copies has been exhausted. In addition literally thousands of inquiries have been received in regard to various phases of the problems involved. Other evidences of the interest aroused, Dr. Smith points out, are had in the space given to this project in the technical press and the large amount of discussion which it has incited in technical societies.

Secretary of Commerce Hoover asserts that the superpower report has stimulated the desire for similar studies in the Pittsburgh-Chicago area and in other sections.

Alabama Power Makes Offer for Muscle Shoals

THE Alabama Power Company submitted to the Secretary of War on Wednesday an offer to take over the Muscle Shoals project. This is the fourth definite offer which the government has received.

The Alabama Power Company, according to a statement by Thomas W. Martin, president of the company, has been identified with the Muscle Shoals development for many years. Long beyond the war it owned the site of the Wilson Dam and was actually proceeding with plans for its development when the government desired it for war purposes. The power company, although it had already spent thereon $500,000, transferred the site to the government for one dollar and title. The company still owns dam site No. 3. The company turned over to the government foundations and under-water structures on which the government could build a 30,000-kw. extension to the company's Warrior River steam plant, and also a 90-mile right-of-way for building a transmission line to Muscle Shoals. An agreement was signed in November, 1918, binding the company to purchase this property from the government.

The formal offer of the power company is contained in the following paragraphs:

> 1. To take out a license under the federal water-power act under which we will complete the construction of the dam, locks and power house at Muscle Shoals, known as Wilson Dam, or Dam No. 1, at our own expense, with initial installation of approximately 240,000 hp., subsequent installation to be made in accordance with the federal water-power act as may be necessary to meet the market demands.
>
> 2. To furnish free to the government, or any one it may designate, from the hydro-electric power plant, 100,000 hp. as required for the production of fertilizers and munitions of war and for research in connection therewith; and if, owing to changes in the act, this use of such 100,000 hp. is discontinued by the government, the Alabama Power Company to purchase and pay for same according to a schedule to be set forth in the license—this power to be the second 100,000 hp. at any time available from the normal flow of the river.
>
> 3. To purchase the government's interest in the Warrior extension of the steam plant of the Alabama Power Company, and facilities, the Warrior and Sheffield substations, the transmission line from Warrior to Sheffield, and the steam plant at Nitrate Plant No. 2, together with the necessary rights-of-way, lands and housing facilities, and to pay therefor in five equal installments the sum of $5,000,000,

less an amount to be agreed on to cover the cost of locks and navigation structures at Wilson Dam; the first payment to be made when license is granted, the remaining payments to be made in four equal annual installments with interest at 5 per cent, with the right to anticipate any part or all of same.

4. To operate and maintain the power plant, dam and gates, the government to operate and maintain the locks, for which the power company will supply the necessary power without expense to the government.

5. The government to transfer to the licensee the Wilson Dam property represented by its investment and commitments to date, free of liabilities and unencumbered, including the construction plant, the locks and navigation structures to be conveyed to the government in fee on completion of construction.

6. Whenever the safety of the United States demands, the United States shall have the right, as more fully provided in the federal water-power act, to take over and operate the project covered by the license for the purpose of manufacturing nitrates, explosives or munitions of war, or for any other purpose involving the safety of the United States for such length of time as may appear to the President necessary for such purposes.

7. The project covered by the license to be subject to recapture by the government at the end of fifty years under the terms of the federal water-power act.

8. The licensee will agree to begin the construction promptly upon the enactment of the necessary legislation and granting of license and to complete the same within a reasonable time thereafter.

To facilitate the carrying out of this plan, we may find it necessary to organize a new company for the purpose, in which case, however, the obligations of this offer shall be binding upon this company in all respects as if it were the licensee.

General Beach Comes Out for Long Term in Muscle Shoals Lease

ONE of the greatest difficulties in handling the Muscle Shoals proposition, Gen. Lansing H. Beach, Chief of Engineers of the army, told the military affairs committee of the House this week, was the fact that no definite assurance could be given prospective bidders. He said that Mr. Ford was the only one who would make a definite response under those conditions.

General Beach pointed out that the Board of Engineers for Rivers and Harbors had recommended the acceptance in 1913 of an offer from the Alabama Power Company in which the government was to do the building and lease the power plant to it at a rate which would amortize the investment and pay a reasonable return to the United States for the use of the money. In that case a lease of 100 years was recommended.

With regard to the fifty-year limit on water-power leases, General Beach said it was not always advisable to apply a general rule. In the case of Muscle Shoals there are arguments for making an exception. The territory tributary to Muscle Shoals, he pointed out, is not yet a thickly settled portion of the country. Manufacturing is not highly developed and the length of time that would be required to develop a market for the power must receive careful consideration.

"I have very serious doubts," said General Beach, "as to our ability to dispose of that power immediately, if we complete the dam ourselves. I have no doubt as to our ability to develop a market for the power in the course of time, but if Mr. Ford's offer is accepted, we shall have a market immediately."

General Beach was asked as to the letter written him by officers of the Georgia Railway & Power Company, the Columbus Power Company, the Central Georgia Power Company and the Tennessee Power Company. He said that the letter was presented in person by these officers. He told the committee that he had stated to the delegation at the time that the letter "struck me as exactly the kind of letter a man would write me who wanted to buy a horse I had for sale. They advised me," continued General Beach, "that I was wasting my young life in trying to secure propositions." The entire letter will be a part of the permanent record of the hearing.

A. I. E. E. Midwinter Convention Held This Week in New York

THE relative values of different methods of suppressing arcing grounds, the economic value of overhead grounded wires and methods of protecting windings against transient voltages were three of the most interesting subjects discussed before the midwinter convention of the American Institute of Electrical Engineers in New York this week. Closely related to this group of papers in a way were the discussions on lightning-arrester practice and the announcement of a new method of studying corona formation by means of amplifiers and the loud-speaking telephone. Data of interest to distribution engineers were contained in a paper on the effect of the thermal conductivity of soil on the heat-radiating capacity of cable.

Except for some general engineering discussions on dielectric strength of oils, skin effect and proximity effect of tubular conductors, solution of alternating-current problems by superimposed imaginary quantities and condenser discharge in general gas circuits, the remaining papers fall into two groups—one relating to rotating machines and the other to communication engineering. The latter group was devoted to discussions regarding the Key West-Havana submarine cable, submarine cable telegraphy and the application of printing telegraph systems to light traffic business. The group on rotating apparatus dealt with the flashing of rotary converters, heating of railway motors, heat losses in armature conductors, predetermining induction-motor characteristics and polyphase commutator machines.

This convention was the first to be held under the new ruling of the board of directors which prescribes that only four general technical meetings of the Institute be held each year. Several hundred persons attended the opening session on telephone and telegraph subjects, at which President William McClellan made a short address. Owing to European commercial competition, he declared, it is necessary for this country to do everything within its power to strengthen its transportation facilities and make industrial processes economically competitive with foreign production. In the solution of this problem the engineer can perform a national service if he will grasp the situation in its broadest aspect.

Thursday night was set aside chiefly for the presentation of the Edison medal to Cummings C. Chesney, manager of the Pittsfield works of the General Electric Company. The annual dinner-dance afforded the usual opportunity for a social gathering.

Features of the papers and discussions presented at this convention will be published in the next issue of the ELECTRICAL WORLD.

Secretary Hoover Calls Conference to Aid Control of Radio Telephony

DEVELOPMENTS in aërial communications that will constitute a new epoch in the dissemination of information are, in the belief of the Secretary of Commerce, soon to be made. Mr. Hoover made the prophecy in connection with the announcement that a radio-telephone conference would be held under the auspices of his department on Feb. 27. Among those who have been invited to attend the conference are Dr. Alfred N. Goldsmith, secretary Institute of Radio Engineers; Prof. C. M. Jansky, Jr., University of Minnesota; Hiram P. Maxim, American Relay League; Prof. L. A. Hazeltine, Stevens Institute; Senator Frank B. Kellogg of Minnesota, Representative Wallace H. White of Maine and R. B. Howell of Omaha, Neb. In addition there will be representatives of the Department of Commerce, War Department, Navy Department, Post Office Department and Department of Agriculture. Dr. S. W. Stratton, the director of the Bureau of Standards, will preside.

It is imperative, Secretary Hoover said, to establish some form of radio control. This applies particularly to the radio telephone. He said the necessities of the situation are such as to require "ethereal cops." Owing to the use of the telephones, he went on, there is great interference with communication with ships at sea and other essential uses of radio, and some plan must be worked out to relieve the confusion that now exists.

Appointments for N. E. L. A. Convention Committees Announced

ANNOUNCEMENT was made this week by the National Electric Light Association of the appointment of chairmen of committees on arrangements for the annual convention, to be held this year at Atlantic City, May 15-20. There will be no general convention committee this year. Clarence Law, New York Edison Company, has been appointed chairman of the transportation committee; Glenn Trumbull, Henry L. Doherty & Company, chairman entertainment committee, and Walter Neumuller, New York Edison Company, chairman of the hotel committee. Hotel reservations, it is announced, will this year be made directly with the hotel.

Candidates for Presidency of A. I. E. E.

F. B. JEWETT

FARLEY OSGOOD

FRANK B. JEWETT is vice-president and chief engineer of the Western Electric Company, New York. He entered the telephone field in 1904 as transmission and protection engineer for the American Telephone & Telegraph Company. In 1912 he became assistant chief engineer of the Western Electric Company, becoming chief engineer in 1916. He was elected vice-president and director last year. Mr. Jewett was graduated from Throop College in 1898. Four years later he received his Ph.D. from Chicago University. During his last two years at Chicago he was research assistant to Prof. A. A. Michelson. The next two years were spent as graduate student and instructor in physics and electrical engineering at the Massachusetts Institute of Technology. While he was transmission engineer for the telephone company the loading of eight-gage circuits was perfected, phantom cables and loading for open wires and cables were developed, and the New York-to-Denver circuit and cable and also the Boston-Washington underground cable were engineered. The realization of wireless telephony was later accomplished under his direction. He served as lieutenant-colonel of the Signal Corps during the war and received the distinguished service medal. He was a member of the Navy Department's special board on anti-submarine devices and also of the State Department's special committee on cables. Dr. Jewett has been very active in association work. He is a member of a large number of organizations. In the A. I. E. E. he has served on committees and was manager in 1915-18 and vice-president in 1918-19.

FARLEY OSGOOD is vice-president and general manager of the Public Service Electric Company, Newark, N.J. Directly after completing his studies at the Massachusetts Institute of Technology in 1897 he entered the telephone field as cadet engineer with the American Telephone & Telegraph Company. In the five years he was in this field he advanced rapidly to the extent of becoming a territorial manager in New Jersey. In 1903 he became chief engineer of the New Milford (Conn.) Power Company. Four years later he became general superintendent of distribution of the Public Service Electric Company. He gradually took over the production department and then the engineering department, and in 1917 became vice-president and general manager. Mr. Osgood has always been active in association work. Besides having been vice-president of the A. I. E. E. in 1914-16 and manager in 1911-14, he has served on the following important committees: Standards, Edison medal, overhead and underground line construction, executive, finance, joint power-factor, and safety codes (chairman). As representative of the Institute on the electrical committee of the National Fire Protection Association, Mr. Osgood had much to do with the formulation of the National Electrical Code. He was chairman of the overhead-line construction committee of the N. E. L. A. when its first national specifications were formulated. He also took an active part in the deliberations which resulted in a compulsory ruling for grounding of secondaries. He has also served on numerous other N. E. L. A. technical committees.

Nomination ballots must reach secretary A. I. E. E., 33 West Thirty-ninth Street, New York, before March 1

Reduced Insurance Rates on Power Houses Soon to Be Effective

NECESSARY delay on the part of the fire insurance companies in checking their schedules preliminary to putting into force their promised substantial revision of the rates on electric power houses and substations, which will, it is estimated, bring about a saving to electric light and power companies of $400,000 a year, has led member companies of the N. E. L. A., through the insurance committee of which association the reduction was obtained, to write to the association headquarters stating that their insurance agents have apparently not been apprised of the plans for the reduction. In order to set executives' minds at rest on the subject the following statement has been issued to them by the N. E. L. A. insurance committee:

> The fire insurance companies passed a resolution that rates on power houses and substations should be reduced downward approximately 25 per cent. A committee of the insurance companies is preparing such a schedule. It is possible this will be ready for adoption in your state through the state inspection bureau within the next month or two. If you will kindly exercise patience for a while, there is no doubt that your plant will be rerated and, it is hoped, found in a condition that will cause a material reduction in your insurance cost.

Engineering Organization of McClellan & Junkersfeld Incorporated

ANNOUNCEMENT is made this week of the incorporation of McClellan & Junkersfeld by William McClellan, Peter Junkersfeld and Horace T. Campion to engage in engineering and construction work. The work of the new organization will be on power plants, transmission systems, water powers, electrification of railroads and general industrial and utility engineering and construction. Offices are temporarily at 141 Broadway, New York City.

Mr. McClellan is now president of the American Institute of Electrical Engineers. His early experience was as engineer in charge of construction with the Philadelphia Rapid Transit Company. He was for many years a managing engineer with Westinghouse, Church, Kerr & Company, participating in the Pennsylvania Terminal engineering and construction at New York and electrifying the Rochester Division of the Erie Railroad. For several years he was electrical engineer and chief of division of light, heat and power of the Second District Public Service Commission of New York. He has been associated with the Cleveland Electric Illuminating Company for about eight years and was for two years one of its vice-presidents. For a time he was dean of the Wharton School of Finance and Commerce of the University of Pennsylvania.

Mr. Junkersfeld from 1895 to 1919 was associated with the Chicago Edison Company and its successor, the Commonwealth Edison Company. When he resigned he was assistant to the vice-president. During this time he was intimately identified with the design and construction of many large stations, aggregating 600,000 kw., together with the transmission lines, substations, distribution system and other physical properties. During the war he was promoted from major to colonel in the construction division of the army, engaged in constructing cantonments, camps, hospitals, port terminals, warehouses, munition plants and other war buildings. Soon after the close of the war he became engineering manager for Stone & Webster, in charge of the engineering department, and an executive of the division of construction and engineering.

Mr. Campion's early business life was spent in engineering and construction work for the Philadelphia Rapid Transit Company, where he was assistant chief engineer in charge of the design and construction of all carhouses, power houses, shops, parks and other physical property. In 1903 he entered the general construction field.

Boston Edison Establishes Pre-war Rate

IMPROVING business conditions warrant the reduction of the maximum rate of the Edison Electric Illuminating Company of Boston to 10 cents per kilowatt-hour, effective March 1, declared President C. L. Edgar last week in a letter to Chairman Attwill of the Massachusetts Department of Public Utilities. In announcing the reduction, Mr. Edgar said that 135,000 customers out of the 150,000 on the company's books will benefit about 9 per cent. These customers are served on the company's "schedule A," which was increased from 10 cents per kilowatt-hour on Oct. 1, 1918, by the application of the coal clause charge, and on Nov. 1, 1918, by the application of a 10 per cent increase the rate became 11 cents plus coal clause. There it remained until June 30, 1920, when the 10 per cent was reduced to 5 per cent, making the rate since 10½ cents plus coal clause. The 5 per cent surcharge and the coal clause will now be dropped from this schedule.

If business continues to improve, said Mr. Edgar, the company expects to make a further reduction to 9½ cents on Sept. 1 next, and by further cuts of ½ cent every six months to reach a maximum rate of 8 cents on March 1, 1924. In this connection Mr. Edgar said: "During the last two or three months for the first time since the armistice business conditions have seemed to be improving along stable and permanent lines, and the company now feels justified in making a reduction in its retail lighting rate known as 'schedule A.' Although the corporation counsel for the city of Boston has stated that in his opinion the company ought not to change its rate during the pendency of a rate case, and although there might be a decided advantage to the company in using the pending rate case as an excuse for not reducing rates at the present time, still it must be borne in mind that the company has increased rates when it found it necessary to do so, although a rate case was pending, so that consistency and fairness at least should require it to make reductions when conditions permit. The company believes that business conditions will continue to improve."

No Chamber of Commerce Referendum on Metric System at This Time

THE National Council of the Chamber of Commerce of the United States at its meeting last week suggested to the board of directors of the chamber that because existing business conditions are not such as to insure a sympathetic consideration of the subject the report of the special committee on the metric system of weights and measures should not be immediately submitted for a referendum vote but should have consideration at a more opportune time. The special committee had been at work since April of last year. Its report contained a clear statement of both sides of the question.

Informal Ruling on What Trade Associations May Do Legally

EVER since the "hardwood" decision a few months ago there has been a demand for a statement from Washington defining just what co-operative activities a trade association can engage in legally. Consequently Secretary of Commerce Hoover wrote to Attorney-General Daugherty for an informal opinion on eleven separate forms of trade association activity, asking if such associations may lawfully engage in any or all of them, "provided the organization and the activity engaged in are not for the purpose of hiding or concealing some agreement, contract, etc., to actually restrain trade or otherwise violate the anti-trust laws." The eleven questions and the Attorney-General's reply were released this week. The questions are as follows:

1. May a trade association provide for its members a standard or uniform system of cost accounting and recommend its use, provided that the costs so arrived at by the uniform method are not furnished by the members to each other or by the members to the association and by the latter to the individual members?

2. May a trade association advocate and provide for uniformity in the use of trade phrases and trade names by its respective members for the purpose of ending confusion in trade expression and for harmony of construction as to the meaning of trade phrases, names and terms?

3. May a trade association, in co-operation with its members, advocate and provide for the standardization of quality and grades of product of such members, to the end that the buying public may know what it is to receive when a particular grade or quality is specified; and may such association, after standardizing quality and grade, provide standard form of contract for the purpose of designating correctly the standards of quality and grades of product; and may it standardize technical and scientific terms, its processes in production, and its machinery; and may the association co-operate with its members in determining means for the elimination of wasteful processes in production and distribution and for the raising of ethical standards in the trade for the prevention of dishonest practices?

CREDIT INFORMATION

4. May a trade association collect credit information as to the financial responsibility, business reputation and standing of those using the products of the industry; and may the association furnish such information to individual members upon request therefor, provided such information is not used by the association or the members for the purpose of unlawfully establishing so-called "blacklists"?

5. May a trade association arrange for the handling of the insurance of its members, including fire, industrial, indemnity or group insurance? In other words, can the members of an industry, through the agency of a trade association, arrange for or place all of the insurance of the members?

6. May a trade association, in co-operation with its members, engage in co-operative advertising for the promotion of trade of the members of that association engaged in the particular industry; and may the association engage in such form of promotion by furnishing trade labels, designs and trademarks for the use of its individual members?

7. May a trade association, for and in behalf of its members, engage in the promotion of welfare work in the plants or organization of its members, which welfare work includes sick benefits and unemployment insurance for employees, uniform arrangments for apprenticeship in trade education, the prevention of accidents and the establishment of an employment department or bureau for co-operation with employees?

8. May a trade association, in co-operation with its members and acting for and in behalf of its members, handle all legislative questions that may affect the particular industry regarding factories, trades, tariffs, taxes, transportation, employers' liability and workmen's compensation, as well as handling rate litigation and railroad transportation questions?

9. May a trade association, in co-operation with its members and acting for and in their behalf, undertake the promotion of closer relations between the particular industry and the federal and the state departments of government which may have administration of laws affecting the particular industry in any form?

TRADE STATISTICS

10 (A). May a trade association collect statistics from each member showing his volume of production, his capacity to produce, the wages paid, the consumption of his product in domestic or foreign trade and his distribution thereof, specifying the volume of distribution by districts, together with his stock, wholesale or retail?

10 (B). And may such trade association, on receipt of the individual reports of each member, compile the information in each report into a consolidated statement which shows the total volume of production of the membership, its capacity to produce by districts of production, which, in some instances, include a state or less area, the wages by districts of production, the consumption in foreign or domestic trade by districts, the volume of distribution by districts, and the stocks on hand, wholesale and retail, by districts?

10 (C). And if, after compiling the information as aforesaid, the information received from the members as well as the combined information is not given by the association to any other person, may it then file the combined statement with the Secretary of Commerce for distribution by him to the members of the association through the public press or otherwise, and to the public generally, and to all persons who may be in any way interested in the product of the industry, it being understood that the individual reports for the members should cover either weekly, monthly, quarterly or longer periods, as may be deemed desirable by the members, and, when a period is adopted, the report for each member shall cover that period and the combined report shall be for that period?

11 (A). May a trade association, at the time it collects the production and distribution statistics above outlined, at the same time have its members report the prices they have received for the products they have sold during the period taken, specifying the volume of each grade, brand, size, style or quality, as the case may be, and the price received for the volume so sold in each of the respective districts where the product is sold?

11 (B). And may the association, without making known to any person the individual price reports of any member, consolidate all of the reports into one and show the average price received for the total volume of each grade, brand, size, style or quality, as the case may be, distributed in each district covered by the distribution statistics for the period covered by each individual report?

11 (C). And may the association, after making such compilation, send the compiled report as to average price, as aforesaid, to the Secretary of Commerce, to be by him distributed to the public and to any or all persons who may be interested in the particular industry making the reports?

DAUGHERTY'S REPLY

In his reply to these questions, the Attorney-General said:

With reference to the first paragraph, there is no apparent objection to a standard system of cost accounting, but I think associations should be warned to guard against uniform cost as to any item of expense. For illustration, a strong effort has been made by some lumber associations to take as a basis for estimating costs of production a uniform charge for stumpage. Of course the cost of the timber in the tree to the different manufacturers who own their timber in the woods greatly varies, and as to each it should be charged at its actual cost. It is as clearly a violation of the law to agree upon the cost of an item that constitutes a substantial part of the total cost price, when its cost actually varies, as to agree upon the sale price, because the sale price is substantially affected by such agreement. It has been ascertained that the members of one association go so far as to fix a uniform cost price, leaving to each member to determine what per cent profit he will add, thus eliminating entirely competition in so far as affected by the cost of production.

Furthermore, I have serious doubts about the advisability of the latter part of the sixth paragraph. I can see no objection to co-operative advertising designed to extend the markets of the particular article produced or handled by the members of an association, but when the several producers or dealers use uniform trade labels, designs and trademarks it seems to me the inevitable result would be a uniformity of price. Where two competing articles are advertised in precisely the same way and bear exactly the same label or trademark, it certainly would be difficult for one to be sold at a higher price than the other, although its quality may be superior. In a way this is illustrated in the cement industry. There a standard of quality has been adopted. That is, it is necessary for all cement to comply with a certain standard, but in practice no manufacturer undertakes to make, or at least no one advertises that he does make, a grade of cement superior to that standard. The result is that there is no competition in the sale of cement so far as quality is concerned. It seems to me therefore that it would be well to eliminate the latter clause in paragraph six, to wit, "and may the association engage in such form of promotion by furnishing trade labels, designs and trademarks for the use of its individual members?"

I can now see nothing illegal in the exercise of the other activities mentioned, provided always that whatever is done is not used as a scheme or device to curtail production or enhance prices and does not have the effect of suppressing competition. It is impossible to determine in advance just what the effect of a plan when put into actual operation may be. This is especially true with reference to trade associations, whose members are vitally interested in advancing or, as they term it, stabilizing prices, and who through the medium of the associations are brought into personal contact with each other. Therefore the expression of the view that the things enumerated by you, with the exceptions stated, may be done lawfully is only tentative; and if in the actual practice of any of them it shall develop that competition is suppressed or prices are materially enhanced, this department must treat such a practice as it treats any other one which is violative of the anti-trust act.

California New Electrical Utilization Safety Orders Near Completion

The revision of the California Electrical Utilization Safety Orders, promulgated by the California Industrial Accident Commission and applicable to all places of employment, is nearing completion and should be ready for final action by the commission in a few weeks.

For many months a general committee representative of all branches of the industry has met with the commission's engineers and made up a draft which will be printed soon and have wide distribution with the request that any criticisms or suggested changes be filed in writing. These recommendations will then go to a revision committee for consideration. Following this the orders will again be printed, discussed at a formal public hearing and then issued as law.

In a statement to a representative of the Electrical World, G. E. Kimball, electrical engineer for the accident commission, said: "It has been necessary to draft several new sections on subjects that have not previously been covered, including requirements for the prevention of fires from electrical causes. The orders have been drafted in plain every-day language, and it has been the aim of the committee to arrange the subjects so that it will be possible easily to locate all orders relative to any particular class of installation."

California Governor Urges Against Increased Utility Rates

Governor Stephens of California has written a letter to the State Railroad Commission urging a re-examination of the decision rendered recently with respect to some rates in southern California. The people expect lower rates and better service, the Governor says, rather than increased rates at this time. He adds that while he has not investigated the evidence, his request is made upon what he terms public sentiment.

"It is not just," the Governor asserts, "to burden the lucrative lines with high rates in order to make a fair return upon lines barely paying operating costs. I am deeply concerned over the future of regulation of public utilities in this state, and I feel that you gentlemen upon whose course so largely depends the future of regulation should examine and re-examine and then examine again the allegations, the facts and your decisions, to be sure that you are right and to satisfy the public, and then, being absolutely certain you are right, see to it that the people understand thoroughly and clearly the grounds for your action. The success of our form of government depends upon the public understanding of and public confidence in the acts of public service."

Thus far no official action has been taken by the commission upon the letter, and the local sentiment is that none will be taken.

Telephone Company to Lease Radio Broadcasting Service

The American Telephone & Telegraph Company has announced that within two months it will open a wireless telephone broadcasting station in New York and will rent the service of this station in much the same way that it now leases long-distance telephone wires.

"This wireless broadcasting station," said the official announcement, "will be unique in many respects. The distributing station is to be equipped with the latest developments of the Bell system, including the use of electrical filters and new methods whereby, as the business grows, several wave lengths can be sent out simultaneously from the same point, so that the receiving station may listen at will to any one of several services

"The company will provide channels through which any one with whom it makes a contract can send out his own programs just as the company leases its long-distance telephone wire facilities for the use of newspapers, banks and other concerns. There have been many requests for such a service, not only from newspapers and entertainment agencies, but also from department stores and a great variety of business houses.

"This is a new undertaking in the commercial use of radio telephony, and if there appears a real field for such service and it can be furnished sufficiently free from interference in the ether from other radio services, it will be followed, as circumstances warrant, by similar stations erected at important centers throughout the United States by the American Telephone & Telegraph Company. As these additional stations are erected they can be connected by the toll and long-distance wires of the Bell system so that from any central point the same news, music or other program can be sent out simultaneously through all these stations by wire and wireless with the greatest possible economy and without interference."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Utah Commission Adopts Uniform Accounting System.—The Public Utilities Commission of Utah has put into effect in that state the system of accounts for public utilities adopted by the National Association of Railroad and Utilities Commissioners. This means that gas and electric companies, which previously were not required to file annual financial statements with the Utah commission, will now do so.

Boston Engineering Societies Vote to Associate.—A plan for associating the 5,000 members of the leading engineering societies of Boston into a unified organization has been adopted by the Boston Sections of the A. I. E. E. and the A. S. M. E. and the Massachusetts Chapter of the American Society of Heating and Ventilating Engineers. The plan provides for the unification under one paid central secretary of the activities of all participating groups, avoiding conflicting dates in section meetings, making available to members of all groups information on meetings of mutual interest, making more simple the planning between sections for joint meetings, simplifying and systematizing lists of members, records and accounts and facilities for employment clearing service. Use of the fine engineering library and of the quarters of the Boston Society of Civil Engineers in Tremont Temple is contemplated.

Agreement Reached in Contest Between Goshen, Ind., and Hawks Company.—The agreement that was described in this column on Jan. 28 as pending in the twenty-five-year contest between the city of Goshen, Ind., and the Hawks Electric Company has finally been reached and will become effective on the approval of the State Public Service Commission. By its terms the city, instead of paying the Hawks company 2 cents a kilowatt-hour for energy, as ordered by the commission after a ten-year contract providing for a price of 1.45 cents had been set aside, will have the benefit of a sliding scale. At present the city manufactures its electricity for street lighting and buys its commercial energy from the Hawks company. The sliding scale is such that the municipal plant management estimates $3 a day can be saved by buying street-lighting energy also of the Hawks company. For residence lighting the rates now in force, and which will be continued, are the highest in the history of the city. The Board of Works and the Council agreed to a compromise, because they estimated that if the city continued the fight the total expense would be $15,000 or more.

Progress of Little Red River Development.—Construction is rapidly proceeding on Dam No. 1 and the power house of the Arkansas Hydro-Electric Development Company on the Little Red River, 6½ miles above Searcy and Judsonia. This dam will be 80 ft. high and 850 ft. long on the crest, extending into the river in the form of a semicircle. The first unit of the development will contain three 5,000-kw. turbines, and the cost of the unit, according to an official statement as quoted by a correspondent of the *Manufacturers' Record*, will be $2,000,000. The territory that will be served first lies between Little Rock and Memphis and has direct connection with St. Louis, Kansas City, Dallas and New Orleans.

Wireless Telephones for Chicago Police.—Every policeman traveling a beat in Chicago is to be equipped by the end of this year, according to official announcement, with a miniature wireless telephone, a small apparatus to be carried in the pocket, by means of which he can be in communication with headquarters every moment. The instrument has a receiver and when properly "tuned in" with headquarters permits the holder to hear his message as distinctly as from a call box. The receiving antennas will be placed in the lining of the policeman's coat. The signal that headquarters is calling him is given by a buzzing sound from the antennas, and he then places the receiver to his ear and receives the message. Policemen may thus be dispatched to any spot at any time without headquarters being obliged to wait until they "report in" at their patrol boxes, as at present. Later, with more improved instruments, it is hoped that the patrolman will be able to send messages to his superiors as well as to receive them.

University of Illinois' Research Graduate Assistantships.—The director of the engineering experiment station of the University of Illinois, Urbana, again calls attention to the fourteen research graduate assistantships maintained by the university to assist in the conduct of engineering research and strengthen the field of graduate work. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry. An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of master of science will be conferred. Nominations to these positions are made from applications received by the director of the station each year not later than the first day of March.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pacific Coast Electrical Association.—The annual convention of the Pacific Coast Electrical Association, which is affiliated with the N. E. L. A. and was formerly known as its Pacific Coast Section, is scheduled to be held in Los Angeles on May 31, June 1 and 2.

New York Electrical Society.—This society is to publish in its *Transactions* illustrated reports of three lectures already delivered this season—"The Commercial Possibilities of the Submarine," by Simon Lake; "Long-Distance Power Transmission," by Dr. Charles P. Steinmetz, and "The New Art of Electrolytic Waterproofing," by Alfred G. Tate.

American Welding Society. — The American Welding Society has just formed a section in San Francisco and has elected the following officers: Chairman, Prof. J. C. Clark, Stanford University; vice-president, H. L. Wintersgill, Westinghouse Electric & Manufacturing Company; secretary, W. B. Sawyer, Jr., United States Steel Products Company; treasurer, K. C. Brackett, Air Reduction Company. Twenty-six firms and three consulting engineers are represented on the roll.

Associated Technical Societies of Detroit.—A body with this name has just been organized by twelve technical bodies in the Michigan metropolis, including the local sections of the electrical, mechanical, civil, chemical, heating and ventilating, military and architectural national societies and other associations. One joint meeting a month will be held, under the management of one of the constituent societies. Officers for 1922 have been elected as follows: Chairman, F. W. Keating; vice-chairman, A. A. Mayer; secretary-treasurer, Walter R. Meier.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, Feb. 18; Birmingham, Feb. 25; Philadelphia, March 4; Cleveland, March 13; Chicago, March 15.

A. I. E. E. Section Meetings—Cleveland, Feb. 21; Erie, Feb. 21; Atlanta, Feb. 23; New York, Feb. 24; Utah, Feb. 24; Vancouver, March 3

Empire State Gas and Electric Association, Meter Section—New York, Feb. 24.

American Physical Society — New York, Feb. 25.

Prime Movers Committee, N. E. L. A.—Pittsburgh, Feb. 27-28.

Electrical Supply Jobbers Association.—Atlantic Division, New York, Feb. 28.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Issue of Contributory Negligence Wrongly Taken Out of Hands of Jury.—In Davidson vs. Otter Tail Power Company a boy whose father was employed in the company's switch house and lived close to it was injured by coming in contact with electric wires while playing around the premises at a time when the company was enlarging the switch house. The exact way in which the accident happened was not clear. The trial judge directed a verdict for the defendant, but the Supreme Court of Minnesota has ordered a new trial, declaring that the question of the company's responsibility and the contributory negligence of the lad should have been left for the decision of the jury. (185 N. W. 644.)*

Where Burden of Proof Falls.—The case of North Coast Power Company vs. Kuykendall concerned an order entered by the state commission of Washington against an increased schedule for electrical energy in diking districts. The Supreme Court of the state has found against the commission's order, saying that where a tariff had been filed by a public service corporation, and where complaint is made before the effective date of the tariff, the burden of proof is upon the public service corporation to show that the proposed rates are just, fair, reasonable and sufficient, but that where complaint is not made until after the new tariff has become effective the burden of proof is shifted and the complainant is compelled to show that the tariff rates are unreasonable. (201 Pac. 780.)

Increase in Cost Due to War Should Be Considered in Fixing Value.—Reversing the judgment of the lower court in Potomac Electric Power Company vs. Public Utilities Commission, the Court of Appeals of the District of Columbia has found: (1) Although the law places the burden of proof upon the party seeking to set aside a decision of the commission, the court must exercise its own independent judgment as to both law and facts where the decision is challenged on the ground that it is based upon a mistake of law, is wholly unsupported by evidence, or is so clearly contrary to the weight of the evidence as to amount to an arbitrary exercise of power; (2) in fixing the value of property devoted to public use in 1916 the commission should consider and give fair weight to the increase in values since 1914 resulting from the war, and its decision fixing the value on July 1, 1914, and adding thereto the actual cost of improvement subsequently made must be set aside; (3) a public utility is entitled to a fair return upon the reasonable value of the property at the time it is being used for the public. (276 Fed. 327.)

Compliance with Contract Cannot Be Compelled After Company, Acting Within Its Terms, Has Caused Its Abrogation.—In City of Uvalde vs. Uvalde Electric & Ice Company, the Court of Civil Appeals of Texas has held that where a city's contract with an electric company provided that the contract should cease to exist if the company failed to comply with an agreement to furnish electricity to the general public at a specified rate the company could not be required to comply with the contract after it had raised this rate, since the contract ceased by its terms to exist when the rate was changed, its abrogation being the only penalty provided. (235 S. W. 625.)

What Constitutes a Sliding Scale?—The Springfield (Mo.) Court of Appeals, reviewing an order of the Public Service Commission of the state, in Bertha A. Mining Company vs. Empire District Electric Company, has held that rates for electricity varying according to the amount of use per horsepower of connected capacity are not a sliding scale schedule as defined by the statute making exceptions to the power of the commission to change rates, a "sliding scale" within the meaning of the statute being one for the automatic adjustment of rates based upon service rendered and dividends paid stockholders whereby dividends fluctuate with every decrease or increase in rates. (235 S. W. 508.)

New York Public Service Commission Law Interpreted by State's Highest Court.—Two questions of law in the application of the public utility laws of New York State have been determined by the Court of Appeals, the highest state court, in Public Service Commission, Second District, vs. Pavilion Natural Gas Company. These questions were, first, whether the gas company could increase the maximum rates fixed in the franchises and agreements by simply filing a schedule of rates with the commission, the same to take effect thirty days thereafter, and, second, whether it could do so notwithstanding the pendency of the proceeding instituted by it. The Court of Appeals has determined that a gas company may file with the commission a schedule of increased rates and put the same into effect thirty days thereafter, subject to review as to their reasonableness, and the schedule applies not only to franchises and agreements as to rates entered into subsequent to the time when the statute authorizing it took effect, but to franchises and agreements entered into prior to that time. It is further held that the fact that at the time the new schedule was filed there was pending before the commission an application by the company to increase its rates does not affect its right to file the schedule.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Deposits for Extensions Should Be Refunded in All Save Extraordinary Cases.—The Arizona Corporation Commission having been appealed to against the custom of an electric company in requiring a deposit equal to the estimated cost of construction of service lines refused to condemn the practice, but said: "It appears that a number of these deposits have been made and that they are being refunded as credits on the light and power bills of the depositors. Under proper restrictions we do not deem such a practice to be unreasonable or unusual. In two instances, however, deposits have been required under contracts which do not contemplate refunds. Circumstances might justify such a course, but no further deposits may be required under contracts not providing for refund until applicant has defined clearly the circumstances."

Apportioning Rebate to Irrigation Customers.—To the Idaho Public Utilities Commission falls, under an act of the State Legislature passed in 1921, the duty of determining the credits due to the irrigation customers of power companies because of the exemption of such companies from taxes on property used for furnishing power for irrigation. The commission has published an account of the method it pursues as follows: "The law does not state how the amount of power used by each consumer is to be measured, but as the exemption is upon property subject to taxation owned by the electric utility and used for generating and delivering electric power, it has seemed to us that the fairest and most equitable basis for apportionment is that of the maximum horsepower demand, which for this purpose is taken for motors of less than 25 hp. as the name-plate rating, and for motors of 25 hp. and over as the average of the four highest fifteen-minute peaks, no two occurring in the same hour. This is the method used in determining the demand in rendering bills. It is true the consumer does not use at all times as much horsepower as is indicated by his maximum demand, but it is also true that whether he uses it or not, the property of the electric utility must be sufficient in amount and capacity to supply that demand at any time; and as we are not here dealing with a question of rates, but with the matter of apportioning rebated taxes upon property used for a certain purpose, the amount thereof which each consumer either uses or requires held for his use appeals to us as a proper measure for this purpose."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Nathaniel A. Carle, who on Feb. 1 assumed the office of vice-president and general manager of the Public Service Production Company, Newark, N. J., had been for several years prior to that date chief engineer of the Public Service Electric Company. In the latter capacity Mr. Carle reorganized and enlarged the engineering staff and supervised the engineering for one of the largest electric utilities in the United States, attaining noteworthy results along both technical and economic lines. Mr. Carle has also been a leader in the work of the national engineering organizations as the chairman of three committees and a member of nineteen others. He has always taken an active part in the planning and carrying on of organization activities both of a technical and a financial nature, and he is now chairman of the Technical National Section of the N. E. L. A. When chairman of the prime movers committee of the N. E. L. A. Mr. Carle formulated plans for the development of an operating code, the object of which is to recommend to central-station companies of various size the most suitable uniform methods of operation and maintenance to insure continuity of service and economy. The compilation of this code is now under way. A great deal of credit is also due to Mr. Carle for bringing about a closer co-operation between turbine manufacturers and users which will assure greater reliability, better economy and lower cost. Mr. Carle was born in Portland, Ore., in 1875 and was graduated from Leland Stanford University in 1898. Since graduation his activities have extended throughout Alaska, Canada, New England, Colorado, the Northwest and the middle Atlantic seaboard. In addition to the engineering committees previously mentioned, Mr. Carle is active in the A. I. E. E., the A. S. M. E., the A. E. R. A., the American Engineering Standards Committee, the American Metric Association and the Engineering Council.

N. A. CARLE

A. H. Markwart has recently been elected a vice-president of the Pacific Gas & Electric Company of San Francisco, Cal. Mr. Markwart was formerly director of engineering of this company and will continue to have general charge of all the company's engineering work. Mr. Markwart was born in Illinois in 1880 and after graduation from the University of California in 1903 he spent a short time with the Pacific Construction Company as civil engineer. From 1904 to 1906 he was assistant civil engineer for the California Gas & Electric Company (now the Pacific Gas & Electric Company). Following this he was chief engineer and manager of the Syndicate Water Company, Oakland, Cal., and was later vice-president and manager of the Richmond (Cal.) Water Company. From 1907 to 1912 he was a member of the civil engineering firm of Galloway & Markwart, which practiced extensively in connection with hydro-electric plants, engineering and irrigation projects. From 1912 to 1915 Mr. Markwart was chief of construction of the Panama-Pacific International Exposition, after which from 1915 to 1917 he resumed his former connection with the firm of Galloway & Markwart. During the war he entered into shipbuilding work and was general manager of the Clyde company on behalf of the United States. Mr. Markwart was appointed to the position of director of engineering of the Pacific Gas & Electric Company of San Francisco in the latter part of 1920.

A. H. MARKWART

J. Frank Dubois recently resigned as manager of the Lynn (Mass.) Gas & Electric Company to take up the personal management of the farm near Peachan, Vt., where he was born on March 10, 1866, and which belongs to him. In 1879 he moved to Nashua, N. H., where he completed his education in the grammar school. After working at various trades he entered the apprentice class of the Thomson-Houston Company in the spring of 1888. Later in the year he left the shops of that company and went out on the road, doing repair and construction work all over New England. His first construction work of importance was the erection of the power plant at Lebanon, N. H. Later he erected a similar plant at White River Junction, Vt. In 1892 Mr. Dubois became manager of the Lebanon & White River Junction power companies. He became connected with the Lynn Gas & Electric Company in 1893 as a clerk. He continued with this company in a clerical capacity until 1908, when after a short absence he returned as assistant to the superintendent of the electric department. In 1911 he was appointed acting superintendent of the electric department and in 1914 was made full manager of that department, which position he held at the time of his resignation.

J. F. DUBOIS

John J. Treacy of Jersey City has tendered his resignation to Governor Edwards of New Jersey as a member of the State Board of Public Utility Commissioners and as chairman of the board.

C. O. Mailloux, consulting electrical engineer and president of the International Electrotechnical Commission, has been elevated from the rank of chevalier to that of officer in the French Legion of Honor. Mr. Mailloux has but recently returned from France, where he delivered the address of eulogy on Ampère at the Ampère centennial.

Robert M. Gates has resigned his position as engineer with the Lakewood Engineering Company, effective Feb. 1.

L. C. Ferguson has been assigned to the Chicago office of the Gilbert & Barker Manufacturing Company to take charge of sales promotion work in that territory.

C. F. Kettering, president of the Delco Corporation and vice-president of the General Motors Corporation, has been elected a director of the Dayton (Ohio) Fan & Motor Company.

O. I. Eberhard has recently been appointed as a special sales representative of the Roller-Smith Company, 233 Broadway, New York City. He will represent the company in certain sections of Pennsylvania.

Arthur Lockwood, formerly with the Brookfield Glass Company, is now with the Whitall-Tatum Company, manufacturer of glass insulators. He will have his headquarters at 46 Barclay Street, New York City.

A. M. Little, who has recently been made vice-president of the Re Qua Electrical Supply Company, Inc., Rochester, N. Y., has been in the electrical business since 1889 and for a number of years has been an important influence in the jobbing industry. Mr. Little started with the Central Electric Company as an office boy. For eleven years he was president of the Mohawk Electrical Supply Company, Syracuse, N. Y., and for seven years prior to that time he was salesman in the eastern part of the country for Pass & Seymour, Inc. He resigned from his office with the Mohawk company in 1921 and a short while later became connected with the J. F. Buchanan Supply Company, Philadelphia, as manager. For a number of years Mr. Little has been an outstanding figure in the activities of the Electrical Supply Jobbers' Association, serving a term as chairman of the Atlantic Division of the association, and as chairman of the publicity committee he initiated the national trade journal publicity campaign of that organization.

A. M. LITTLE

Obituary

Richard H. Rice, for thirty years a prominent figure in the engineering world, inventor and designer of steam turbines and engines and manager of the Lynn (Mass.) works of the General Electric Company, died suddenly of heart failure while on an outing at Lake George, N. Y., on Feb. 10. Mr. Rice was born in Rockland, Me., Jan. 9, 1863, and was graduated from the Stevens Institute of Technology in 1885. After graduation he was employed for a year as construction engineer with the Pittsburgh, Columbus, Cincinnati & St. Louis Railroad and later by the Pennsylvania Railroad in a similar capacity. In 1886 he joined the forces of the Bath Iron Works, Bath, Me., as draftsman and a year later was chief draftsman in the office of E. D. Leavitt, Jr., consulting engineer for the Calumet & Hecla Mines, Cambridgeport, Mass. In 1894 he was called to be superintendent of the William A. Harris Steam Engine Company of Providence in charge of the design of ship-propulsion machinery. Later he joined the Rice-Sargent Engine Company of Providence as secretary-treasurer of the organization and from there went to the Lynn works of the General Electric Company in charge of the turbine department of the factory, where under his direction the development of the steam turbine was carried on to its present proportions, turbines being one of the principal products now manufactured at Lynn. In 1919 Mr. Rice was appointed manager of the plant, succeeding W. C. Fish. During the three years of Mr. Rice's managerial term he built up a strong reputation for fairness, justness and honesty of purpose coupled with a broad-gage view of industrial problems.

R. H. RICE

As may be inferred from his record, Mr. Rice's life was distinguished by persistent and successful accomplishment in his adopted profession. An inventor of high ability, Mr. Rice was the recipient of some fifty important patents pertaining to steam turbines and engines. Chief among his inventions was the first turbo-blower for blast furnaces to be installed in America, though the Rice & Sargent steam engines designed jointly with John W. Sargent were of equal value. These were recognized as among the best low-speed and medium-speed steam engines in the country and were produced by the Rice & Sargent Engine Company between 1894 and 1903. In his early work at Lynn Mr. Rice designed the smaller ratings of Curtis turbines up to 5,000 hp. He had been prominently identified with progressive industrial movements for the betterment of relations between employer and employees and was a member of the Associated Industries of Massachusetts, president of the National Conference of State Manufacturing Associations and a member of the A. S. M. E. and of other clubs and organizations.

N. A. Wolfe, who had been connected with the General Electric Company since 1910, died in December of spinal meningitis after an illness of a week. He was a graduate of the University of West Virginia and a member of the A. I. E. E.

E. S. Morrell, assistant superintendent in charge of the electrical and mechanical equipment of the general office buildings of the Pennsylvania Railroad, Philadelphia, died on Dec. 24, 1921. He had been with the Pennsylvania Railroad since 1904. He was a member of the A. I. E. E.

Harry Frankel, president of the Frankel Connector Company and the Frankel Display Fixture Company, died Feb. 2 of heart disease at his home in New York. He was the founder of both companies and had been in the business for twenty-four years. He was the inventor of a patented electric testing clip and solderless connector, which was widely used by the Signal Corps of the United States Army during the war.

HARRY FRANKEL

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Electric Refrigerating Machinery Sells Well

SALES of refrigerating machinery in December and January, according to a manufacturer of that sort of equipment, were just about double those of the same months one year ago. This activity, of course, is more or less seasonal as the first months of the year see users reconditioning their plants, putting in new equipment or expanding their facilities. Nevertheless, the fact that orders are double the same period last year is indicative of greater confidence in business and a much easier financial market. The manufacturer interviewed by a representative of ELECTRICAL WORLD stated that his plant was running full time and that orders still were coming in in good volume. Price, it is admitted, may have had a large influence on demand, quotations having been substantially lowered in the first part of December.

The smaller machines for household use, he declared, were not in very heavy demand. This is merely a reflex of the opinion of the public that they are still too high-priced a luxury. Research work is being done by at least one manufacturer to obviate this objection of high initial cost and to improve the machine at the same time.

Demand Only Fair for Industrial Wiring Material

THERE are two angles from which manufacturers of conduit fittings and other wiring supplies must view the next six months, according to a manufacturer in that line who expressed his opinion to the ELECTRICAL WORLD. One is the viewpoint of the manufacturer of material for residences, and he is justified in looking toward spring optimistically. There is no doubt that residence construction will go forward even stronger than in 1921. On the other hand, a different class of material goes into industrial buildings, and the amount of this type of construction is likely to remain low. The informant of the ELECTRICAL WORLD declared that he expected the department which made his industrial outlet boxes and wiring materials to keep just about ahead of expenses, or at least to be very slightly ahead, during the next six months. This view is predicated on the maturity of at least 50 per cent of the industrial construction now on paper.

How to Exploit British Appliance Market

THE British market for electrical household appliances may be exploited, according to a report to the Department of Commerce from Consul Coulter at London, most easily by establishing branches in Great Britain and being prepared to give service and repairs to keep the machines in order. It might be possible also to act in connection with the larger stores to give model exhibits for propaganda purposes. Another method is to establish agents, for in this case those of British nationality would reach the public more quickly and advantageously than Americans. Trade fairs and exhibitions afford an opportunity to give practical demonstrations before architects, builders and consumers. Such an exhibition is to take place at Olympia, London, during March of this year, sponsored by the London *Daily Mail* and known as the "Ideal Home Exhibition."

Kitchen equipment has met with some favor owing to the high price of coal and the desire for greater convenience. The cost is greater than that of gas, however, the monthly electric bill for a small flat for two persons, equipped with light, electric heater and range, running about $12. Electric ranges in the smaller sizes retail there for about $65. Dishwashing machines, on which quotations range from $30 to $65, are too new to have found much favor with the public. Electric flatirons, percolators and toasters have been popular on account of smaller first costs, which average about the same as American prices. Air heaters are being used to some extent, and the models on the market run from $14 to $35, depending on size. A difficulty confronting American manufacturers and emphasized in the report is the great variety of voltages used in different localities.

Collections Show Improvement but Credits Still Are Tight

COLLECTION conditions, according to reports from widely separated sections of the country, are better than was the case thirty days ago, though credit departments have not relaxed their strictness to any degree. In New York collections still stay between forty-five and sixty days, but with a tendency to decrease further. The brightest spot is the gradual but successful whittling down of long-standing accounts.

New England jobbers found collections in January somewhat slower than had been expected after the improvement of December, and at present some of the leading houses are running from seventy to ninety days on accounts. Trade acceptances are being used more widely, and close supervision of outstanding accounts is the general practice. In view of the easier money market, it appears that the slow recovery of business is a primary factor in this situation, combined with taxation and inventory report work which absorbs a good deal of time under present conditions. Nothing very striking in the way of improved business is expected for the next month or two, according to leading credit men in the jobbing field, but there is still no lack of confidence in the underlying soundness of the industry, which, like many others, suffers from disturbed international economic situations.

There has been no marked change noted in the Southeast in the credit and collection end of business for the past thirty days. The slow improvement in business conditions has not been largely reflected in the payment of past-due accounts and probably will not be for some time to come. The number of acceptance transactions is below normal throughout the district, some centers handling practically none at all. Clearance sales have assisted somewhat in the liquidation of old debts, but there are a great many outstanding obligations, particularly in the rural districts that remain to be accounted for. Failures for the year 1921 in the Sixth Federal Reserve district numbered 1,920, as against 597 for 1920, while December exceeded November by 63½ per cent. While it can be said that there is an all-around improvement, at the same time the general slowing down of business and reduction in buying power has had an effect that is far-reaching and which will not have entirely disappeared for several months to come.

Credit conditions in the Middle West have not changed during the last month. Dealers are still holding out to the last minute before paying their bills, and most of the jobbers report that their collections are still on a sixty-day basis. Jobbers, however, expect better credit conditions in the near future since another step toward a final settlement of the building trades controversy has produced a tone of optimism throughout the industry.

Credit conditions in the Southwest are also virtually unchanged, except that the average of the individual obligations is smaller. The average basis of collections is from forty-five to seventy days. Money rates are slightly easier, but bankers continue to scrutinize all loans closely and lend on a most conservative basis.

December, 1921, showed an increasing number of failures in the San Francisco district, but a decrease in the proportionate amount of each. Collections are improving, and no conservative enterprise or sincere firm is refused credit or justifiable assistance in emergencies. Credit men spend more time with the trade and are able by cautioning salesmen to hold their sales to reasonable amounts to assist customers in a constructive way. The smaller amounts now necessary to secure maximum prices are also largely responsible in holding down outstanding investment.

Collections on the north Pacific Coast during the month of January improved very materially, and for the month the days outstanding were forty-three and two-tenths as compared to approximately forty-six for December. Credits in general are still restricted except to reliable concerns in good standing, in which cases credits are considerably freer than they have been. Though it is expected that much liquidation is still to occur before the end of this year, the general feeling is that the liquidation curve has reached the bottom and that losses on stocks will be virtually over by the close of the year.

German Deliveries Now Uncertain

BECAUSE of the depreciation of the mark it seems probable that German manufacturers of electrical machinery and equipment will not be able to deliver on the longer-time contracts made in marks. Information to the foregoing effect has been received by the Department of Commerce. The advices also indicate that many dealers in American electrical equipment are suffering losses due to the fact that their stocks were purchased at higher prices than those now prevailing.

January Construction Second Largest on Record

JANUARY construction was 49 per cent greater in volume than it was in the corresponding month last year, according to figures gathered by the F. W. Dodge Company. The total amount of contracts awarded last month in the twenty-seven Northeastern States of the country was $166,320,000. This represented a decline of 16 per cent from December, 1921, but it was the second largest January total on the records of the company, being exceeded only by January, 1920.

The work actually started in January, as indicated by the award of contracts, held up better than had been expected, and in addition the volume of contemplated new work reported, amounting to $435,859,000, was the largest monthly total of contemplated work reported since April, 1921, registering an increase of 3 per cent over the amount reported in December and 27 per cent over the amount reported iin January, 1921. All this indicates an increased volume of construction in 1922.

Residential building accounted for 45 per cent of the January total, amounting to $75,728,000. Business buildings amounted to $23,694,000, or 14 per cent of the total; industrial buildings, $19,695,000, or 12 per cent; public works and utilities, $18,735,000, or 11 per cent. Industrial building, though still small, showed a gratifying increase over the previous month.

The only district showing an increase over December was the Pittsburgh district, which includes western Pennsylvania, West Virginia, Ohio, Kentucky and Tennessee. The increase amounted to 16 per cent, but, on the other hand, the total was 6 per cent below that for January, 1921. Decreases from December in other districts ranged from 7 per cent to 64 per cent.

Advance Fan Orders Better Last Year's Volume

JOBBERS all over the country are showing much more confidence in the coming fan season than was in evidence last year, and the advance orders indicate that under the conditions that prevailed last summer the manufacturers may expect an even more successful season. Last year at this time manufacturers were more or less disheartened at the slowness of distributers in indicating their needs, but, owing to the heat which prevailed widely, the summer turned out to be one of the most successful ever experienced in the fan trade. In addition to this dilatory attitude on the part of the distributers, there was a feeling among the retailers that fan prices had not been sufficiently liquidated to awaken demand. Both distributers and jobbers started that season with heavy carry-overs.

This year the situation is entirely different. Sales of fans in every section of the country were unusually heavy and jobbers and retailers start the coming season in many cases without more than two or three fans from 1921 stocks. As this is the case, any demand at all will immediately react on the manufacturer. Then another source of trouble was removed last December when the fan list was reduced from 15 per cent to 20 per cent. Since that time prices with a few exceptions have remained stationary, with the prospect that they will continue to do so all season. Caution still prevails to some extent in the face of this when it comes to ordering, but sales so far are estimated at from 20 per cent to 30 per cent ahead of last year.

Just as in previous years it is expected that the 8-in. to 12-in. sizes will prove popular, with the 16-in. size still selling well and the ceiling fan gaining in favor.

Metal Market Situation

FEBRUARY so far has brought no more business for copper-selling agencies than did January. The price, which during the week went down to a nominal 13¼ cents per pound, is again being shaded. The 13¼-cent price prevails mainly among producers, and in the outside market all the copper wanted can be obtained at 13 cents. This is only 1⅜ cents per pound above the low point in 1921, which was reached in August.

It is stated by an authority on the market that he has never seen more unsatisfactory conditions, not even in 1914. It is difficult to gage the market, to tell what to expect and to locate possible sources of consumption. Buyers do not seem at all anxious to take advantage of the decline to stock up. As stated before, it is probable they did most of their stocking for the first two quarters on the rising market before Jan. 1.

The amount of copper in second hands is believed to be small. The main trouble, according to one producer, is that the large agencies have seen fit to follow the market down instead of believing sufficiently in the strength of their position so far as the first half is concerned to wait until the weak metal was absorbed and the market came to them.

NEW YORK METAL MARKET PRICES

	Feb 7, 1922	Feb. 14, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	61 10 0	60 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.37½	13.25 –13.37½
Electrolytic	13.00–13.25	12.87½–13.00
Casting	12.75	12.62½
Wire, base	14.50–14.75	14.50–14.75
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.40	4.40
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.82½– 4.87½	4.85
Tin, straits	31.75	30.37½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	10.75–11.00	10.00–10.50
Brass, heavy	4.75– 5.00	4.75– 5.00
Brass, light	4.25– 4.50	4.25– 4.50
Lead, heavy	3.50– 3.75	3.50– 3.75
Zinc, old scrap	2.00– 2.12½	2.00– 2.12½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WITH the new year advanced more than a month and a half, demand still fails to recover and reports from various sections characterize business as dull, spotty or merely fair. Jobbers as a whole refuse to give in to a spirit of deadly pessimism and predict a revival in two or three months. Chicago notes fair sales of appliances and wiring materials, but mainly because of energetic salesmanship. St. Louis jobbers are looking forward to spring, when much line construction is due, but are experiencing a dull demand and very competitive market now. Unemployment in the Southeast is gradually declining as steel, cotton, textiles and other industries recover; the electrical business still remains somewhat dull, however. All through the West and on the Pacific Coast the same inactivity is noticeable. Several price changes, downward for the most part, are reported from various cities.

NEW YORK

Business in the electrical trade continues at about the same level as last week. No new developments of importance were reported this week, and jobbers generally stated that material is moving steadily, although there is no unusual demand in any line. Stocks of nearly all items are good or at least sufficient to meet the present demand. Wiring supplies show the most activity, and the character of the orders received by jobbers indicates that a large part of this material is being used for residential work and other comparatively small jobs. Few large orders for wiring material have been placed, although inquiries have increased.

Price competition on certain items is very keen, and some quotations are declared to show no profit whatsoever. This condition, however, does not appear to be any more acute than usual in view of the large number of people doing a jobbing business in this territory.

Appliance business is rather quiet, although indications are that vacuum cleaners and washing machines are coming into more active demand. Heating devices, since stocks were replenished after the first of the year, have been dull.

Conduit.—Sales are moderate and orders are usually for small quantities. Prices quoted this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in., $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft.

Rubber-Covered Wire.—No change in conditions in the wire market was noted. No. 14 rubber-covered is quoted at $6.50 per 1,000 ft. in 5,000-ft. lots, although this price might be shaded on a larger quantity.

Flexible Armored Conductor.—The demand for this material seems better than for any other item of wiring supplies. Prices have stiffened slightly since last week. Quotations on No. 14 two-wire, single-strip, ranged from $43 to $45 per 1,000 ft. and on double-strip from $45 to $47 per 1,000 ft. in that quantity. Stocks are good.

Sockets.—Demand is light and some price concessions have been made to obtain business, although many jobbers are holding out for 33 cents on full sockets in standard-package lots. This price has been shaded in some quarters.

Loom.—Little activity is shown in the demand for this material. The 7/32-in. size is quoted at $14.85 per 1,000 ft. and the ¼-in. size at $16.20 per 1,000 ft. These prices are on quantities of 5.000 ft.

Lamp Cord.—No change has been made on prices of this material for some time. Stocks of good size in some jobbers' hands have kept quotations at a rather low figure. No. 18 cotton twisted sells for $12.90 per 1,000 ft., and the parallel at $15.60 per 1,000 ft. in that quantity.

Vacuum Cleaners.—Cleaners have been moving steadily all winter, and with spring in sight this business is picking up.

Washing Machines.—A little more activity is reported, and inquiries for spring delivery are increasing.

CHICAGO

Very little change in the building situation occurred this week. The final adjustment between the militant unions and the citizens' committee to enforce the Landis award is some time off, since the committee feels that to put the unions back in good standing would not be fair to the non-union men now working under this award. Of the 313 building permits issued since the first of the year, with a total valuation of $8,063,700, 73 per cent are scheduled to be done under the Landis award.

The electrical business has been good in spots. Wiring materials have been selling in fair amounts, but most jobbers feel that this holding off of buying is due to the uncertainty arising from the building problems. The only apparatus that is moving fast is radio. All dealers complain about shortage of stocks and report that both complete sets and spare parts are selling very fast.

Wire.—The market for wiring materials this week is spotty, a few jobbers reporting a slow movement while others tell of a healthy demand. This variation may be due possibly to the keen price competition existing among jobbers and also to the uncertainty caused by the unsettled building trades situation. No. 14 rubber-covered wire is still selling for $6.75 to $6.85 per 1,000 ft. in 5,000-ft. lots. Stocks of most dealers are ample. The call for weatherproof and bare wire has not changed much, and it is selling in fair amounts at 16¾ cents per pound in 1,000-lb. lots.

Flexible Armored Conductor.—Sales have been spotty, paralleling the movement of rubber-covered wire. However, a few jobbers reported some good sales on the two-wire, double-strip No. 14 conductor, which sells at $46 to $47 per 1,000 ft. in 5,000-ft lots. The single-strip sells for $45 per 1,000 ft. Stocks are fair to good.

Conduit.—Little change in the demand for this material has been noted. While in a few cases it has been moving slowly, the majority of dealers report a fair, steady movement on the large size conduit. No price changes have been announced, and the ½-in. black pipe still sells for $45 per 1,000 ft. in 5,000-ft. lots.

Heating Appliances.—Interest on the part of the public in obtaining bargains is requiring better sales efforts to win orders. A fair movement of open-air heaters, flatirons and toasters has been reported.

Radio.—This is the one line that is selling so rapidly that dealers cannot fill orders fast enough and still keep their stocks in good condition. There does not seem to be any preference on the part of the public toward buying complete sets since the majority of dealers state that they are selling just as many parts for building sets as they are selling the finished expensive ones.

Washers and Cleaners.—A fair demand is continuing, aided by intense sales efforts. Stocks are improving.

BOSTON

Business holds its own with a slow but unmistakable upward trend in the electrical field. Highly encouraging gains in central-station output compared with last year reflect an increasing demand for both lighting and power service. Small manufacturing plants are picking up more orders and motor sales are less stagnant. Building contracts in New England totaled $16,000,000 in January, or nearly double the figure for a year ago. A substantial increase in residential construction is expected in the spring, and a good deal of new work is going forward this winter, owing to favorable weather. Thirty-two per cent of the

January total covered residences and 20 per cent industrial building. Important new factory contract work will shortly be awarded at Cambridge. Prices underwent various readjustments last week, flexible armored conductor and porcelains weakening. Jobbers' stocks are not short of any important items. About 30,000 textile operatives are on strike in this district against wage reductions recently effective, but in many centers employees are continuing at work under the revised conditions.

Wire.—Steady prices rule with moderate demand. Rubber-covered wire is quoted at $6.75 per 1,000 ft. from jobbers' stock in 5,000-ft. lots. Weatherproof is dull, the outdoor construction season being too far off to affect demand.

Lamps.—Trade is good in the better-known types and jobbers are handling a very fair volume of business. The demand for electric service in homes and business establishments, coupled with vigorous sales efforts to stimulate better lighting, is rewarding dealers and distributers.

Flexible Armored Conductor.—Double-strip has dropped from $45 to $44 per 1,000 ft. in 1,000-ft. lots, with a 5 per cent discount for prompt payment in place of the former 2 per cent discount. Sales are light.

Knobs and Tubes.—Prices softened somewhat last week. The demand is fair and stocks are meeting it comfortably. House-wiring campaigns by central-stations are helping the market. Current prices per 1,000 on typical sizes are as follows in barrel lots: "Nail-it" knobs, $15.50; $\frac{5}{16}$-in. x 3-in. tubes, $4.50; $\frac{5}{16}$-in. x 4 in. tubes, $7; $\frac{5}{16}$-in. x 6-in. tubes, $9; two-wire and three-wire unglazed cleats, $11.

Washers.—Sustained sales effort is yielding at least moderate returns. Stocks are ample for first-class deliveries. New designs are being received with interest and better business is anticipated in the early spring. Very little discussion of prices is being aired at present.

Motors.—Although the motor business cannot be classed as good, it is in a healthier condition than of late. A stream of small orders is being handled from week to week, with enough "proposition work" to keep sales engineers fairly active.

Loom.—A quiet market is noted without much change in prices. Small sales are going through in connection with the activities of contractor-dealers in wiring jobs of moderate size.

Radio Sets.—Active buying of radio apparatus for amateur use is under way. Interest in wireless telephony is increasing by leaps and bounds as a result of broadcasting service from Eastern stations.

ATLANTA

No marked revival in business activity is to be noted during the past week, indications seeming to point to a continuation of the present situation until spring weather is nearer at hand. Engineering and contracting firms, however, reflect a feeling of increased optimism that is, of course, based upon inquiries preliminary to renewed construction and expansion. Non-employment throughout the section is gradually declining, owing to municipal and civic improvements, which are getting under way generally in this section, while iron and steel plants continue to show small increases in the volume of operation, thirteen blast furnaces now being in service as compared with eight six months ago. Textile manufacturing is reported in much better shape than at the same time last year. Of course, this increased employment will be reflected in the volume of retail trade, which will in turn stimulate all lines. Manufacturers have recently closed very satisfactory orders for large generator sets of both the steam and hydro-electric type, together with transformer and oil-switching equipment required to complete the installation.

Air Heaters.—The recent cold snaps have failed to bring out the movement that might have been expected. Present indications are that jobbers will have a fairly heavy carry-over to next season. No price-cutting is yet in evidence.

Safety Switches.—The moderate-priced and more popular sizes of switches continue to show fine sales, the demand being particularly brisk in the sizes of from 30 amp. to 100 amp., two-pole and three-pole. The smaller towns are beginning to take increasing quantities, owing largely to municipal regulations.

Telephone Equipment.—The activity can be reported as only fair, the rural communities not yet having funds in hand to make rural-line extensions. Stocks are good with no change in prices reported.

Portable Drills.—Continued depression in the garage and automobile lines is holding back sales in this specialty, and as a result heavy stocks have accumulated. Prices remain steady.

Panelboards.—Sales of the larger size of panelboards are reported somewhat dull, though increasing popularity is to be noted on the so-called sectional board. The smaller size of boards is moving satisfactorily, shipments being on the thirty-day basis. No recent price change is recorded.

Schedule Material.—Purchases are on the hand-to-mouth basis, contractors placing orders only for immediate requirements.

Lock Nuts and Bushings.—A price reduction of 5 per cent is reported with good sales and plentiful stocks.

Outlet Boxes.—This item has been reduced 10 per cent in price within the past ten days, with prospects, however, of a strengthening in the market and a consequent price advance in the near future. This is the cause of an unstable condition in the market for this article.

Oil-Engine Generating Sets.—Quite a number of satisfactory sales with an increasing volume of inquiries is reported by manufacturers of this apparatus, funds from bond issues in the small towns of South Georgia, Florida and Alabama being available for municipal improvements. Stocks are good.

ST. LOUIS

Building permits issued in the city of St. Louis during January amounted to $1,119,530, as compared with $333,025 in January, 1920. The increase is occasioned by considerably more construction of small dwellings, flats and stores. There was some increase in permits for workshops and manufactories, but the total for last month amounted to only $182,500 for two permits. This lack of industrial construction is holding back development in sales of electrical materials in St. Louis. Although business is admittedly dull, it is steady and gradually improving. Municipalities continue to show interest in power-plant equipment and street-lighting systems. Another industrial concern last week made inquiry for turbine, generator and motor equipment, to be used out of the city. The central-station companies are planning for extension work this spring.

Immediate business is very small, and for that reason prices are extremely competitive, especially on motors, transformers and generating equipment. With the consequent reduced profits, jobbers are endeavoring to increase the turnover rate and are maintaining stocks as low as they consistently can. Notwithstanding these efforts, some stocks of size larger than desired, are found.

Meters.—Sales have decreased from 20 per cent to 40 per cent during the last few months, but indications are that there will be a good spring business. Local stocks are ample for small orders, and prompt factory shipment can be made on larger quantities.

Motors.—Prices are highly competitive. Some improvement is noticed in sales of sizes up to 75 hp. There is very little industrial construction work, but plant changes are made where cash requirements are comparatively small, and most of the motor business comes from this source.

Transformers.—Fairly steady demand continues for small single-phase distribution transformers, but large-capacity power transformers are moving slowly. A few local sales are being made of auto-transformers and two-winding low-voltage units for measuring light and power on single meters.

Wire.—With stocks increasing, prices are becoming more competitive. No. 14 rubber-covered is selling from $6.50 to $6.70 per 1,000 ft. in 10,000-ft. lots. The base on bare and weatherproof is around 16 cents per pound.

Porcelain.—There is a tendency toward lower prices, but quotations are fairly firm, 2½-in. tubes selling for $6.15 per 1,000 in barrel lots and 3-in. tubes for $7.50, with special discounts allowed in some cases for 5-barrel lots. "Nail-it" knobs remain at $19.50 per 1,000 in barrel lots.

Conduit.—Local stocks are ample for the demand, which is principally for the smaller sizes. Prices are tending lower, but the following are representative for bundle-lot orders: ½-in. black, $4.73 per 100 ft.; ½-in. galvanized, $5.32 per 100 ft.; ¾-in. black, $6.20 per 100 ft.; ¾-in. galvanized, $6.86 per 100 ft.

Tape.—The heavy demand of a month or two ago has been satisfied and stocks are now becoming heavy. Friction tape is selling from 35 cents to 65 cents per pound, depending upon quality, with a representative price of about 38 cents per pound. Rubber tape is quoted at about 36 cents per pound.

Outlet Boxes.—Following quotations are made for 3¼-in. round boxes per 100: In lots less than 100, black, $11, galvanized, $12; in lots of 100 or more, black, $8.75, galvanized, $9. The 4-in. boxes are priced as follows: In lots less than 100, black, $12, galvanized, $13; in lots of 100 or more, black, $9, galvanized, $9.90.

DENVER—SALT LAKE CITY

The past week in the Intermountain section has been sluggish. Retail dealers in most lines are trading again in new merchandise, with indications of stabilized prices. Electrical dealers are extremely cautious in placing orders with jobbers. This arises partly from a shortage of working capital and partly from the expectation of declining prices. Banks generally are in a much better shape. The critical period, seems to have passed. Collections are somewhat easier and interest rates are gradually declining. Every one admits that times are still hard, but few admit that there is any real occasion for discouragement. Several large copper plants in Arizona are reported to have resumed production. The general effect of the revival of copper has been good. Several thousand men have found employment and are again in the market for supplies. It has improved the business morale immensely in the immediate territory of the mines. The effect on the copper market, however, has been adverse. New buying in January was on a restricted scale. This was due to the fact that most buyers had filled their requirements during November and December at the prevailing attractive prices. A protracted cold wave still has the Intermountain region in its grip. It has had a rather depressing effect on general business.

Commercial Lighting Fixtures.—There is not much movement in this line. The demand always falls to a low ebb during the inactive period in construction. The price is affected directly by the copper market, and hence just now is quite unstable, with a slight tendency downward.

Appliances.—Little activity is reported. Jobbers are well stocked with small chance to unload.

Lamps.—Lamps are moving satisfactorily, even better than usual for the lamp season. All kinds and sizes are called for.

Conduit.—Prices on conduit are reported a little stronger. Only small orders are coming in.

SEATTLE—PORTLAND

Portland and Seattle business conditions continue about the same as for the previous week. Lumber production for the week ending Feb. 11 was 13 per cent below normal. New business for the week was 13 per cent below production and shipments were 17 per cent below production. Building throughout the Northwest continues active, and with this section on the eve of a record building year an early return to normal for the lumber industry, the primary industry of this section, is looked for.

Electrical manufacturers and jobbers of Portland report that business is holding its own or perhaps improving slightly, and is fully as good as was predicted for this time of the year. There seems to be a marked tendency toward buying in standard-package quantities rather than in broken-package lots, which is quite the opposite from the practice for some time past. Jobbers of Seattle are generally agreed that thus far business has not fully measured up to expectations for the new year. New industrial business is pretty lean, and while a good deal of building is now under way, much of this business finds its way into the hands of dealers who specialize more or less in wiring supplies and sell direct to the consumer. Fixtures, hardware and high-tension insulators have dropped in price in Portland.

Conduit.—This commodity has been moving very well. Price reductions effective about a week ago and amounting to about 5 per cent make quotations as follows: ½-in. black, $6.70; ¾-in., $9.30, and 1-in., $13.45; ½-in. galvanized, $7.25; ¾-in., $10, and 1-in., $14.45, all prices per 100 ft. in 10,000-ft. lots.

Wire.—There has been a slight drop in rubber-covered wire, but this has not as yet affected the No. 14 size. Present quotation on No. 14 rubber-covered wire is $7.50 per 1,000 ft. in 5,000-ft. lots. No. 6 weatherproof sells at the base price of $17.25 per 1,000 lb.

Outlet Boxes.—A very decided drop in prices of outlet boxes has occurred in Portland. The 3¼-in. boxes, formerly selling at about $12 per 100, are now quoted at $8.60 per 100 in lots of 100. The 4-in. boxes formerly quoted at about $15 per 100 are now $10.75 per 100 in lots of 100. A proportional decrease applies to box covers.

Ironers.—Demand is fair, with sales of gas-heated ironers leading in the Puget Sound region and electrically heated ironers in the Portland district. The automatic gas ironer sells for $205 and the electric for $255.

SAN FRANCISCO

Construction work continues busy, being only slightly impeded by a mild winter. A 5 per cent decrease is announced on some sizes of rubber-covered wire larger than No. 14. No. 12 single-braid solid is now selling for approximately $9.75 per 1,000 ft. and No. 10 for $13 per 1,000 ft. in 5,000-ft. quantities, with a 5 per cent higher price for single coils. Other prices remain virtually unchanged. Local stocks are very good. The demand is now quite steady without any wide variation to cause sudden flurries of orders. Three-braid base sizes of weatherproof wire are selling in coil lots for 21 cents per pound with a cent lower price for 500-lb. lots. This is a raise of ½ cent per pound. The demand is good, sizes No. 2, 4 and 6 being reported very low recently.

Boxes and Covers.—This line has recently been subject to considerable fluctuation, the 1,000-piece price now being approximately 55 per cent off standard lists with a 10 per cent increase for packages. This advance of about 10 per cent succeeds a drop of nearly twice as much and has caused many good orders. Nearly all contractors availed themselves of this change to lay in good stocks.

Farm Plants.—It is really the slow season for these plants, as the farmers are making their spring outlays and are far from their crop money. Moreover, farmers are not disposed by temperament to take a chance on purchasing anything without seeing the actual purchase money in sight.

Radiators.—There is an increasing disposition to specify larger radiators for apartment-house wiring, figuring an average basis of 1½ watts per cubic foot.

Sewing Machines.—Several makes sold almost exclusively through electrical dealers are being removed from the market. The remaining manufacturers are finding that so far this line is rather widely at variance with the general run of lines carried by electrical dealers and that their best results are being obtained from firms specializing in electrical household appliances. Prices are rather unsteady, owing to bargain prices on the discontinued machines with recent reductions of 10 to 15 per cent on some of the standard lines.

Fixtures.—Brisk competition is the rule for several reasons. Electrical dealers carry more wiring fixtures than formerly. A larger number of important buildings now specify certain patented fixtures. Many of the new buildings are obviously temporary structures that do not pay the proper attention to this feature.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Second Electric Vehicle Show in April

At a meeting of electric automobile manufacturers and dealers held on Feb. 7 plans for the 1922 electric automobile show were discussed. The invitation of the New York Edison Company to hold the exhibit in its Irving Place showroom was accepted, and April 3-15 was decided upon as the date. A similar show was held a year ago and it is probable that the event will become an annual affair. As with the 1921 show the display will be held in two parts. The first week will be devoted to street truck and passenger cars, while the second week will be given over to manufacturers of industrial trucks.

"Mazda" Dealers Meet

One hundred and fifty dealers in "Mazda" lamps met during the week of Jan. 24 in Philadelphia, Pa., to discuss trade conditions. Optimism prevailed regarding the market. The speakers included H. M. Gansman of the H. C. Roberts Electric Supply Company, S. G. Hibben of the Westinghouse Lamp Company, T. B. Dinkmeister of the Luminous Unit Company and A. A. Grace of the Westinghouse Electric & Manufacturing Company.

Reasonable Optimism at Washing-Machine Meeting

Members of the American Association of Washing Machine Manufacturers at the annual meeting held in Chicago, Jan. 18-19, expressed the opinion that the coming year will show a steadily rising sales curve and that sales for the year will be ahead of those for 1921. With financing on a better basis and the public in a more generous mood, the year, it was believed, will be a satisfactory one. The year 1920 was abnormal, and it is better to make comparisons with 1919; in this connection it was brought out that 1921 was ahead of that year.

Discussion at the meeting was concerned mainly with merchandising problems, and there were brought forward many good ideas on how the manufacturer can aid the dealer in making a success. The report on the educational work showed the demand for a bulletin on good washing-machine methods to be double the original expectations.

J. L. Fellows, Grinnell Washing Machine Company, Grinnell, Iowa, was chosen president for 1922 with other new officers as follows: W. A. Carson, Sunbeam Domestic Appliance Company, Evansville, Ind., first vice-president; S. H. Altorfer, Altorfer Brothers Company, Peoria, Ill., second vice-president; George Thornton, Michigan Washing Machine Company, Muskegon, Mich., third vice-president; W. H. Voss, Voss Brothers Manufacturing Company, Davenport, Iowa, treasurer; Enoch B. Seitz, Chicago, secretary.

Fire Damages Broderick & Bascom Plant

The St. Louis plant of the Broderick & Bascom Rope Company, manufacturer of steel rope and cable, was damaged by fire last week, the loss amounting to about $75,000. The fire was confined, however, to one of the wire-stranding departments, and the output of the plant is reduced by only about 20 per cent. The department will be again operated as soon as the machinery in it can be replaced in operating condition. With its Seattle factory and with the ample stocks it has on hand in St. Louis, no difficulty is anticipated in meeting the requirements of all its customers.

Power Apparatus Sales Show Good Increase

A large increase in the sale of power apparatus thus far in 1922, with January sales of $1,500,000 in turbine-generators and condensers, has been reported by the Westinghouse Electric & Manufacturing Company. Some of the companies purchasing this apparatus were the Pennsylvania Edison Company, Easton, Pa.; the Madison (Wis.) Gas & Electric Company and the North Carolina Light & Power Company. Most of the business was included in ten units. Takata & Company of Japan have ordered another large turbine-generator for one of the new plants. Fifty steam auxiliary units were sold during the month for a wide range of applications, many of the purchasers being industrial power plants.

Lawrence Company Elects Officers

The board of directors and stockholders of the F. D. Lawrence Electric Company, Cincinnati, Ohio, at the annual meeting on Feb. 6 elected the following officers: F. D. Lawrence, president; F. W. Klein, vice-president; A. S. Reichman, treasurer and general manager; Warren P. Sayers, secretary and sales manager; Edwin R. Knauft, assistant secretary and assistant treasurer.

Incorporate to Make Radio Sets

The Morrow Radio Company, Springfield, Ohio, was organized recently by Lorentz A. Morrow and Louis E. Bauer, both of Springfield. Mr. Morrow announced that the company is being organized for the purpose of manufacturing radio apparatus and that production of complete unit receiving sets will be started as soon as the organization is completed. Preparations are now under way for the equipping of a factory which will be situated in Springfield. Associated with the new organization are William Bruce, John Morrow and R. F. McNett, all of Springfield. All of the men connected with the company have been active in amateur radio activities in Springfield for some time. Mr. Bauer has been especially interested in experiments in the use of wireless for police work and it is said that attention will be given by the new concern to the development of compact receiving units and other devices applicable to this line.

Remy Resumes Operations

The Remy Electric Company's plant at Anderson, Ind., resumed operations recently with 970 employees enrolled. The factory was shut down for a week for inventory. Business indications are said to favor a continued run.

Arc-Device Manufacturer Incorporates

The company formerly known as J. H. Wagonhorst & Company, Youngstown, Ohio, manufacturer of electrical arc devices for photographic processes, has incorporated under the name of the Photogenic Machine Company. The new company takes over all the property of the Wagonhorst company and is under the same ownership and management. John P. Young is president and treasurer, E. G. Perkins is general manager, and G. W. Perkins is secretary.

Cleaner Manufacturer Takes New Quarters

Preparations have been completed by the Ramey Manufacturing Company, Columbus, Ohio, to move to a new plant in that city at 8 East Livingston Avenue. The company manufactures electric vacuum cleaners, sawmill blowers and furnaces. The building into which the company is to move was formerly occupied by the Immel Auto Body Company and consists of five stories and basement. The move will afford the company about 22,000 sq.ft. of floor space, or double the space of the plant formerly occupied and the output of furnaces will be considerably increased, necessitating the employment of twice the number of men now at work. The outlook for both cleaners and furnaces during 1922, according to E. J. Ramey, president, is good, and the company is showing its confidence by expanding in this way.

General Electric Goes Ahead with Work at Schenectady

Officials at the Schenectady plant of the General Electric Company are optimistic over the outlook for 1922, stopping of the government work at the plant having resulted in no lay-offs so far. Some of the electrical work on government ships is still proceeding and will probably not be stopped until a definite disarmament program has been announced. Should all naval work at the plant be stopped, it is understood there will be no curtailment of employment as officials there announced last November that a program of development and production for stock had been decided upon. This work has been put under way, necessitating the re-employment of about 200 men.

Foreign Traders to Meet in Philadelphia

The ninth convention of the National Foreign Trade Council is to be held in Philadelphia May 10, 11 and 12, according to the call just sent out by James A. Farrell, chairman of the National Foreign Trade Council and president of the United States Steel Corporation. The convention will discuss the means of promoting the restoration of the power of production and consumption in the important markets of the world and the financing and expanding of the foreign trade of the United States.

Solar Light Establishes Branch Plant

The Solar Light Company, 69 Wooster Street, New York, manufacturer of nigtrogen-filled high-power lamps, has leased the upper portion of the building at 24 Mechanic Street, Newark, N. J., for the establishment of a new branch plant. The property is owned by the Brown-Hunkele Corporation, manufacturer of motors and parts. The lessee will take immediate possession and install equipment to give employment to about 150 persons. Joseph Blum is secretary.

Electric Storage Battery Company Optimistic for Coming Year

The management of the Electric Storage Battery Company, Philadelphia, views business prospects for 1922 with optimism. The company is understood to be operating at about 70 per cent of capacity at the present time, and with the automobile industry showing signs of reviving activity it is believed sales will come back close to normal. The growth of the company's business from 1914 to the present time was phenomenal, according to figures on gross sales for the various years during that period. In 1914 gross sales, less cost of manufacture and purchase and all incidental expenses, amounted to $1,395,793. By 1919 they had increased to $6,000,852, and in 1920 they were $12,134,614.

Several changes have been made in the various offices of the company in New York City. That part of the sales force formerly at the Exide factory branch, West End Avenue and Sixty-fourth Street, has been moved to the New York branch office at 23-31 West Forty-third Street, which hereafter will be the headquarters also of the export sales department. Under the new arrangement, F. L. Kellogg, manager of the North Atlantic district; F. F. Sampson, New York branch manager, and J. F. Kelly, Jr., export sales manager, will be at the West Forty-third Street offices.

St. Louis Electrical Show Postponed

The electrical show which the St. Louis Electrical Board of Trade had planned to hold in March has been postponed until the fall of 1922. Unforeseen difficulties arose, according to the announcement of the organization committee, and when these had finally been disposed of the time had become too short to permit the preparation of an exhibit of the high quality desired. The organization committee has been continued and the show will be given in the fall.

Acme Fixture Moves to Larger Quarters

The Acme Lighting Fixture Company, formerly at 132 West Fourteenth Street, New York, has moved both its factory and showroom to 107-9 West Thirteenth Street, New York, where it will have much larger quarters. The company will occupy the entire building, which is six stories high and 40 ft. x 100 ft. in dimensions. There are about 20,000 sq.ft. of manufacturing space, enabling the company approximately to double its production of both electric and gas-lighting fixtures. The first floor is being fitted out as a showroom and office.

The company is showing its confidence in business by this expansion of facilities, according to H. S. Weill, president. There was enough fall building to keep up demand, he stated, and spring construction should start soon and bring a strong revival of buying.

Geier Company Plans Extensive Advertising for 1922

An optimistic note for 1922 appliance business is sounded in the advertising program of the P. A. Geier Company, Cleveland, manufacturer of electric vacuum cleaners. Double-page spreads, full pages, half and two-thirds pages in national mediums is part of the plan. The Geier company bases its advertising program upon the fact that there are more than 5,000,000 American housewives composing the potential market for vacuum cleaners, but that under present industrial conditions it will take particularly extensive advertising and intensive sales work to make a satisfactory impression on this market.

The International Floor Machine Company announces that it is now established at 220 West Nineteenth Street, New York City, where it has larger quarters.

The Allen-Bradley Company, Milwaukee, announces that it has recently established an office at Baltimore, where it is represented by Harry M. Wood, who is also sales agent for several other electrical manufacturers.

The National Light & Electric Company has been established at 289-291 Market Street, Newark, N. J., to distribute electrical supplies in the state of New Jersey. The company is under the management of A. R. Hamerslag, G. Ollendorf, and H. Hirsh.

The Morganite Brush Company, Inc., New York, has announced that its agency in southern California, formerly held by C. W. Farnham, has been transferred to the Special Service Sales Company, 502 Delta Building, Los Angeles.

The Dayton-Dowd Company, centrifugal pump manufacturer, Quincy, Ill., has opened a district office at 809 Keenan Building, Pittsburgh. The office will be in charge of T. J. Barry, who for several years past has been connected with the home office of the company in engineering and sales work.

The Louis C. Eitzen Organization has been formed, with headquarters at 280 Broadway, New York City, for trade promotion purposes. The company has announced that it is prepared to represent manufacturers in domestic and export sales either in the New York territory or as exclusive agent and to handle advertising programs and sales promotion work.

The Mechanical Appliance Company, motor manufacturer, Milwaukee, has appointed a number of distributers on the Pacific Coast through its sales agents, the Coast Equipment Company. They are the Peerless Electric Motor Company, 50 Second Street, San Francisco; Woodell-Rendler Company, 111 East Third Street, Los Angeles; A. H. Cox & Company, 307 First Avenue, Seattle; E. L. Knight & Company, 409 Washington Street, Portland, Ore.

The Killark Electric Manufacturing Company, 3940-48 Easton Avenue, St. Louis, has made a new departure in condensing twenty-five catalog sheets into a four-sheet bulletin, listing new discounts on all its products.

The Rathbun-Jones Engineering Company, Toledo, Ohio, has appointed the Ingersoll-Rand Company, 11 Broadway, New York, general sales agent for its gas engines, which are designed to drive compressors, pumps and other machinery.

The Westinghouse Electric International Company has removed its Cuban office from the Edificio Banco del Canada to the Edificio Banco Nacional de Cuba at Havana. John J. White is manager in charge of the Cuban office and of the activities of the company in Cuba. The removal gives the company larger quarters and better facilities.

Foreign Trade Notes

EXTENSION TO TELEGRAPH LINE IN ARGENTINA.—By a decree recently signed by the President of Argentina further extension of the national telegraph lines in the northern provinces of Argentina is called for. The new lines will require an investment of 500,000 pesos, according to reports of Trade Commissioner George S. Brady of Buenos Aires.

THE CAXTON TRANSLATIONS INSTITUTE.—47 Victoria Street, London, S. W. 1, England, is publishing a new trade directory of the importers and exporters of the United States, South America and Germany under the title of "Guia Alemana y Americana." It wlil contain 1,500 pages, will embody 45,000 names of firms and will be printed in three languages, English, Spanish and German. A cross index is to be included to give reference to the 500 trade names of goods included in the directory.

GERMAN ENGINEERING EXPERTS REFUSED ADMISSION INTO AUSTRALIA.—Six German engineering experts who were engaged by the Victorian government to supervise the erection of briquette machinery in connection with the Morwell electricity scheme, according to the *Electrician*, have been refused admission into Australia by the Commonwealth government. Permission had been granted to import the briquetting apparatus, at cost of £100,000, from Germany, on the plea that it is not obtainable elsewhere. The action is taken under the amended immigration act of 1920, which classes persons of German parentage and nationality as prohibited immigrants for a period of five years. The act gives the federal government the power to grant exemption, but the government refuses to exercise it, stating that the Victorian government could have obtained experts from North America.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A request has been received from an importer and commission agent in India (No. 744) for quotations on electrical apparatus, brass and copper sheets and rods, brass and copper pipes, etc.

The head of an electrical supply house in South Africa (No. 747) is in the United States and wishes to secure an agency for the sale of electrical equipment for automobiles and electric vehicles.

The purchase and agency are desired by a firm in Spain (No. 753) for the sale of electric batteries, hand and pocket flashlights, novelties, electrical machinery and supplies, appliances, tools and utensils used in workshops for the construction and repair of electrical machinery.

New Apparatus and Publications

PLUGS. — Henry Hyman & Company, Inc., 476 Broadway, New York City, have recently placed on the market a duplex plug and a heater plug, known as the "Best."

FARM-LIGHTING PLANT.—An electric light and power plant for farm uses has been placed on the market by the Perfection Hoist & Engine Company, Two Rivers, Wis.

RANGE. — The Globe Stove & Range Company, Kokomo Ind., has placed on the market an electric range having four surface units of the open type and two complete ovens.

LUBRICATING OIL.—The Henry Wells Oil Company, 11 Haymarket, London, S. W. 1, is distributing a pamphlet entitled "Germ Process Motoils," covering its "Germ Process" lubricating oils.

MOTOR STARTER.—"Starting Small A. C. Motors" is the title of bulletin No. 101, distributed by the Monitor Controller Company, Baltimore, describing the Monitor "Thermaload Starter," for which patents are pending.

WIRE. — The Copper Clad Steel Company, Braddock, P. O. Rankin, Pa., has issued two leaflets, one entitled "Technical Data and Tables on Aristos 'Copperweld' Overhead Ground Wires," and the other "Technical Data and Tables on Aristos 'Copperweld' Messenger and Guy Wires."

AIR GUN.—A brass air gun which is airtight, fitted with the "Jenkins" renewable disks, for use in foundries, machine shops, power plants, etc., has recently been placed on the market by Jenkins Brothers, 80 White Street, New York City.

RHEOSTAT.—The Allen-Bradley Company, Milwaukee, has issued bulletin E-2910, covering its type E-2910 alternating-current or direct-current rheostat designed for general laboratory use.

RHEOSTATIC SWITCH.—The Economee Rheostatic Switch Company, 3,551 North Fifth Street, Philadelphia, is distributing a small booklet describing the "Economee" standard type A lighting series and standard type B motor series rheostatic switches.

New Incorporations

THE GILBERT (W. Va.) WATER & LIGHT COMPANY has been incorporated with a capital of $25,000 by L. T. Nichols, James N. Belcher and O. H. Preston.

THE HOOSIER HYDRO-ELECTRIC COMPANY has been organized at Indianapolis, Ind., with a capital stock of $10,000, to generate and distribute electricity. The directors are J. A. Shafer, P. C. Kepler, Lawrence McTurnan, L. V. McTurnan and R. A. Morris.

THE HAWES-FARMER ELECTRIC COMPANY has been incorporated in New Bedford, Mass., with a capital stock of $20,000. The directors of the company are Farland M. Farmer, president; Roy T. Hawes, treasurer, and Clayton P. Hawes.

THE GRATZ LIGHT & POWER COMPANY, of Gratz, Pa., has been chartered with a capital stock of $10,000 to operate a light and power system. The incorporators are Elmer H. Coleman and George E. Hepler, Gratz.

THE MUSCONETCONG POWER COMPANY has been chartered with a capital stock of $125,000, to construct and operate an electric power plant in the Musconetcong River district, New Jersey. The incorporators are: H. Otto Wittpenn, 75 Montgomery Street, Jersey City; Charles W. Alpaugh and William Braun.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 17, 1922)

1,404,036. Transportation Apparatus and Method for Use in Driving Tunuels; Paul Lippert and Thomas E. Richards, Jr., Chicago, Ill. App. filed July 6, 1920. Protected third-rail during construction.

1,404,063. Electric Heat-Producing Element and Applications Thereof to Apparatus or Articles; Charles H. Roddis, Bedford, England. App. filed June 29, 1920. Composed of carborundum.

1,404,077. Flashlight; Joseph Vince, Brooklyn, N. Y. App. filed Jan. 18, 1921. Switching contact to zinc direct.

1,404,097. Electric Wire Swivel Coupling; Thomas L. Dennis, New York, N. Y. App. filed May 27, 1920. Appliance attachment plug.

1,404,098. Electric Swivel-Coupling Lock; Thomas L. Dennis, New York, N. Y. App. filed Aug. 18, 1920. Appliance attachment plug, with locking device.

1,404,125. Rheostat; John G. Kjellgran, Cleveland, Ohio. App. filed Nov. 13, 1919. With switches for outdoor use.

1,404,156 Plating Electrolyte and Process of Making Same; Quintin Marino, London, England. App. filed Nov. 15, 1921. To deposit nickel on metallic plate.

1,404,168. Trolley System; John J. Stock, Erdenheim, Pa. App. filed April 18, 1921. Used for amusement purposes.

1,404,171. Plate Holder; and Indicator Therefor; Harry F. Waite, New York, N. Y. App. filed Nov. 16, 1918. Dental plate for X-ray machine.

(Issued Jan. 24, 1922)

1,404,184. Electrical Connector Device; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 9, 1917. Lamp socket.

1,404,187. Electric Lighting System; Henry E. Borger, Newark, N. J. App. filled Jan. 29, 1918. For automotive vehicles.

1,404,248. Trolley Retriever; Adrian C. Van Hooydonk, Canton, Ohio. App. filed Dec. 18, 1919. When pole jumps from wire it drops to a safe position.

1,404,254. Toy Crane; George Zahorsky, Detroit, Mich. App. filed July 17, 1920. With magnet lift.

1,404,255. Controller for Electric Motors; Gilbert E. Adams, Gary, Ind. App. filed Oct. 30, 1920. Cuts out resistance in definite time intervals.

1,404,258. Battery Hand Lamp; Ernest Alschuler, New York, N. Y. App. filed June 21, 1920. Constructed to prevent accidental lighting.

1,404,259. Battery Hand Lamp; Ernest Alschuler, New York, N. Y. App. filed June 21, 1920. Means for insulating internal conductors.

1,404,262. Battery; William Balderston, Madison, Wis. App. filed Aug. 6, 1920. Four dry cells in one case.

1,404,267. Resistance Unit and Method of Making; Frederic H. Bullinger, Yonkers, N. Y. App. filed April 27, 1920. Rigid terminal connections for tube type.

1,404,288. Repeater-Testing Arrangement; William H. Harden, Brooklyn, N. Y. App. filed May 16, 1919. Detects and measures unbalance on communication lines.

1,404,295. Burglar Alarm and Protector; Aaron Horvitz, Chicago, Ill. App. filed April 12, 1917. Designed for office buildings.

1,404,311. Electrical Testing System; Henry W. O'Neill, Brooklyn, N. Y. App. filed Dec. 17, 1920. For measuring small alternating currents.

1,404,317. Electrically Heated Receptacle; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Oct. 26, 1920. Used with dental apparatus to heat atomizer fluids.

1,404,332. Electrical Recorder; Horace H. Welch, Milwaukee, Wis. App. filed June 16, 1919. For taking readings at intervals and recording same.

1,404,341. Economizer for Inclosed-Arc Lamps; Tito L. Carbone, Charlottenburg, Germany. App. filed March 10, 1916. Plate attached to upper electrode.

1,404,344. Electric Socket; John Cuthbert, Chicago, Ill. App. filed Dec. 4, 1916. Conductors attached from open end of lamp socket.

1,404,361. Electric Oven; Juan O. Gonzalez, Mexico, Mex. App. filed Aug. 16, 1920. Wooden box insulated by asbestos, air and mica.

1,404,362. Electric Flashlamp; Magnus Goodfellow, London, Enland. App. filed Aug. 12, 1921. Bulb protected when not in use.

1,404,387. Electrolytic Cell; Samuel M. Green, Springfield, Mass. App. filed Feb. 26, 1921. For producing chlorine and caustic soda.

1,404,396. Telephone System; Max Langer, Charlottenburg, Germany. App. filed Nov. 13, 1919. Metering of calls on automatic system.

1,404,413. Sanitary Telephone Mouthpiece; Harry S. Wheaton, Dallas, Iowa. App. filed May 26, 1921. Contains a disinfectant fluid.

1,404,416. Semi-Automatic Telephone System; John Wicks, Chicago, Ill. App. filed March 4, 1918. Reringing called subscriber after automatic ring stops.

1,404,437. System for Protecting Electric Current Distributing Nets Against Temporary Interruptions; Martin Hochstadter, Berlin, Germany. App. filed Oct. 20, 1914. Disconnects from system defective portion only.

1,404,442. Means of Producing Constant-Current Regulation of Generators; Otis A. Kenyon, New York, N. Y. App. filed Jan. 22, 1918. Variable carbon-pile control on direct-current machines.

1,404,496. Trolley for the Aerial Collection of Current for Electric Traction in General; Lorenzo Vallino, Cuorgne, Ivrea, Italy. App. filed March 5, 1920. Two-wire collector.

1,404,497. Electric Heater; John J. Vetter, New Brunswick, N. J. App. filed March 31, 1920. Represents a pile of logs.

1,404,549. CONSERVATION OF VEGETABLE MATERIALS; Theodor Schweizer, Zurich, Switzerland. App. filed March 4, 1921. By electric current.

1,404,573. TELEPHONE INSTALLATION IN WIRELESS TELEGRAPHY; Leon N. Brillouin, Paris, France. App. filed June 13, 1917. Connection of tubes for amplifying.

1,404,574. TELEPHONE AND WIRELESS TELEGRAPHY INSTALLATION; Leon N. Brillouin, Paris, France. App. filed April 25, 1918. Connects grid of first tube to plate of next.

1,404,581. TELEPHONE RECEIVER; Merritt S. Conner, Adelphi, Salford, England. App. filed July 31, 1918. Magnetic shunt to reduce reluctance and hysteresis losses.

1,404,587. HAIR CURLER; Joseph De Ruvo, New York, N. Y. App. filed March 23, 1921. Hair pressed between two cylinders.

1,404,664. TROLLEY WHEEL; Elisha J. Smothers, Oliver S. Banks and Joseph Golobich, Pittsburgh, Pa. App. filed Nov. 17, 1921. With roller bearings.

1,404,694. SWITCHING MECHANISM FOR CONTROLLING CIRCUITS; Edgar P. Hazazer, Detroit, Mich. App. filed Nov. 28, 1916. For reversing motor-driven ventilating fans.

1,404,720. STREET INDICATOR FOR STREET CARS; Lyle G. Scott, Two Harbors, Minn. App. filed Sept. 11, 1920. Electrically operated rollers.

(Issued Jan. 31, 1922)

15,277 (reissue). AUTOMATIC TEST AND RINGING CIRCUITS; Hiram D. Currier, Chicago, Ill. App. filed Sept. 9, 1920. Automatic ringing on manual operated telephones.

15,278 (reissue). ELECTRON-DISCHARGE APPARATUS; Irving Langmuir, Schenectady, N. Y. App. filed April 23, 1919. Rigid frame for grid element.

1,404,726. REMOVING SLEET FROM ANTENNAS; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 14, 1919. Heating wires in small sections by current.

1,404,731. ELECTRICAL RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 9, 1917. Non-switch light socket.

1,404,732. COMBINATION ELECTRIC LIGHT FIXTURE; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 6, 1919. Fixture equipped with circuit-trapping socket.

1,404,733. ELECTRIC FIXTURE; Reuben B. Benjamin, Chicago, Ill. App. filed March 3, 1919. Waterproof plurality socket.

1,404,734. ELECTRIC FURNACE; Morris H. Bennett, Waterbury, Conn. App. filed Oct. 1, 1919. Three-phase furnace.

1,404,756. SIGNALING SYSTEM; Alfred N. Goldsmith, New York, N. Y. App. filed May 9, 1918. For regulating current in oscillating loop of antenna system.

1,404,799. CURRENT-SUPPLY CIRCUIT FOR VACUUM BULBS; Samuel P. Shackelton, New York, N. Y. App. filed May 31, 1919. Plurality of busbars for proper voltage to tubes in telephone exchange.

1,404,800. TELEPHONE ATTACHMENT; Albert G. Sheller, Claysville, Pa. App. filed July 20, 1920. To detect a party cutting in.

1,404,814. INSULATOR; Nils J. A. Wahlberg, Pittsburgh, Pa. App. filed April 9, 1918. Suspension insulator for trolley conductor.

1,404,817. TELEPHONE ATTACHMENT; Philip J. Werber, St. Louis, Mo. App. filed Feb. 28, 1921. Bottom on transmitter diaphragm to preclude noises when listening.

1,404,826. CORE STRUCTURE FOR TRANSFORMERS; Vern E. Alden, Baltimore, Md. App. filed July 10, 1918. For large polyphase transformers.

1,404,838. MECHANICAL CONVERTER; David C. Davis, Wilkinsburg, Pa. App. filed July 3, 1916. Employed in the rectification of alternating currents.

1,404,850. SPEED INDICATOR; Frank C. Harris, Fairfield, Iowa. App. filed Feb. 2, 1920. Electrically operated for use in automobiles.

1,404,853. DISTRIBUTING DEVICE FOR REELING MECHANISM; John A. Heany, New Haven, Conn. App. filed Jan. 24, 1919. For guiding wires onto reels.

1,404,862. ELECTRIC MOTOR-DRIVEN JACK; Frank A. Kirstatter, Cleveland, Ohio. App. filed May 12, 1920. Automobile jack with self-contained motor.

1,404,871. COLLECTOR RING; Roy A. McCarty, Wilkinsburg, Pa. App. filed May 17, 1920. Set in resilient bed.

Construction News

Projects, Plans, Bids and Contracts
Contemplated or Under Way

New England States

PORTLAND, ME.—The Cumberland County Power & Light Company has submitted a petition to the Public Utilities Commission for permission to eliminate direct-current service and install an alternating-current system.

BRISTOL, N. H.—Herbert B. Rust, Meredith, N. H., and associates are nogotiating with the City Council for the construction of a hydro-electric plant on the Pemigewasset River. It is proposed to construct two dams to form a 10-mile lake for water supply. The plant will furnish power to municipal plants in this section, as well as to public utilities. The Bristol Council has had plans prepared for the municipal station for local service.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company is contemplating improvements and extensions to its Kelly's Falls power plant, to cost about $300,000. Equipment, including a steam turbine direct-connected to a 12,500-kw. General Electric alternating generator and an additional switchboard, will be installed.

WHITINGHAM, VT.—The New England Power Company, 50 Congress Street, Boston, Mass., is clearing the site in the Deerfield River Valley, near Whitingham, for its proposed new hydro-electric plant. The work includes a half-mile tunnel 20 ft. in diameter. The cost about $1,000,000. The Power Construction Company, 35 Harvard Street, Worcester, Mass., is engineer.

AUBURN, MASS.—A committee has been appointed to investigate the question of establishing a municipal electric light plant in Auburn. Arthur W. Warren is a member of the committee.

BOSTON, MASS.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has had plans prepared for coal-handling equipment to be installed at the local navy yard and will call for bids in the near future. (Specification 4583).

NEW HAVEN, CONN.—Plans are under way by Dwight E. Smith, architect, Liberty Building, for the construction of a new industrial plant, 156 ft. x 201 ft., and a one-story power house, 40 ft. x 50 ft., to cost about $100,000. The owner's name has been withheld.

Middle Atlantic States

DUNKIRK. N. Y.—The City Council contemplates the installation of an automatic police and fire-alarm system throughout the city.

NEW YORK, N. Y.—Large and small motors, four electric power elevators for motor trucks, thirty-five electric passenger elevators and other electrical and mechanical equipment will be installed in the twenty-one-story addition to be erected by R. H. Macy & Company, department store, Broadway and Thirty-fourth Street, to cost $5,000,000. Marc Eidlitz & Son, Inc., 41 East Forty-second Street, are contractors.

RUSH, N. Y.—The Rush Electric & Machine Company is considering extensions to its electric generating plant to supply electricity in Rush and surrounding communities. Louis Bassett is president and general manager.

JERSEY CITY, N. J.—The Boulevard Commission has authorized plans prepared for the extension of the "islands" and central lighting system on the Boulevard from Communipaw Avenue to Sip Avenue and for extension to the ornamental lighting system from Sip Avenue to Newark Avenue.

LITTLE FALLS, N. J.—The Township Committee is considering the establishment of two lighting districts in Little Falls.

PASSAIC, N. J.—The City Commissioners have entered into a contract with the Public Service Company for the installation of thirty-five additional lamps of 1,000 cp. each on Main and Lexington Avenues. All other lamps will be increased to the 60-cp. standard.

PHILLIPSBURG, N. J.—The Pennsylvania Edison Company will build a new transmission line to the electrically operated pumping station being erected by the city on the Delaware River for the municipal waterworks.

TRENTON, N. J.—The City Commission is arranging a program for the installation of new lamps on about 96 miles of streets during the present year. Commissioner Page is in charge.

TRENTON, N. J.—The Eureka Power Company, a subsidiary of the Pennsylvania & New Jersey Traction Company, is considering the construction of a new 13,000-volt transmission system to New Hope, Center Bridge and Stockton. A contract has been secured for industrial power service at New Hope and for street lighting at Stockton.

EASTON, PA.—The Pennsylvania Edison Company has commenced work on an addition to its local generating plant, to include the installation of a 10,000-kw. turbo-generator. Extensions will be made to the transmission and distributing lines, including a new line into New Jersey, connecting with the system of the New Jersey Power & Light Company, Dover, N. J. The total cost is estimated at about $600,000.

JOHNSTOWN, PA.—The Penn Public Service Company has issued $750,000 in bonds, part of the proceeds to be used for plant extensions and improvements.

PHILADELPHIA, PA.—The Bureau of Water, City Hall, will take bids at once for the construction of an electrically operated pumping plant on Shawmont Avenue.

PHILADELPHIA, PA.—The Bath Portland Cement Company, Finance Building, will build a power house in connection with its proposed new cement mill at Sandts Eddy, Pa., to cost about $1,750,000. The mill will be equipped throughout for electrical operation. The company also contemplates improvements to its mill at Bath, Pa., including the complete electrification of the plant, to cost about $300,000. A 4,000-hp. turbo-generator and auxiliary equipment will be installed. Louis Rafetto is president.

PHILADELPHIA, PA.—The Philadelphia Electric Company is arranging for an increase in capital from $60,000,000 to $150,000,000, part of the proceeds to be used for additions, including the completion of the power plant at Beach and Palmer Streets, with the installation of a 30,000-kw. turbo-generator; also an extension to this plant, to duplicate the present building and equipment, with installation of three 30,000-kw. turbo-generators, extensions and improvements in the Christian Street power plant on the Schuylkill River, and extensions to transmission and distributing lines.

PROGRESS, PA.—The Borough Council is planning the installation of a street-lighting system.

SHARON, PA.—The Shenango Valley Electric Light Company has arranged for a bond issue of $45,000, the proceeds to be used for extensions and improvements.

WOMELSDORF, PA.—The Borough Council is considering the sale of the municipal electric power plant to private interests.

BALTIMORE, MD.—Electric pumping plants and other electrically operated equipment will be installed at the new filtration plant for the waterworks system to be constructed at Montebello by the Water Board, City Hall, estimated to cost about $1,200,000. William A. Megraw is water engineer.

ELKTON, MD.—The Northern Maryland Electric Company will soon begin work on a new transmission line from its generating plant at McCall's Ferry and Port Deposit to Perryville and Havre de Grace, Md. A line will also be built from Oxford to Rising Sun, Md., and a number of new substations erected. The company recently acquired the property of the Havre de Grace Electric Company. J. H. Ware is president.

CLIFTON FORGE, VA.—The City Council is considering the construction of a municipal electric light plant.

WINCHESTER, VA.—The Winchester Lumber Corporation, Winchester & Western Railroad Building, recently organized, is planning to construct a power plant in connection with a series of twenty sawmills and other lumber plants on timber properties in Hardy and Hampshire Counties, W. Va. William B. Cornwell is president.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 23, for conduits and wiring in the United States Treasury Building, Washington, D. C.

WASHINGTON, D. C.—The Commissioners of the District of Columbia will receive bids until March 7 for 17,000 ft. of telephone and signal cable for the electrical department.

WASHINGTON, D. C.—The Purveying Service, Public Health Service, will receive bids until Feb. 23 for body-cabinet hot-wire milliampere meters, electrodes, etc. (Circular R-201.)

WASHINGTON, D. C.—The Chief Signal Officer, United States Army, will receive bids until Feb. 24 for 70,000 ft. wire for the Signal Corps, type W-28, and thirty-five reels for same. (Circular PR 9838-1CP.) Also, Feb. 27, for one electric storage battery. (Circular PR 9634-262CP.)

North Central States

KALAMAZOO, MICH.—Motors and other electric power and operating equipment will be installed in the addition to be erected at the paper mill of the Kalamazoo Vegetable Parchment Company, to cost about $400,000. J. Kindleberger is president.

SAGINAW, MICH. — Electric motors, switchboard and other power equipment will be installed in the high school and vocational shop to be constructed by the Board of Education, to cost about $1,200,000. Cowles & Mutscheller, 114 Washington Street, are architects.

AKRON, OHIO—The Palmer Match Company, Second National Bank Building, will build a power house in connection with its proposed new plant at Coventry, Ohio, to cost about $700,000. Charles H. Palmer is president.

CLEVELAND, OHIO—Estimates have been submitted to the City Council by A. B Roberts, Director of Public Utilities, placing the cost of the installation of an ornamental lighting system on Pearl Road at $20,098 with 100 ft. spacing and $17,482 with 125-ft. spacing, and on West Fourteenth Street at $48,512 and $42,249 with respective spacings. An ordinance providing for an expenditure of $12,100 for the purchase of 10,000 16-in. globes for the division of street lighting has passed its first reading in the Council.

DAYTON, OHIO—The Engineering Division, Air Service, McCook Field, will receive bids until Feb. 24 for furnishing six portable electrolytic cells. (Circular 112.)

ROCKFORD, OHIO—The Rockford Electric Lighting Company has filed notice of an increase in its capital stock from $50,000 to $100,000.

STEUBENVILLE, OHIO—The Wheeling Steel Company, Wheeling, W. Va., will build a new power house at its local plant. A larger electric station will be erected here in the future to provide all power necessary for the works. The company will also build a new power house at its plant at Portsmouth, Ohio.

CHICAGO, ILL.—A one-story and two-story power plant will be erected by the Standard Laundry Company, 1818 South Wabash Avenue. W. G. Uffendell, 39 South State Street, is architect.

CHICAGO, ILL.—A power plant will be installed in the sixteen-story exhibition building, 200 ft. x 400 ft., to be erected by the American Furniture Mart Building Corporation, estimated to cost about $5,000,000.

DECATUR, ILL. — The Illinois Traction System, Peoria, is considering the construction of a large electric generating plant at Decatur. The erection of the plant is dependent upon authority from the city to use water from a new artificial lake at Faries Park for condensing purposes. The cost of the project is estimated at between $600,000 and $1,000,000.

DECATUR, ILL.—The City Council is considering extensions to the municipal electric light plant.

MATTOON, ILL.—Plans are under way by the Central Illinois Public Service Company, Mattoon, for the construction of a new power plant at Grand Tower, with an initial capacity of 30,000 kw. The company also plans to install additional equipment at its Harrisburg plant to increase the output to 30,000 kw.

WAUKEGAN, ILL.—Plans are under consideration for the installation of an ornamental lighting system on Genesee, Washington and Madison Streets and on the four sides of the court house square.

KILBOURN, WIS.—Bids will be received by August Luettgerodt, village clerk, until Feb. 24, for one 150-hp., 50 frequency changer set, 25-cycle change to 60 cycle, 2,200-2,400 volts. H. A. Smith, Madison, is engineer.

MANAWA, WIS.—The Little Wolf Lumber Company is considering the construction of a new hydro-electric power plant, with auxiliary steam equipment, to cost about $25,000. Thomas W. Orbison, consulting engineer, 812 College Avenue, Appleton, is in charge.

MILWAUKEE, WIS. — The Sewerage Commission, City Hall, has plans under way for a new electric power plant, to cost about $2,000,000. Will J. Sando, 1338 Wells Building, is engineer.

SHEBOYGAN, WIS.—The H. C. Prange Company has completed plans for the erection of a new three-story power house, 40 ft. x 60 ft., to cost about $50,000.

WEST SALEM, WIS.—Bids are being received, it is reported, by Walter S. Woods, consulting engineer, LaCrosse, in the name of Dr. E. C. Swartout, 904 Rose Street, LaCrosse, for the construction of a dam 166 ft. long, remodeling power house and installing new generators, switchboards, waterwheels, etc., at West Salem, to cost about $65,000.

DES MOINES, IOWA—An electric power department will be installed in the new Theodore Roosevelt High School, to cost about $1,000,000. George L. Garton is secretary of board of education.

OTTUMWA, IOWA—The City Council has plans under consideration for the construction of a hydro-electric power plant, to cost about $600,000. Permission has been granted by the United States War Department to dam the Des Moines River near Harvey.

ST. LOUIS, MO.—The E. B. Hartwell Handle Company, 120 Dock Street, will establish an electric power plant in connection with its new local factory. E. B. Hartwell is secretary and manager.

BROOKINGS, N. D.—The State Board of Regents, Pierre, contemplates the construction of a new power plant at the State College of Agriculture and Mechanical Arts, Brookings. T. W. Dwight is president of the board. H. F. Berg, Pierre, is state architect.

HASTINGS, NEB.—The Council, A. T. Bratton clerk, will receive bids until Feb. 27 for a motor-generator set, estimated to cost about $41,000.

ORLEANS, NEB.—The Council is considering plans for the installation of a municipal electric lighting plant to cost about $25,000, for which bonds have been voted

Southern States

DILLON, S. C.—Bonds to the amount of $100,000 have been voted for improvements to the municipal electric light and waterworks plant and for extensions to the sewerage system.

PERRY, GA.—The Council will install new electrically operated pumping equipment at the municipal waterworks. O. H. Sheffield is engineer.

BOYNTON, FLA.—The Town Council is considering the erection of a 6-mile electric transmission line from Boynton to Fort Worth, via Lantana and Hypoluxo. Ward Randolph, Fort Worth, Fla., is consulting engineer.

ERIN, TENN.—The plant of the Erin Light & Power Company has been purchased by J. B. Ross. The new owner contemplates the installation of additional lamps.

MEMPHIS, TENN.—Plans are being prepared for a new power house, heating system and laundry in connection with the proposed isolation hospital to be built on the grounds of the Memphis General Hospital. R. O. Johnson is chairman of the board of trustees of the General Hospital.

MURFREESBORO, TENN.—A power house will be erected by the State Board of Education, Nashville, Tenn., at the local Middle Tennessee Normal School, in connection with a number of other buildings, at a total cost of $107,000. J. B. Brown is secretary of the board.

DOTHAN, ALA.—The City Council is considering the installation of an additional unit in the municipal electric light plant and extensions to the waterworks, to cost about $70,000.

COLLINS, MISS.—The Town Council is considering remodeling the municipal electric light plant and waterworks. Oil engines may be installed. Swanson-McGraw, 705 United Fruit Building, New Orleans, La., are consulting engineers.

VERONA, MISS.—The Verona Lighting Company, recently incorporated by Richard Dalee and T. A. Goodwin, contemplates the establishment of an electric lighting system.

FORT SMITH, ARK.—Plans are under consideration by the City Council for the installation of an ornamental lighting system on Garrison Avenue from Sixth Street to Eleventh Street.

BUNKIE, LA.—The Bunkie Ice Company, Ltd., is installing an additional 170-kva. General Electric alternating-current unit to be driven by a Worthington heavy oil engine. Installation will be completed by April 1, 1922. C. J. Pope is manager.

NEW ORLEANS, LA.—Fire, Feb. 4, destroyed a portion of the building of the New Orleans Railway & Light Company, causing a loss of about $150,000. It will be rebuilt.

SHREVEPORT, LA.—The Council is planning the installation of a new automatic fire-alarm system.

DALLAS, TEX.—The Dallas Power & Light Company has preliminary plans under way for extensions to its transmission and distributing lines, with installation of new transformers and other equipment at the power plant. C. W. Davis is general manager.

HITCHCOCK, TEX.—The construction of a municipal electric light and power plant, to cost about $50,000, and an ice-manufacturing plant, are under consideration by the Common Council.

HOUSTON, TEX.—Arrangements have been made by the Galveston-Houston Electric Company for issuing $1,700,000 in bonds, part of the proceeds to be used for extensions and improvements to its plant.

WICHITA FALLS, TEX. — The Wichita Falls Light & Power Company is planning the erection of 25 miles of electric transmission line from Wichita Falls to sites of main and diversion dams of an irrigation project. The cost of the line is estimated at $100,000. Fred A. Jones, Dallas, will superintend construction.

Pacific and Mountain States

KENWICK, WASH.—The Pacific Power & Light Company is arranging for rebuilding its main transmission system between White Bluffs and Hanford, with a number of extensions along the route.

SOUTH TACOMA, WASH.—Large and small motors, and other electrical equipment will be installed in the proposed new local shops of the Northern Pacific Railway Company, comprising a number of one-story buildings, estimated to cost about $250,000.

LOS ANGELES, CAL.—Steps have been taken by the Los Angeles Railway Corporation, it is reported, for a trackless trolley system on Western Avenue. The company also contemplates the erection of a new substation. George H. Khurts is general manager.

MARTINEZ, CAL.—The Pacific Gas & Electric Company, San Francisco, has plans under consideration for the construction of a new power house at Martinez, to cost about $200,000.

RIVERSIDE, CAL.—The City Council is perfecting plans for the installation of an ornamental street-lighting system on Locust Street.

SANTA ANA, CAL.—The Council has called a special election in March to approve a bond issue of $75,000 for the installation of electric generating equipment at the municipal waterworks to supply electricity for local service.

VISALIA, CAL.—The Southern California Edison Company will start construction soon on a new substation in Visalia, to cost about $100,000. The new plant will be equipped for 60,000 volts. The local steam plant, which is equipped for 30,000 volts, will be abandoned. The company will soon begin work on a pole-treating plant in Visalia, to cost about $20,000.

BOURNE, ORE.—The Bourne Gold Mining Company has been granted permission by the State Engineer to appropriate waters from Cracker and Little Cracker Creeks for developing 852 hp. for operation of the E. & E. Mine at Bourne.

CANBY, ORE.—At an election to be held Feb. 21 the proposal to issue $10,000 in bonds for the construction of a municipal electric light plant will be submitted to the voters.

MILTON, ORE.—The City Council is considering the construction of an auxiliary electric power plant, to cost about $20,000.

SALEM, ORE.—Plans are under consideration by James Lindsey, 438 Worcester Building, Portland, and associates for the construction of a hydro-electric generating plant in the Marion Lake district, near Salem, to cost about $225,000.

SAN CARLOS, ARIZ.—The development of an irrigation and hydro-electric project on the Gila River, near Gila, to involve an expenditure of about $8,000,000, is reported to be under consideration. The water which is to be obtained by means of storage will also be used to irrigate about 100,000 acres of valley land. The hydro-electric plant will furnish power for mining camps and industrial plants throughout this part of Arizona. The enterprise is to be financed by F. A. Gillespie of Oklahoma.

LAS CRUCES, N. M.—The Chamber of Commerce has plans under way for the installation of a new street-lighting system in certain sections of the city.

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The Hobbles of Fear Are Off

AFTER all the lawyer talk about trade associations, punctured periodically by more mysterious court decisions, the publication of Secretary Hoover's correspondence with the Attorney-General comes as a refreshing surprise. On top of months of negative argument and worry over what *cannot* be done, here at last we have a list of things that *can* be done. Allah be praised! Let's go to work.

True, the legal mind points out that this is but the opinion of one administration and must be sustained by the Supreme Court before it shall be secure. But behind administrations and all courts stands a combination even greater than they—common sense and public opinion. And once the people of America become acquainted with the practiced purpose of the trade associations and see that their work is good, there will be no more thought of legislating them out of business than of suppressing universities and hospitals.

THERE are about twelve hundred trade associations in this country. Very few of them have got into trouble. Because most men are honest naturally most associations of men are honest. But the retribution which has been visited upon the few that have done wrong has been so conspicuous and so indefinite that fear has settled on the necks of all of them with paralyzing effect and a great injury to industry. Several organizations have been so perturbed that they have disbanded, so that doing nothing they might do nothing wrong.

Mr. Hoover suggests and Mr. Daugherty now agrees on eleven classes of useful work in which the trade association may properly engage. They are broad and ample, offering almost unlimited opportunity for service. Approval is given of uniform systems of cost accounting, though cost statistics may not be exchanged. But statistics on production, wages, capacity, sales, distribution and price may be collected, provided that they are compiled into classified totals and averages and delivered to the Secretary of Commerce for distribution through the press to industry and to the public.

IN other words, a man's own business is his own affair and he may keep it secret if he likes. But the public has an interest in the business of an industry. And if such an industry organization is dealing fairly with the public, it need not hide its figures or its work. And if it has no secrets, it need never be afraid. This is just sense.

Every trade association in the land should cheerfully and gratefully accept this offer and proceed to clear its statistics through the government. At last it can quit worrying and go openly to work on all these helpful things that can and should be done. The hobbles of fear are off.

Edward Marriott Hewlett

Pioneer and original investigator in the switchboard field, particularly in the matter of large oil circuit breakers.

PUBLIC conception of what an individual has done is frequently very misleading. It is not unusual for a man to be popularly known for an achievement which, after all, is only of a minor nature in comparison with his other work. The case of E. M. Hewlett, engineer of the switchboard department of the General Electric Company, is one in point. Mr. Hewlett has devoted almost his entire attention to the development of switchboards and switchboard devices, particularly circuit breakers. The work that he has done in the investigation of factors affecting the rupturing capacity of large oil circuit breakers will probably be of the most lasting importance to the industry. Lack of such information has for some time been a serious limiting factor on large power layouts. None the less, in the popular mind of the industry Mr. Hewlett is known as the originator of an insulator for line suspension. It must not be thought, however, that this work was unimportant. On the contrary, it made possible the development of high-voltage systems—100,000 volts and above—and thus added a great impetus to the building of high-tension lines.

It was in 1890 that Mr. Hewlett, then a young man of twenty-four, entered the electrical field. He had previously spent several years in Colorado as manager of the Cascade Town Improvement Company where among a number of other things he made the preliminary layout for the building of the carriage road to the summit of Pike's Peak. He started his electrical career by taking the "expert course" of the old Thomson-Houston Company at Lynn, Mass. About a year later he went to the New York office, where he worked on a number of electrical displays which at the time attracted considerable public attention. At that time he received charge of improving the lighting of the Statue of Liberty, which resulted in the installation of the first focusing lamps in the torch and also of a row of lamps under the rim of the liberty cap. In this connection he was the first to try floodlighting the statue, but the generating capacity available was insufficient so for the time being the project was abandoned.

In 1893 the Thomson-Houston Company and the Edison General Electric Company combined to form the General Electric Company, and Mr. Hewlett returned to the Lynn factory as assistant to the department head on switchboard and controller work, doing development work on switchboards, magnetic blowout circuit breakers and other magnetic blowout devices. Later he developed insulators for third-rail railway work and for underground trolley rails running in slots which previously were required in connection with cable street-car systems. He also developed the underground "contact plow" which is still in use. Mr. Hewlett developed a type of oil circuit breaker with a high interrupting capacity for use in the main station of the Metropolitan Street Railway Company, New York. The success of this pioneer large-capacity installation gave an incentive to other companies. As power distribution developed and the voltage was increased step by step, it was necessary at each successive stage to study the possibilities of insulators, insulating materials and so forth for the bushings for oil switches and for supporting disconnecting switches, busbars, etc. During this period Mr. Hewlett developed switches and switching equipment to meet each new requirement.

Mr. Hewlett designed the control switchboards for the Panama Canal. This installation was particularly adapted to naval use and made possible the control of the machinery from a distant control point, something that had not heretofore been done. During the war he was chief consulting engineer of the naval experimental station at New London.

Mr. Hewlett was born Sept. 14, 1866, at Cold Spring, N. Y. He has spent his entire career in the electrical industry with the General Electric Company and its predecessor, the Thomson-Houston Company, and is one of the pioneers of the industry who are still vigorously engaged in constructive work.

Editorial Comment

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Volume 79 Number 8

Muscle Shoals Not for Private Exploitation

THE idea back of the water-power act, which is discernible in almost every line and thrusts itself to the fore on every page, is that the water powers of the country shall be developed either by or for the people. To them is given the prior claim, and only under exceptional circumstances can private enterprises obtain leases. That the Ford offer for Muscle Shoals was ever considered at all was due to the paramount national interest in munitions and fertilizer and to nothing else, and now that Mr. Ford's real reason has been revealed interest in his bid for Muscle Shoals wanes. His purpose is not to make fertilizer; this is only a hope. What he seeks at the expense of the public is cheap power to make automobiles and automobile parts.

This much has been established in hearings before Congressional committees. We have commented before on the ridiculously low price offered by Mr. Ford for the property of Muscle Shoals, and time has unfolded what the formal proposal hides. The Alabama Power Company last week offered to pay as much for the steam plant and uncompleted water-power project alone as Mr. Ford bid for the entire property, and we doubt whether Congress will long debate which of the two to choose. An electric public utility is engaged in public service. Every cent it earns and every cent it spends is subject to the scrutiny of a public service commission. Such a utility is bound to supply every one, without discrimination in either rates or service, and its interests are those of the public. It excels government ownership and operation in that, although publicly regulated, it retains all of the initiative and skill of private enterprise. The Alabama Power Company's system is interconnected with the other great power networks in the Southeast. It is therefore in a position to develop Muscle Shoals to a maximum and to spread the advantage not only throughout Alabama, but through Tennessee, Georgia, South Carolina and North Carolina as well. Mr. Ford represents only himself. The Alabama Power Company represents the power users of the entire South, or, generally speaking, the public itself.

A Clearing House for Meeting Dates Is Needed

DURING this coming week the jobbers are holding meetings in Chicago on Monday and Tuesday. There are jobbers' meetings in New York on Tuesday. There are meetings of the jobbers' association executive committee in Atlantic City on Wednesday and Thursday. On the same days there are also in New York meetings of the N.E.L.A. Commercial Section wiring committee, Merchandising Bureau, Lighting Sales Bureau, Power Sales Bureau and the joint committee on the "better business" campaign. These are different organizations with practically no overlapping membership, but they are of particular interest and concern to many others within the industry who are often desirous of attending both jobber and central-station meetings or at least of getting contact with the out-of-town electrical men who may be attending them. And this conflict of dates makes it impossible.

It has often been suggested that some checking authority be set up to pass on the dating of all meetings of electrical men, so that they may be more sensibly distributed around the calendar and men who have good reasons for wanting to attend more than one class of meetings may not be prevented by their inability to spend the same day in two cities. One of the things that the electrical industry suffers from is the lack of contact which exists between the different classes of electrical men. Central-station men and contractors should therefore be encouraged in every possible way to attend meetings of manufacturers and jobbers and to contribute their thinking. Manufacturers, jobbers and contractors should be urged to sit in on central-station meetings. Jobbers and manufacturers should deliberate more together. For the greater the interchange of ideas, the clearer will become the common purpose and the better the results for the whole industry.

It will be helped by more careful scheduling of meetings so that conflict of dates may be avoided. We suggest that the Society for Electrical Development be established as the clearing house for meetings and that hereafter all meeting dates arranged for committees and for conventions be considered tentative until submitted to the society for a report as to what conflicting meetings have been already recorded.

The Lesson of the Indianapolis Mob Scene

PUBLIC utility men should not pass over the story of the remarkable mob-demonstration in Indianapolis the other day without a little thinking on the actual significance of this unprecedented affair. Led by the Mayor of the city—a sensationalist—several thousand people gathered in response to placards which the Mayor had posted about the town and marched to the State House as a protest against a decision of the Indiana Public Utilities Commission. They were deluded, undoubtedly. They were misinformed and misled by the Mayor. But they were interested. They had been told that their rights had been violated by the granting of higher rates and the authorization of a merger. They recognized their concern in such a matter and turned out at the Mayor's call—five or six thousand strong—and followed him to the Capitol, led by a band of music. There was no hysteria, no mob fury. The Mayor made a speech of denunciation from the State House. Then they all went home.

The point is this: More than five thousand people in Indianapolis gave this undeniable evidence of their interest in utility rates and mergers. They made a protest because they were misinformed. They would have been satisfied and have made no protest if the facts had been given to them as thoroughly as the fabrication was. But the true story of this act of the utility commission performed in their behalf, the real reasons why these things were done—which they would have been glad to know about—were never carried to them. Therefore, the Mayor's version, which they were not glad to hear, aroused them to the expression of resentment.

Perhaps some day public service corporations and utility commissions will learn that it is not enough to issue terse, formal statements and hand down decisions in semi-technical or semi-legal language and leave the public to find out what it is all about. The story of what has been done *for* the public can be made even more interesting than any agitator's tale of what he claims has been perpetrated against it. But nobody seems to care enough to take the trouble to present the welcome and encouraging details. Therefore the people hear and know practically nothing of this interesting concern of theirs until some trouble maker comes along with facts that are all wrong. The Indianapolis mob scene should bring this home to every one of us.

Electric Ovens Challenge Fuel-Fired Type

LITTLE less than inspiring are the recent service records of electric ovens under stress of depressed industrial conditions. When applied by engineering skill to cut down the losses in material undergoing heat treatment, to improve the quality of the product or to reduce the hours or minutes of processing, this class of equipment makes history.

This branch of the art is still young, and every year sees real progress toward broader and deeper service values. Better control of performance in ovens designed for baking water japan represents one of the important developments of the year just passed. The explosion problem no longer looks formidable with the improved ventilation now attainable. In the manufacture of shoe eyelets, camera parts, automobile starting and lighting equipment, cutlery, glass and other products, notable gains in time, quality, convenience and hygiene are being realized. When some operations can, by using electric ovens, be cut in time to from 2 to 10 per cent of the older requirements and with actual improvement in finished material, the challenge of this type of industrial heating is well-nigh unanswerable.

One word of caution is necessary in the rapid advance of this absorbing specialty. The closest co-operation should be maintained between the user, the central-station engineer and the oven manufacturer in fitting equipment to specific commercial services. Upon the mechanical arrangement, housing and form of electric heating apparatus often depends its application efficiency. "Catalog engineering" is ultra-risky here, not perhaps in the way of total failure, but along the line of falling far short of the expected results. In new applications, even of well-standardized equipment like the so-called space-heater units, through preliminary experimentation under skilled eyes pays rich returns on the time and cost necessary to indicate the best practice. American manufacturers are sometimes accused of letting the attractions of "mass production" overbalance technical skill in the turning out of delicate and expensive products. Whether these strictures are justified or not, the carefully applied electric oven is becoming more and more a tool of precision through which uniformity of quality may be still more nearly perfected, and thus literally it is indispensable to its user.

The California Commission Has a Backbone

IN THE first days of the California Railroad Commission Theodore Roosevelt said to the late John M. Eshelman: "Your first task will be easy. Elected as you will be under a movement responsive to the people and independent of the corporations, you will find it easy to reduce rates where they are too high, and you will find many rates too high. Your real task will come later when you have to do justice to the corporations and raise rates in spite of the popular clamor to lower them. The test of public regulation will be the ability of public men to do that and to maintain popular confidence in doing it." The California Railroad Commission has just had such a test, and it has shown the public that it stands for established principles of sound regulation without fear of political death or desire for preferment. The attack was made by Governor Stephens, who criticised the commission for its action in increasing the rates of two utilities in southern California. Although, in view of the forthcoming state elections, the Governor's action might well have been construed to be purely a political one and for this reason passed by with only a perfunctory reply, the commission has chosen to make it clear in vigorous fashion that it will show no favoritism.

During the ten years' life of the California Railroad Commission the utilities of the state have shown a growth surpassing on a basis of population that of the utilities in any other section of the country. The power companies have expanded and covered the state until no section of importance is without an adequate supply of electric service. The use of electricity has become second nature both to the industries and the homes of the commonwealth. The rates for service are fair to the consumers and are cheaper than the cost of competing energy. But the end is far from being in sight. Tremendous programs of expansion have been announced. This year it is planned to expend more than $50,000,000 in the extension of the stations and distribution systems of the power companies. The apparatus to utilize this energy will bring the total expenditure in the state during the year for electrical material and labor for its installation to the astounding total of nearly $190,000,000. The veriest tyro should appreciate that an industry of such a size and of such importance to the state must have the protection of the law and the confidence that it deserves.

Inasmuch as the California Railroad Commission holds in its hands the power to assist or materially to retard the growth of these companies, the commission should share with the utilities in public good will and support. But public confidence and understanding concerning the actions of the regulatory bodies and the policies of the utilities are things of slow and tender growth. In time the people's viewpoint will accord with the facts, but today confidence is easily turned into distrust, and both utility commissions and public service companies must keep the records clean and stand up stiffly for the right.

Safety Engineering Should Begin at the Drafting Board

THERE can be little doubt that foresight is absolutely fundamental to successful safety engineering, and yet between the recognition of this truth and preventive activities a very wide gap often exists. It is justly a source of pride that electrical engineers and inventors have paid so much attention to safety problems from the early days of the industry. Modern apparatus, and even the older machines, have a remarkable record of safe operation in innumerable plants, and the advance of the art of distribution has been accompanied by sustained interest in safeguarding the performance of equipment. There is still room, however, for more thorough preliminary consideration of safety problems, both in designing apparatus units and in laying out structures to house or serve them. Questions of illumination, spacing, shielding, reduction of projections and obstructions in forming frames, improving accessibility of emergency switches—these and other matters associated with the fullest and safest use of plant equipment in its broadest meaning deserve the consideration of the designing and operating engineer alike. Some regular provision for special scrutiny of machinery designs and plant layouts along safety lines should certainly form a part of well-rounded electrical engineering creative work, for out of minor defects in layout may arise major troubles.

Adaptation of Furnaces to Lower-Grade Fuels Should Be Studied

ALTHOUGH most operating companies are now able to obtain all the fuel they require in the grades they desire, it was not long ago when many of these same companies had to be satisfied with anything they could get. If similar conditions are forced upon the companies again, or if it is found more economical to burn lower-grade fuels than are now being used, it should be a source of encouragement to know that even hogged wood is being burned successfully and economically in the Northwest as a central-station fuel. Furthermore, this accomplishment should be an inspiration to the study of the furnace adaptations necessary to burn other fuels which are abundant in different parts of the country. The method of burning hogged wood as well as the results obtained should be of interest to engineers, even if they never contemplate use of this particular fuel, as showing how resourcefulness can lift an engineer out of a predicament.

As pointed out elsewhere in this issue by H. S. Bastian of the Portland Railway, Light & Power Company, hogged fuel has two peculiarities that required no little study before they were mastered—it feeds badly from conveyors and, falling into piles, it burns on the surface so that it requires air from above to aid combustion. Like other combustibles rich in volatile constituents, it needs large furnace space. The form finally adopted in the case considered was the Dutch oven with a curtain arch over the bridge wall. The arch was of particular service in holding the gases in the hottest part of the combustion chamber and thus speeding their ignition. It also steered the flames from the front of the fuel piles down over the rear so that the area of active combustion is the surface of the conical piles and not the area of the grate.

After the necessary changes were made in the furnace, a thorough test showed that the water-tube boiler could be pressed to 350 per cent of its rating and brought to an over-all efficiency of nearly 63 per cent using fresh hogged fuel.

The experiment thus brought to a successful conclusion not only effected a considerable saving in the fuel costs of this particular company, but it is of general value in showing what may be done by the careful study of methods of combustion in utilizing almost anything that can be made to burn. Sawmill waste, like bagasse, is a fuel available only in special places, while poor coal and lignite are to be had over great areas. By proper precautions they too can be put to excellent use.

Opinion of Lightning Arresters Clearly Defined

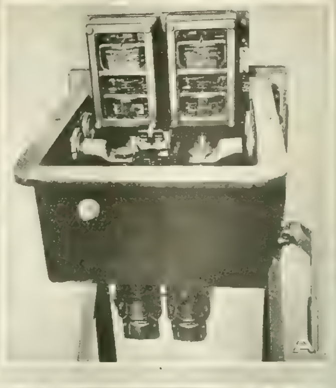
PRESENT opinion as to the value of lightning arresters for high-voltage lines was clearly revealed at the midwinter convention of the American Institute of Electrical Engineers. Replies to a questionnaire of the protective devices committee indicated a general belief in the superior value of the aluminum and oxide-film arresters, but also an appreciable definite opinion in favor of low-discharge-rate spark-type arresters. The latter were sharply opposed in the paper by E. E. F. Creighton setting forth the importance of the high discharge rate of the valve-type arrester, and this position was generally supported in the discussion.

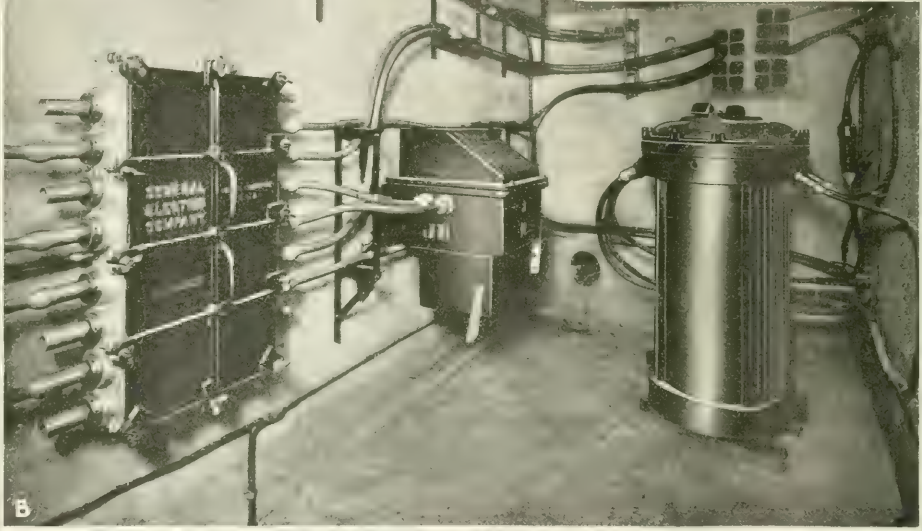
It appears probable that present doubts as to the value of the valve-type arrester lie rather in the question of its reliability than in that of its principle of operation. It deteriorates in several ways, and expert care is necessary for continuity of function. This difficulty has been and is under experimental study, and simpler tests and less care for proper condition are already announced. Particular interest attaches to the announcement, in the discussion, of a new type of valve arrester which involves the use of neither liquid electrolyte nor chemical change, the causes of most of the troubles of the present valve-type arresters. The new principle is an ingenious combination of high-resistance metal disks utilizing the electric properties of very thin air films. Commercial appearance is promised shortly.

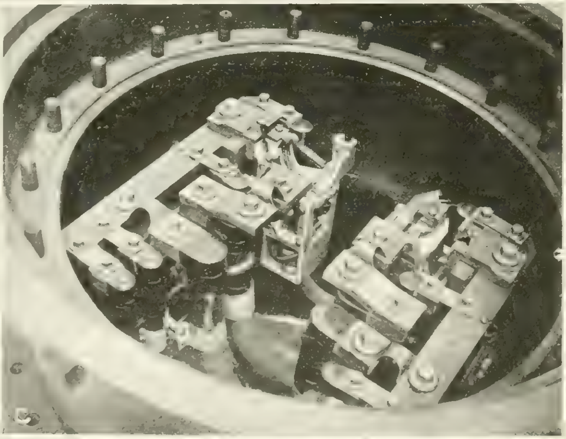
Progress to date is clearly shown in the agreement as to the approximate values of voltage and traveling charge associated with lightning disturbances and as to the fact that the line insulators themselves are an important factor in relieving them. This suggests the fundamental, though necessary, fault in present lightning-arrester practice, that most lightning disturbances must pass over a long length of line before reaching the arrester designed to relieve them. Ideal protection would be offered if every insulator were an arrester, so that wherever a disturbance appeared relief would begin at once. The thought may be extended still further to the suggestion that each foot of line be its own arrester by allowing it to discharge into the air by means of corona whenever the voltage rises appreciably above normal. This form of protection has been seriously proposed abroad, but American engineers have apparently given it little attention.

Further research in the lightning-arrester field will probably give first attention to the improvement of the valve type. In view of present definite knowledge of the quantities involved, it would also appear a relatively simple matter to determine whether the corona discharge would be helpful. The principle is ideal; the only question is as to its quantitative value.

Underground Networks Being Equipped with Manhole Circuit Breakers







MUCH has been done during the last few years to isolate system disturbances, the most recent step taken being to use manhole-type circuit breakers and selective protection within the distribution network itself. As economical and reliable devices are developed it may be expected that sectionalizing apparatus will be applied to overhead networks as well. Two recent examples of underground installations are shown. *B* is a typical transformer vault in the underground system of the Puget Sound Power & Light Company containing a manhole circuit breaker *(A)* with selective protection. *C* is a manhole-type sectionalizing switch in the direct-current network of the New York Edison Company.

Prices, Turnover and Expansion

Three Aspects of the Business Problem of the Central-Station Manager Which Are Fundamental to Success Yet Little Thought of by the Other Business Men

By **W. W. FREEMAN**
President Union Gas & Electric Company, Cincinnati

THE basis of practically all troubles between the public and the public utilities is misunderstanding. Because the power house, the transmission lines and the meters in their cellars are all mysteries to the people, they are naturally uninterested, unsympathetic and suspicious. They fail to realize that fundamentally the utility is just a business of manufacturing, distributing and selling a product that is no more cryptic in character than many chemical commodities, for instance. It is extremely desirable, therefore, that the business side of the central station should be explained and made clear and the reasons why a utility must be a monopoly and must have more and new capital continually should be presented in such form that soon all men will understand. The exposition of three aspects of the central-station business problem which Mr. Freeman makes in this article is the kind of a human-interest story that can profitably be carried to the public, for it is just the kind of information that pictures the human side of the utility in a way that appeals to other business men.

THERE is an interesting comparison—or, rather, three interesting comparisons—between the business aspect of a central-station company and the business or financial problem of an ordinary commercial enterprise. It is important, it is vital in the operation of a utility, yet it is seldom heard discussed in meetings of electrical men and therefore has never been considered by the general public. Nevertheless, I believe that were this interesting parallel to be pictured clearly to the people so that it became a matter of common understanding, it would exert a very profound influence upon the attitude of the public toward the utility.

The central-station company is fundamentally a business enterprise because of the very fact that it is financed by people who have invested their savings in its capitalization for profit. It is only because this business corporation is engaged in the manufacture, distribution and sale of an essential public service that the element of public regulation has been introduced and the control of this business has been taken in part out of the hands of the men to whom the investors have given their authority to operate the entire enterprise. But by the exercise of that very control the business of the central station is deeply affected, so that it becomes a problem very different from that encountered by the business man in other lines, and in ways which would seem extremely hazardous, if not fatal, to many a manufacturer of insulators or soap or woolen fabrics.

Price Fixed by Buyer

In the first place, the utility business is probably the only business where the price is fixed, not by the seller, but by the purchaser. This may not be literal or technically accurate, but in so far as the principle is involved it is true. The rate is fixed by the utility commission in the interest of the consuming public, and this is proper. But the effect upon the central-station company is to prevent this commercial enterprise, this business, from adapting and adjusting its prices to the market and the times as other kinds of business do as a matter of course. It establishes a price fixed for a long period, inflexible and unable to meet abnormal needs or opportunities. And this works to the disadvantage both of the utility and the public, as was seen during the war period, when expenses soared above all precedent and it cost more to provide the service than the rate produced.

When this is clearly understood by the people, there will evolve, I believe, some form of controlled rate that can be automatically adjusted to meet abnormal economic conditions as they may arise, by giving the utility commission continuing jurisdiction enabling them to act promptly as the need arises, in the interest both of the utility and the people. The result would be that relief could be given at the time of stress and readjustment made apace with a restoration of the former status, instead of its being necessary for the utility to suffer by compulsion until a critical condition compels attention, after which the public will naturally expect a corresponding reduction of the rates as soon as the emergency has passed, forgetting that rates cannot come down any more quickly than they went up, if a balance is to be struck.

Slow Turnover

The second comparison lies in the matter of turnover, the length of time required to reproduce in cash the equivalent of the amount invested in the conduct of the business. The baker sells out his stock each day. He has practically a daily turnover, and the percentage of profit which he makes each day multiplied by three hundred days in a year is the approximate rate of his earnings. The ordinary larger business enterprise expects to turn over its capital three, six or twelve times a year. The department store turns its money over four times, and if it realizes 5 per cent on each turnover it shows an annual earning of 20 per cent on its capital. But the central station turns its money once in each five years, if it is fortunate, and a 20 per cent gross earning is most successful. The public service corporation, therefore, that might earn 50 or 100 per cent gross on its business done would still receive a lower return on its invested capital than other manufacturers and business men expect to make.

The public utility needs from four to fifty times as much capital invested as is required for other purely commercial industries. This money must be tied up in stations, generating equipment, transmission lines and all the other contingent expenses of the service. Each kilowatt of energy can be produced only through the functioning of this combined investment, and instead of making bread, delivering it and getting its money back as the baker does, the utility must permanently entomb its capital in physical property from which develops the service which it sells. This clear picture of the profit-production process of the central station has not been carried frankly to the people, but some day will be understood and bring with it a clearer popular conception of what the utility should be required to earn.

The third comparison is no less striking. In every commercial enterprise provision must be made for financing new capital requirements and providing for enlargements and extensions of the business. The ordinary method of other manufacturers and merchants is to set aside a surplus out of their profits as a building fund. A bank that has a capital of from one to twenty-five millions will usually have on its books an accumulated surplus of from five to twenty-five millions. Other businesses provide other amounts, but it is standard practice, required by the common conception of "good business." But the utility company is compelled to go to the public each year for the new capital it needs.

The laws under which the utility commissions operate specify that a "reasonable rate" should be charged for a public service, and "reasonable rate" is construed to mean the sum needed for operating expenses and a fair return of profit. But no provision is made for building up a reserve out of accumulated profits with which to grow. As the business expands and new lines and new stations are required, fresh capital must be obtained from the public. The total that must be sought, for instance, to meet the present situation, where throughout the entire country central stations are operating close to capacity with the approaching prospect of an increasing industrial market making a demand upon them for a steadily increasing power supply, bulks into a sum that is enormous. It is estimated that the capital that will be required to finance new capital expenditures for public utilities within the next four years will necessitate the provision of the equivalent of $125,000 each and every hour of that period.

A DIFFICULT SITUATION

This produces a situation of extreme difficulty for the utility executive that reacts greatly to the disadvantage of the public. If an ordinary manufacturing concern chooses to expand its business by increasing its plant or output or extending its selling activities, that is a matter of its own concern. The public has no voice in it and the business man goes ahead in accordance with his own wishes. The utility has but one possible purpose in expanding its property, and that is to meet the demands of the public for service. It is not the desire of the company that prompts new capital expenditure, but the actual demands of the public for a service which they can get in no other way. And therefore the utility is justified in going before the public freely, frankly and without hesitation or reluctance when new money is needed, to meet the public openly and ask for what is needed under the restrictions which the public itself has established.

The public regulates and restricts the utility in the operation of its business, but it leaves entirely in our hands the solution of the problem of raising the money needed to do the job, which it wants done in its way. There is no reason, therefore, why we should not in so far as possible share the problem openly with the public by informing them as to the conditions and gradually developing a more active co-operation in the processes of financing.

There is a cheerful and a satisfying side to it as well as a perplexing one, however. Under the growing influence of the popular appreciation that public utilities are regulated and guarded by the state, the reputation of public utility securities has gradually been enhanced until they stand today as one of the best obtainable investments. The banker buys them for resale, but he has changed from the earlier attitude in which he felt it necessary to coerce the utility in his endeavor to meet the needs of his customers.

Out of this increasing interest in utility securities has come the new practice of selling direct to the customer, of taking him into partnership as an owner of the business, whereupon we have a new psychological effect. The public service company is no longer his enemy whom he should resist, but his good property and friend whom he should defend and protect. Pride in his investment grows into an active interest in the company and a concern for its ability to pay a profit. I have one case in mind that illustrates it well, wherein a man who in times past had been a most determined opponent of the utility came to a public meeting and supported it. It was soon found that his son had become a stockholder and the father's view had changed.

WHY A MONOPOLY

The central-station company must be a monopoly for the simple reason that it requires so much money to capitalize it that duplication would be folly. There is but one way in which a utility can be duplicated and operated in defiance of economic laws, and that is by the municipal ownership of the competing company. But it is being proved that municipal ownership is political ownership. True public ownership can only be obtained by the natural process of the purchase of an interest in the utility itself by the people as individuals. Already 1,600,000 people own public utility securities in the United States, plus all those others who are potentially stockholders through their interest in banks, insurance companies and other corporations that have invested in them. As a matter of fact, the proportion of the people who are not already directly or indirectly interested in the public utilities is exceedingly small.

It remains for us, in the utility business, to make this clear to them and to show them wherein their interest and our own are one. When all this is understood by the public the hurtful restrictive influence of regulation will be relieved, because the people will wish this business of theirs to prosper to the fullest degree and make possible a service that is unhampered.

New Italian Hydro-Electric Plant to Yield 16,000,000 Kw.-Hr. a Year

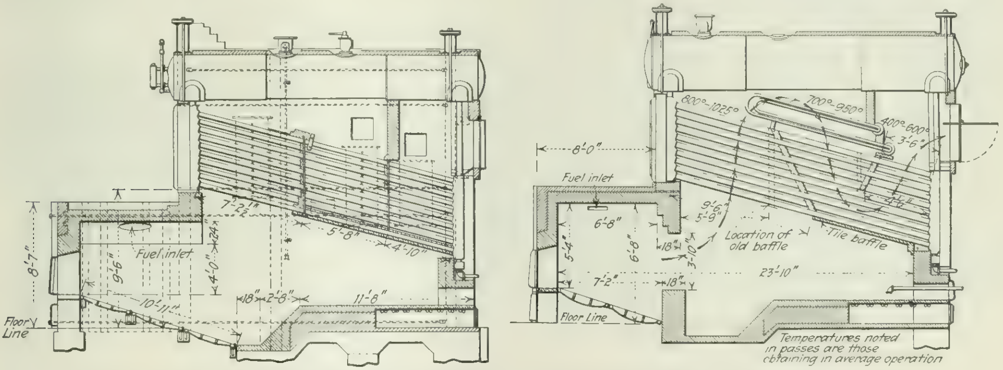
A HYDRO-ELECTRIC plant with a power yield of 16,000,000 kw.-hr. per annum is nearing completion at Piana dei Greci, 20 miles south of Palermo, Italy. A report made to the electrical equipment division of the Department of Commerce gives the details of the plant's construction. Some of this information is as follows: The dam is 110 ft. high and 980 ft. long. It provides nearly 20,000,000 cu.yd. of storage. The water has a drop of 1,550 ft., driving three groups of turbines and alternators rated at 3,500 kw. each. The project also permits of some use of water for irrigation in the Palermo Valley. The power line to Palermo is being strung on two different metallic posts, each carrying two sets of 100-mm. copper wires.

Generating Power from Waste

"Hogged Fuel," or Sawmill Refuse, Proves to Be a Valuable Combustible in Lumber Producing Regions Care Must, However, Be Exercised in Firing if Best Results Are to Be Obtained

By H. S. BASTIAN
Assistant Construction Engineer Portland Railway, Light & Power Company

When the Portland Railway, Light & Power Company decided, early in 1920, thoroughly to investigate the use of "hogged fuel," or sawmill waste, not only were the actual theoretical and practical heating values of this combustible studied but also its action in the furnace, in order that the furnace after it had been rearranged might utilize to the highest degree possible the potential heat energy contained in the fuel. Numerous types of hogged-fuel furnaces were in existence, but in order to meet the conditions imposed by limited space and a boiler plant in active operation and to reduce changes to a minimum the fundamental characteristics of this particular fuel were studied.



Temperatures noted in passes are those obtaining in average operation

FIGS. 1 AND 2—ORIGINAL ARRANGEMENT OF FURNACE FOR BURNING HOGGED FUEL, AND MODIFIED ARRANGEMENT WHICH NEARLY DOUBLED EFFICIENCY

The boilers selected for the tests were 440-hp. Babcock & Wilcox water-tube boilers, served with Dutch ovens. The fuel is fed through two holes in the top of the arch directly over the grates by means of conveyors and chutes, forming cones of fuel on the grates.

At the best, the conditions surrounding the use of hogged fuel are far from desirable as it carries water to the extent of about one-half its weight and its bulk is three or four times an equivalent weight of coal and nine times that of an amount of coal of equivalent available heating value. This makes special handling and storing facilities imperative. Mechanical difficulties of handling are also encountered, as this material will not flow freely through a chute or out of a hopper. The fuel is measured in "units," a unit being 200 cu.ft. (5.6 cu.m.), generally measured as it falls from a conveyor, without being packed.

Characteristics of Hogged Fuel

Instead of burning, as do coal and coke, with a glowing bed, hogged fuel burns almost entirely from the surface. Disturb the pile or turn the surface under, and the fire might be extinguished. More than that, this fuel cannot be treated as a solid but only as a gas, as it sometimes has a ratio of volatiles to fixed carbon of five to one and this ratio averages well over three to one in the fuel as fired. These volatiles start to pass off at a temperature below the boiling point of the water in the fuel. Thus it is necessary to catch and consume the gas, which represents fully two-thirds of the total heat in the fuel. In this respect the combustion of hogged fuel is something like that of lignite.

The Dutch oven type of furnace offers the most promising means of successfully burning sawmill refuse as it is one of the best types of furnace for gaseous fuels. The importance of treating hogged fuel as a gas can be appreciated by reference to the typical analysis printed here and to the accompanying curves. In addition, the percentage of ash is small, making this fuel radically different from other solid fuels.

Consideration of these characteristics will account for the action of the Dutch oven furnace as finally adopted by the Portland company. The style of furnace adopted for use with the particular style of boilers involved was best adapted to the peculiar nature of the fuel. This arrangement fulfilled the requirements that any required changes should be kept at a minimum. The last row of grate bars was removed and a 3-ft. (0.9-m.) bridge wall built. A 22-in. (56-cm.) hanging-curtain arch was inserted directly over the bridge wall. Fourteen boiler tests and forty-three fuel analyses have been made and were reported on page 215 of the 1921 report

TYPICAL CHARACTERISTICS OF FRESH HOGGED FUEL

Material	Douglas Fir	Ash (per cent)	0.7
Moisture (per cent)	47.9	B.t.u. per lb. dry	8,970
Volatile combustible (per cent)	39.7	B.t.u. per lb. available, as fired	4,050
Fixed carbon (per cent)	11.7	Pounds per unit (200 cu.-ft.)	3,900

of the prime movers committee of the National Electric Light Association.

The first boiler tests made with the unaltered furnace resulted as shown in column 1 of the accompanying table. The latest test (column 2) of the type of furnace finally adopted with superheaters added to the boilers shows by comparison the improvements that have been effected and also indicates what operating results can be obtained from the use of this waste fuel. During a later test one boiler was held at 305 per cent rating for six hours, with an hourly peak rating of 350 per cent, using fresh hogged fuel. With stored fuel a rating in excess of 250 per cent was obtained.

Requirements for High Efficiency

In order to get the most efficient results with the least amount of excess air, the volatile gases must be thoroughly mixed with air and burned before coming in contact with the cool boiler tubes. The curtain arch aids this by retaining and mixing the gases in the hottest part of the combustion chamber. The removal of the last row of grate bars kept the fuel under the Dutch oven arch, where all the distilled gases were forced to mix with air in the hot zone of the furnace. The time available for making this mixture of air and gas is very small, and the arch virtually lengthened the time in which combustion could take place by increasing the speed of ignition.

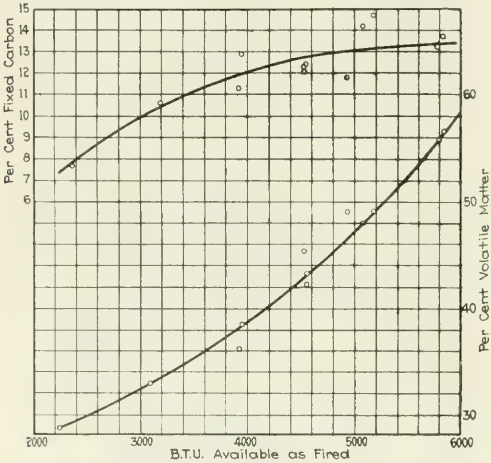


FIG. 3—RELATION OF FIXED CARBON AND VOLATILES IN HOGGED FUEL TO B.T.U.

The air for combustion should be applied at the point where the combustion occurs, which in the case of hogged fuel burning in deep cones is at the surface of the pile. Since a large portion of the combustible is already in suspension in the furnace in the form of gas, a counter-current of air serves to mix the combustible and the oxygen in a highly effective manner. In this combustion the heated furnace walls play a very important part. The air coming up through the fuel pile and the grates is moving in the same direction as the gaseous portion of the fuel, and traveling more slowly, owing to the resistance of the fuel bed. This "stern chase" does not result in the most efficient furnace action.

By bringing part of the air directly in contact with the surface of the fuel the escaping gases have an opportunity to unite with oxygen at once and form a blanket of flame through which the remainder of the combustible gas must pass. The air is readily supplied by opening the doors in front of the furnace over the fire, a method of procedure generally adopted to check the action of a coal fire. In this case, however, combustion is quite noticeably aided. If the doors are opened to such an extent that a light haze just appears at the stack, the furnaces will carry their heaviest load with a resulting flue-gas analysis, as noted in the accompanying test data. Should the fire doors be closed, a thick black smoke, resembling the smoke from a badly controlled oil fire, appears.

How Hogged Fuel Burns

The importance of keeping all the surface of the fuel covered with flame should be thoroughly appreciated. Hogged fuel does not lie quietly on the grates until consumed, as do most fuels. Nearly 75 per cent of the fuel is burned in suspension in the form of gas. Hence an unburned spot on the surface of the fire has the same effect as a missing grate bar in a coal-fired furnace. Before the curtain arch was installed in these furnaces the rear surface of the fuel merely smoldered and threw off pale blue flames. The hanging arch was so placed that the flames from the front of the furnace were guided down over the rear surface of the cones of fuel, with the result that, despite the fact that the grate area was reduced by one-third, the combustion area, and consequently the boiler capacity, was practically doubled. A secondary combustion chamber would remedy the deficiency caused by an inactive fuel surface, but in this case the endeavor was made to obtain the entire action under the oven arch.

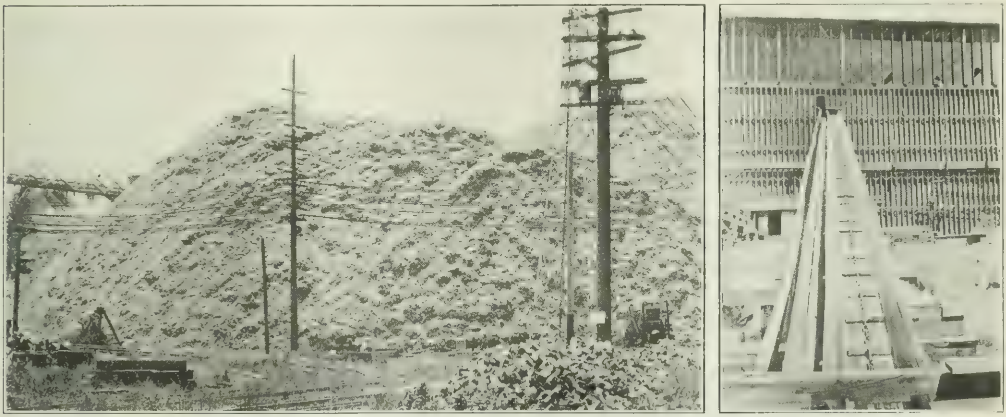
COMPARATIVE TESTS OF FURNACES USING HOGGED FUEL

	Original Furnace	Rebuilt Furnace
Duration of test (hours)	10	15
Make of boiler	B. & W.	B. & W.
Grate surface (sq. ft.)	121.8	87.2
Heating surface, boiler (sq. ft.)	4,399	4,399
Heating surface, superheater (sq. ft.)	....	855.5
Steam pressure (lb. gage)	171	177
Temperature of steam (deg. Fahr.)	372	557
Temperature of water entering boiler (deg. Fahr.)	84.4	94
Temperature of escaping gases (deg. Fahr.)	610	505
Percentage of moisture in fuel as fired	50.1	44.8
Factor of evaporation	1.17	1.27
Equivalent evaporation per square foot of water heating surface per hour (lb.)	3.96	8.45
Equivalent evaporation per hour (lb.)	17,435	37,172
Boiler horsepower developed	505	1,078
Percentage of rated capacity developed	114	246
Water fed per pound of fuel as fired (lb.)	1.58	2.5
Equivalent evaporation per pound of dry fuel (lb.)	3.63	5.74
Calorific value of 1 lb. of dry fuel (B.t.u.)	9,170	8,850
Efficiency of boiler, furnace and grate, based on dry fuel (per cent)	38.4	62.95
Efficiency, based on fuel as fired (per cent)	44.8	71.1
Analysis of flue gases by volume (per cent).		
Carbon dioxide	12.4	16.2
Oxygen	4.8	3.4
Carbon monoxide	0.57	0.05
Nitrogen, by difference	82.23	80.35

A peculiar condition existing in the combustion of hogged fuel lies in the fact that the percentage of CO_2 in the flue gas may not always be a true criterion of the efficiency of combustion. The wood, in breaking down into methane and other combustible gases, sometimes leaves as a residue the stable CO_2 compound, which is not formed as a direct product of combustion. This, however, is not very easy to establish definitely. If no CO and but little free oxygen is detected, the combustion may be considered of good quality.

The boiler plant in which these investigations were conducted is made up of eight 440-hp. Babcock & Wilcox horizontal water-tube boilers and one 500-hp. Stirling boiler. Six of the horizontal boilers and the Stirling boiler are equipped with superheaters. The plant generates 18,000 lb. to 25,000 lb. (8,000 kg. to 9,000 kg.) of steam per hour for heating and other work and in addition runs one 12,500-kw. turbine at an over-all water rate of 14 lb. (6.3 kg.) per kilowatt-hour at full load and 3,000 kw. to 4,000 kw. on other units at an over-all water rate of 22 lb. (9.9 kg.) per kilowatt-hour. Thus the boiler plant using the fuel can operate almost continuously at 250 per cent rating and better. Individual boilers frequently exceed 300 per cent rating for considerable periods when fuel conditions are good. Indicating flow meters on each boiler make continuous observation easy.

The best method of controlling fires in this plant was found to be with a supervising fireman on the floor whose duty is to keep close watch on the condition of the fires. When any furnace is found to be too full or not full enough, a signal to the man on the firing deck on top of the Dutch oven indicates to him how to regulate the feed to the furnace in question.



FIGS. 4 AND 5—55,000 TONS OF HOGGED FUEL STORED FOR USE IN SUMMER, AND CONVEYOR, DRIVEN BY 50-HP. MOTOR, FOR HANDLING FUEL FROM DOCK TO STOCK HOUSE

STORAGE OF FUEL

The plants using this fuel run as stand-by plants during the winter and as base-load plants during the summer low-water period. It happens, as a natural result, that the particular sawmills which supply the plants in question produce more waste fuel than is needed in winter, and in summer the demand exceeds the supply. Therefore, it is necessary to store the surplus fuel during the periods of abundance. These storage piles sometimes assume quite generous proportions. One of several piles alone covers a ground space 400 ft. x 500 ft. (120 m. x 150 m.), is 90 ft. (27 m.) high, and contains 55,000 tons of fuel. It would supply the station on whose grounds it is stored with sufficient fuel for six weeks' full-load operation. It is deposited on the pile and reclaimed by means of huge drags, like hay rakes, attached to steel cables and hauled to and fro over the pile by 75-hp. logging engines.

It is not advisable to keep this fuel in storage in the open for more than a few months at a time, and then only through the dry summer season. The fire hazard from a heap of this material is not great, and ordinary precautions, such as are taken in any well-equipped industrial storage yard, are sufficient. The experience of this company has shown that when properly stored no spontaneous combustion can occur. The fuel when heaped up moist will generate heat, but this action takes place in the interior of the pile, where all air is excluded. The heat has never been found to rise above 145 deg. Fahr. in the pile.

SPONTANEOUS COMBUSTION NOT LIABLE TO OCCUR

In raking the fuel from storage, the compact, heated interior of the pile exhibits a phenomenon which shows that unless the fuel is brought in contact with the air in small quantities, spontaneous combustion might in rare cases take place. The instant that a mass of fuel brought out from the interior is allowed to fall apart in contact with the air, a sudden rise of 10 deg. to 15 deg. Fahr. in temperature takes place. This sudden heating is but momentary. Should a very large mass of fuel be suddenly mixed with air, the heat generated might approach the ignition point. However, this chance is quite remote and has never been approached closely in practice.

The chief objection to storing this fuel is its deterioration with age. Fresh hogged fuel, especially when moist, will set up a slow oxidation when piled up and left undisturbed and in time will be reduced to a fine hard substance of practically no value as a fuel. To reach this state, however, it is necessary for the fuel to remain in storage a year or more. The result of eight months' storage may be seen by comparing the analysis of fuel stored for this length of time with the analysis for fresh hogged fuel:

	Relation to Condition when Fresh
Moisture (per cent)	61.3
Volatile combustible (per cent)	28.9
Fixed carbon (per cent)	7.7
Ash (per cent)	2.1
B.t.u. per pound, dry	8,170
B.t.u. per pound, available as fuel	2,360

In burning this stored fuel the draft in the furnace must be considerably increased. For example, a certain boiler rating requiring a damper draft of 0.6 in. (15 mm.) with fresh fuel requires 0.9 in. (22.5 mm.) of draft when stored fuel is used.

Lightning Protection

Uppermost at

A.I.E.E. Midwinter Convention

Arrester and Ground-Wire Practice, Use of Petersen Coil and Protecting Windings Against Transients Receive Chief Consideration—Communication Problems, Performance of Rotating Machines and General Engineering Subjects Comprise Remainder of Program

PROTECTION against lightning and other disturbances was the subject of five of the most interesting papers presented before the midwinter convention of the American Institute of Electrical Engineers last week. Two other groups of discussions, appealing particularly to machine designers and communication engineers, referred to the performance of rotating machines and to printing telegraphy and submarine cable communication respectively. For the distribution and transmission engineer the papers on thermal conductivity of soil and further studies of corona hold much of value. Of the remaining papers, which were on general engineering subjects, the mathematical papers by Steinmetz and Karapetoff drew forth a considerable amount of discussion.

Features of most of the papers and summaries of those which were too abstruse to abstract are presented in the following sections.

SURGE PROTECTION

Analysis of Lightning Arrester Operating Practice

F. L. Hunt

Turners Falls (Mass.) Power & Electric Company

TO OBTAIN information regarding the prevalent practice of engineers and operating companies in the use of lightning arresters a short questionnaire was sent by the sub-committee on lightning arresters to members of the protective devices committee and to a few other operating engineers. The answers to this questionnaire are digested below:

GENERAL TYPES* OF LIGHTNING ARRESTERS RECOMMENDED FOR FEEDER CIRCUITS OF 1,000-KW. RATING OR GREATER

Voltage	Oxide Film	Aluminum Cell	Condenser Resistance Gap Parallel to Condenser	Compression Chamber	Horn Gap With Water Resistance	Bennett Type	No Arrester
10,000	16	15	1	1	1		
33,000	16	14			1		1
66,000	14	13			2	1	1
150,000	13	13			1	1	1

*Out of the twenty replies, it should be noted that the majority of those recommending oxide film recommend the aluminum cell also.

Twelve replies express the opinion that there are no cases where arresters should be omitted entirely. Several state that they could be omitted on small substations or on short and unimportant lines. One recommends omitting arresters for 30,000 volts and over, one for 66,000 volts and over, and two for 150,000 volts and over. Another declares that arresters are not needed where apparatus of modern design is installed.

From the replies to the question "How many lightning arresters would you recommend and what general class of arrester would you specify for a substation feeding six 22,000-volt overhead circuits?" the following analysis was made: Thirteen recommend one arrester for each circuit, of which ten recommend the oxide film; five recommend one arrester on the bus; one recommends one arrester for each two circuits, and one recommends one arrester for each transformer bank.

Regarding the use of horn-gap lightning arresters on circuits of 10,000 volts and above, the following opinions were received: Eleven do not recommend this use in any case; four recommend their use on unimportant circuits from small stations; three recommend their use with resistance in series on circuits of 12,000 volts or over; one on 22-kv. circuits from substation; one on all circuits over 10,000 volts; and one on customers' small substations.

From an analysis of some of the reports on lightning arresters and from a study of their design, it appears that in order to insure the best protection one of the paths through the lightning arrester should be a high-current-capacity path, that is, a path that will allow a large current to flow at the time of lightning discharge. If such a path is provided, the arrester will have a lower maximum voltage across the terminals at the time of discharge than will be the case if the discharge capacity or rate of discharge is limited by the insertion of a resistor. It is possible that with a resistor in series the maximum voltage will be higher than the breakdown potential of the apparatus or cables which the arrester is intended to protect.

D. W. Roper emphasized the need of operating companies co-operating with the protective devices committee of the A.I.E.E. in studying methods of securing the most dependable operation from lightning arresters. He expressed the opinion that many so-called lightning arresters are being put on the market which do not perform the functions required of lightning arresters. To protect unwary purchasers, he suggested that the A.I.E.E. ought to define the functions of a lightning arrester very clearly or specify the performance desired.

Value of Petersen Coil for Suppressing Arcing Grounds

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Public Service Electric Company, Newark, N. J., and the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., respectively.

ACCIDENTAL arcing grounds on transmission lines constitute one of the foremost problems to be solved in the transmission of energy over great distances. A device, known as the Petersen earth coil, advocated by Prof. W. Petersen of Germany for suppressing these accidental grounds has resulted in investigations and tests being made in this country to obtain additional information relative to the operation and limiting features of this coil.

The essential part of this new apparatus is a suitable reactor connected between the neutral of the circuit and ground. This reactance is chosen of such a value as to neutralize the capacitance of the circuits when an accidental ground of one phase takes place. Under this condition the reactor is electrically in parallel with the active capacitances, and the only current that flows to the combination of the inductance and capacitance in parallel is the current necessary to supply the energy loss in the combination. This energy current can be made very small, and it is this relatively small current that passes through the accidental arc to ground. If the ground is of the arcing type, the arc will, under favorable conditions, be extinguished, as the energy flowing through the fault is only that necessary to supply the losses in the resonant circuit. If the losses are low, the energy flowing through the fault will be insufficient to support an arc and the voltage of the resonant system will be gradually reduced to zero, while the voltage between the former faulty wire and ground will gradually rise to normal value.

The advantages of the Petersen earth coil system are, first, the suppression of arcing grounds under favorable conditions; second, the reduction of insulator trouble, and, third, the small earth current when a fault occurs to ground.

The disadvantages are, first, high potentials between line and ground due to series resonance; second, maintenance of a series of arcs under unfavorable conditions, that is, resonance and high loss, or large dissonance and either high or low loss; third, difficulty in obtaining selection of the faulty line by means of relay protection, and, fourth, reduced lightning protection due to the necessity of high settings of the neutral with abnormals or transients.

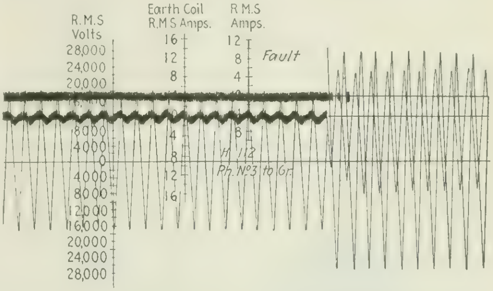
ORDER OF PREFERENCE OF FIVE METHODS OF GROUNDING A SYSTEM NEUTRAL.

(*v*) *Dead Ground*—Without the installation of resistance or reactance coils. (*w*) *Low Resistance Ground*—Two to four ohms. (*x*) *Critical Resistance Ground*—Resistance necessary to damp out the natural oscillation of the system. In general, this will be a high resistance compared to 2 to 4 omhs. (*y*) *Petersen Earth Coil*—A reactor tuned for resonance at fundamental system frequency with the capacity of the system to ground. (*z*) *Infinite Resistance from Neutral to Ground*—Ungrounded or free neutral system.

	Order of Preference				
Effect on	1	2	3	4	5
A—Voltage Stresses					
(*a*) At normal frequency	v	w	x, y, z		
(*b*) Due to arcing grounds	x, y	v, w	z		
(*c*) Due to lightning	v	w, x	y, z		
B—Current stress	z	x, y	w	v	
C—Relay operation	v	w	x, y, z		
D—Continuity of service	v	w	x	y	z
E—Cost:					
(*a*) Insulation of power system	v	w	x, y	z	
(*b*) Grounding devices	z	v	x	w	y

Considered from the viewpoint of effect on voltage stresses, current stresses, relay operation, continuity of service and cost, the methods of grounding the neutral of a system rank in the following order of preference: First, dead ground; second, low-resistance ground, and, third, critical resistance ground, or the Petersen coil. A more detailed comparison of five methods of grounding is given in the accompanying table.

In the discussion of this paper, W. W. Lewis gave the results of some investigation with the Petersen earth coil that he had made on a 100-mile transmission circuit of the Alabama Power Company. He found that the coil was useful as an arcing ground suppressor, but that practical operation was confined to transmission at a comparatively low-voltage and medium distance. L. P. Ferris said that any unbalance in the capacity of a line could be corrected by the transition of the wires. In this way the proper value of inductance for the coil could be determined so as to produce a resonant circuit with the line capacity of each phase. Mr. Lewis also pointed out that the effects of the Petersen coil are very similar to those of the isolated or free neutral system except in case of insulator flashover when the former adequately suppressed the arc.



EFFECT OF PETERSEN COIL WHEN ONE PHASE IS GROUNDED

The upper curve (right scale) indicates the current in the fault. The current is zero until the phase is grounded, when it rises to a peak value of 7 amp. The middle curve (middle scale) indicates the current in the earth coil which rises from 1.5 amp. under normal conditions (due to unbalanced condition of phases) to 16 amp. when phase is grounded. The lower curve (left scale) indicates the voltage of the non-grounded phase, which rises from Y voltage to Δ voltage when the phase is grounded.

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A Defense of Standard Practice in Lightning Arresters

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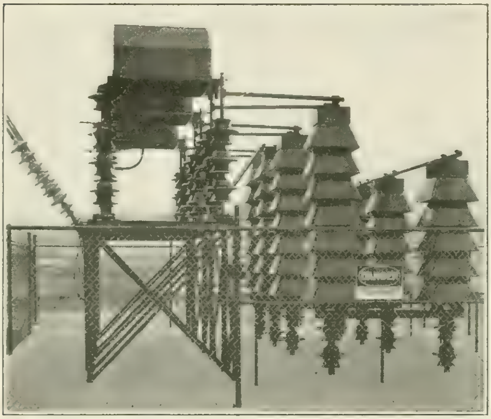
IN A RECENT investigation conducted by the protective devices committee criticisms were received of current lightning-arrester practice as applied to transmission lines. This paper is an endeavor to answer such questions of practice and criticisms of standard arresters.

For the most part practice in lightning arresters is standardized. In fundamental principles there have been no changes for many years, though improvements in details, especially of construction, are still being made. The oxide-film arrester gets rid of the oil and electrolyte and avoids the necessity of daily charging, but fundamentally it is designed along the same principles as the aluminum arrester. The important principle is the electric valve action—there are but a few milliamperes of discharge at normal line voltage, but at abnormal line voltages the discharge current rises to hundreds of amperes. In answer to criticisms made by a few prominent engineers, it is maintained as fundamental that a high discharge rate for an arrester is an absolute essential. The burden of proof falls on those engineers who use arresters of low discharge rate. These arresters cannot discharge the dangerous lightning surges on overhead lines since the current in a traveling wave is about 2 amp. for every thousand volts of lightning potential. Since there are lightning arresters of low discharge rate in apparently satisfactory use, an explanation for this anomaly is found in the use of insulators of low arc-over voltage. Either the lightning potential is relieved locally at the insulator or the resultant traveling wave is of too low voltage when it reaches the transformer greatly to endanger the insulation. However, such poor line insulation is not a solution of the problem of continuity of service.



LIGHTNING ARRESTERS MUST HAVE LARGE DISCHARGE CAPACITY AND NOT REQUIRE MUCH ATTENTION

How many arresters should be used to protect a six-feeder system? It depends on the conditions of insulation in circuit breakers and the importance of continuity of service. According to the conditions discussed, from one to seven arresters with auxiliaries are needed.

The use of no arresters was discussed in this paper from three standpoints—(1) if it is contended that lightning is not of sufficient voltage to cause damage; (2) if it is considered a better investment to put lightning-arrester money into spare transformers; (3) if it is considered good practice to insulate a transformer so highly as to give it immunity from lightning. The conclusion reached was that each of these three suppositions is faulty and dangerous.

A new method of inspection of aluminum arresters was proposed, based on the fact that the power factor of the cells varies considerably according to their condition. There are promises of effecting economies in overhauling aluminum arresters and of lengthening their life. Experiences with a 33-kv. arrester in service thirteen years without overhauling were given. The plates are still in good condition. The usual damaging deposits of decomposed oil on the aluminum film were prevented by using an initial rush of charging current.

A brand new development in lighting arresters was announced by Dr. Joseph Slepian, who described a valve type of arrester which involves some rough-surface high-resistance electrodes in contact with each other. This construction interposes minute air gaps which break down at 350 volts due to a glow discharge.

Prevention of Transient Voltage in Windings

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The production of transient voltages in ordinary windings such as are used in transformers, reactors and similar instruments is due to faulty arrangements of inherent capacitance with the inductance of the winding. The fundamental principle whereby the resulting non-uniform voltage distributions and oscillations may be eliminated may be stated as follows: If the capacitance associated with any inductance is so disposed that the initial distribution of a suddenly impressed voltage, which is effected by the capacitance, is uniform with respect to the inductance, the growth of a current within the inductance will be uniform, and the voltage distribution will therefore remain uniform, each element of capacitance receiving charge at the same rate that it loses it.

A general method of constructing windings with ideal distribution of inherent capacitance consists in inclosing or embedding the entire winding within the dielectric of a suitably proportioned condenser, the terminal plates of the condenser being connected to the terminals of the winding, and each turn of the winding being so positioned that, with uniform voltage distribution, its potential will be the same as that which would exist in the part of the dielectric where the turn is located if the winding were not present.

In case of cylindrical layers two cylinders would be required within which the windings would be placed, as described in the foregoing paragraph, with the outer cylinder and the inner cylinder connected to the outer and inner terminals respectively. With the multi-coil winding the top and bottom terminal would be connected respectively to circular plates placed at the top and bottom of the winding.

Economic Value of the Overhead Grounded Wire

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The necessity of the overhead grounded wire is now less apparent than formerly. In the early days it was needed to assist lightning arresters, but today arresters have a sufficient discharge rate not to require the assistance of the grounded wire. Investigation shows that the overhead grounded wire protects only for a specifically limited range of voltage. It is no protection for induced voltage below the normal arc-over value of the insulator and no protection when the induced voltage is sufficient to arc over the insulator. Appraisal of the weight to be given to the various functions of the overhead grounded wire and consideration of its cost lead to the conclusion that, barring exceptional cases, it is an actual detriment when placed on semi-insulating structures such as wooden-pole lines.

When used on this type of construction it actually lowers the arc-over voltage of lightning.

On a metal tower the overhead grounded wire loses its ability to protect against arc-over of insulators in proportion to the earth resistance at the legs of the tower. Metallic connections of a tower of high earth resistance to an adjacent tower of low earth resistance have little if any beneficial effect in protecting the insulator from lightning as the horizontal distance is too great.

On a grounded neutral system experimental tests of a short circuit of a single phase showed the necessity of connecting the overhead grounded wire to the station connection to reduce the earth resistance to a safe value. Otherwise the neutral voltage rose so high during short circuit as to jump-spark into the low-voltage wiring, blowing fuses and affecting the switch control.

Looking to the future, the overhead grounded wire, by lowering the general resistance to accidental short-circuit currents, will have a valuable function in connection with arc suppressors. This function is really the one already recognized as an aid to proper operation of relays.

Value on Wood Poles Questioned

As applied to metal structures the analyses do not bring out any detrimental function of the overhead grounded wire. It is not condemned in this use but attention must be directed to its limitations. The cost of the overhead grounded wire is a considerable factor. At maximum it now seems that for most cases one grounded wire is enough. Exceptional cases and conditions must be decided by detailed consideration.

On non-metallic structures the overhead grounded wire is not needed as an aid to lightning arrester. Instead of protecting, it actually lowers the arc-over of insulators subjected to a lightning voltage. The overhead grounded wire is not needed for mechanical strength where pin-type insulators are used. It is detrimental in increasing the wind and sleet load. It may find some use as a low-resistance earth connection, but is it needed to localize faulty insulators? Not where wooden pins are used, and it is of possible but doubtful economic use where metal pins are used.

As an absorber of traveling waves the overhead grounded wire is useful but not necessary. It is not needed to aid distant arresters. It is not necessary for isolated installations of transformers along the line which has no arresters. There are other and cheaper ways of getting protection. The overhead grounded wire may be used if desired near a station, with special precautions in construction, for use against direct stroke and yet save the expense for the rest of the lines.

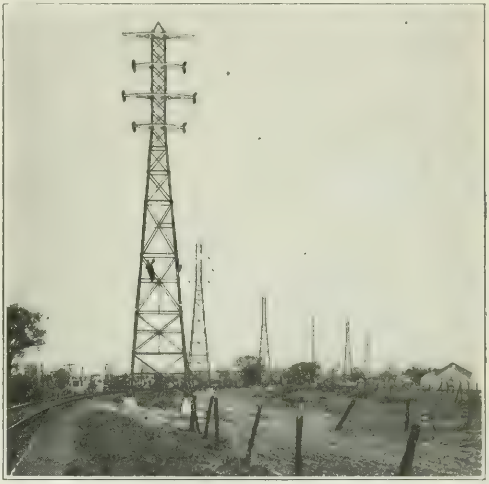
As a return wire and a parallel conductor to lessen the scattered electrostatic field, the overhead grounded wire has its normal useful function. Except for very high voltage, prominent harmonics, and near parallel telephone lines, this factor will seldom justify the expense, however.

In bringing the zero potential of the earth from its surface to the height of the power lines the installation of an overhead grounded wire on an insulated structure is very detrimental. It reduces the arc-over voltage from the power wire to ground. This is the factor which seems sufficiently prominent to condemn the use of the overhead grounded wire on wooden structures.

Both agreement and disagreement with Dr. Creighton were voiced in the discussion of his paper. W. W. Lewis contended that the experience of operating companies does not bear out the conclusions above, the Southern Power Company, for example, having found ground wires of considerable value on 44,000-volt and 33,000-volt lines in preventing splitting of wood poles and in giving mechanical support thereto. The Utah Power & Light Company, too, has found that wood poles are shattered where not protected by ground wires. This trouble has been prevented in some cases by the use of grounded bayonets or bands around the tops of the poles.

C. L. Fortescue expressed the belief that overhead grounded wires will give adequate protection where properly installed and maintained, because the increased capacity to ground which they afford should limit potential rises on the system. He pointed out that the Byllesby Engineering & Management Corporation is continuing the use of ground wires.

Dr. C. P. Steinmetz agreed with Dr. Creighton regarding the facts presented but disagreed with him in his conclusions. He declared that if he were given the choice between an overhead ground wire with no lightning arresters and lightning arresters with no ground wire, he would choose the ground wire if properly installed and maintained. The two most important functions of the ground wire, in his opinion, are its ability to reduce induced voltages and to dampen the effect of traveling waves. While the ground wire may reduce induced potentials only 40 per cent, the ground wire may be effective in eliminating 90 per cent of the troubles because the reduction in supervoltages will bring them close to the value which high-voltage apparatus can withstand. In cases of very large power circuits where the total resistance is low there may be danger from heavy line surges.



ON METAL STRUCTURES GROUND WIRES ARE NOT DETRIMENTAL, BUT MAY BE ON WOOD POLES

E. P. Peck was one operating engineer who agreed with Dr. Creighton. According to a questionnaire sent to the major operating companies, he declared, about fifty were against ground wires while only eleven were in favor of them. Furthermore, he declared that his experience in the South showed no value in ground wires, whereas they may be detrimental because they establish ground potential too close to the conductors, and reduce the insulation afforded by the wooden structure supporting the lines. As a result, on wooden pole lines a number of pins and crossarms were burned and insulators damaged.

COMMUNICATION

Résumé of Submarine Cable Telegraph Practice

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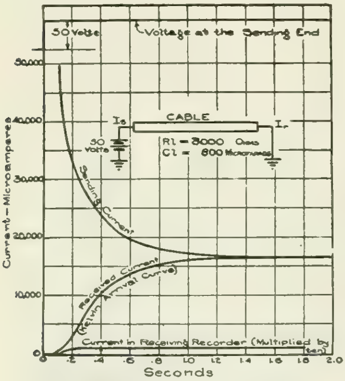
Descriptions of apparatus used in modern submarine cable telegraphy and some of the limiting conditions of operation were given by the author, who also developed a method of analyzing the action of cables and various types of apparatus which may be regarded as standard at the present time. After giving a brief history of the development of submarine cable telegraphy he took up in order the construction and laying of cables, duplexing, the cable key and the automatic transmitters, the siphon type recorder and three types of magnifiers, an equal number of telegraph relays, and the shaping of signals. Under limiting conditions of operation he considered the sensitiveness of receiving apparatus, the duplex balance, effect of extraneous currents and magnetic storms, and the desirable sending voltage. The theory of cable operation was considered from the viewpoint of arrival-curve analysis and frequency characteristics of cables and sending and receiving apparatus.



IMPORTANCE OF STUDYING ARRIVAL CURVES IS EMPHASIZED

Considering the duplex balance, the author outlined the theory of operation, accuracy requirements and operating difficulties. He concluded with a discussion of artificial lines and the applicability of Kelvin's KR law to submarine telegraphy.

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Longest and Most Deeply Submerged Telephone Cable

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American Telephone & Telegraph Company and Western Electric Company, New York

The Key West-Havana submarine telephone cable system, which is 104.9 nautical miles long and 1,000 fathoms deep in some places, was described in this paper. Three single-core, continuously loaded cables are involved, each of which provides, in addition to a telephone channel, direct-current and carrier-current duplex telegraph channels. A description was given of the design and construction of the cables, the methods of superposing the various channels on each cable and the terminal apparatus. A feature of the cables is the copper taping used to diminish the loss caused by sea return.

In discussing this paper, B. Gherardi pointed out that continuous loading was chosen because of the mechanical limitations and excessive maintenance expense of coil loading. Dependability of service was the chief requirement influencing the use of single-conductor cable with metallic-ground return.

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Printing Telegraph Applied to Factories, Banks, Railroads, Etc.

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Some of the economic principles which determine the applicability of the automatic printing telegraph to present-day communication problems were considered by the author of this paper. The discussion was limited to those forms of light-traffic-load systems which have been developed particularly for linking together the departments of a factory, the terminal points of a railroad, the branches of a bank or the units of any other large corporations. A description was given of the principles of operation of three systems, namely, the Morkrum "green-code" system, the Western Electric "start-stop" system and the Kleinschmidt system.

The three most important savings effected with printing telegraph systems are saving of time, line wire and labor. Three examples were given illustrating these points. The first took the case of a concern where orders are received at a central point but filled in different departments in the same plant. Ordinarily such orders are sent to the first department, where certain articles are placed on a truck together with the orders. The truck is then sent to the next point, where additions are made, and so on until the truck passes through all stations involved. By using the printing telegraph the orders to the different departments may be sent simultaneously and automatically while making out the invoice.

To illustrate a condition where line wire may be saved, a condition was assumed involving a need for rapid transmission of a fairly large volume of traffic from New York to Chicago. If Morse operators were placed at each point, an average of between thirty and forty words per minute would be the most that could be handled. Furthermore, to handle the traffic two line wires would have to be leased. The cost of the wires with two Morse operators at each end would be approximately $47,200 per year. By using automatic equipment the same traffic could be easily handled and $20,000 per year would be saved.

Perhaps the best illustration of how a saving of labor can be effected by the installation of automatic equipment is the case of press associations. At one time a well-known press association employed as many as 100 messengers to deliver news to various newspapers scattered throughout a city. Light-traffic-load printing telegraph systems are now giving these papers far better news service, and by means of periodic inspections a few maintenance men keep the equipment in order.

Calling attention to the extent to which the automatic printing telegraph has been applied to commercial communication, R. E. Chetwood pointed out that 185,000 miles of the Western Union trunk system is equipped with this apparatus. If it had not been used probably 460,000 miles of line would have been required. This equipment handles 75 per cent of the trunk-line traffic.

ROTATING APPARATUS

Mechanical Device Indicates Performance of Induction Machines

VLADIMIR KARAPETOFF
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A KINEMATIC device called the "Indumor," which represents the vector diagram of a polyphase induction machine, is described in this paper. The parts are made to assume at will different positions corresponding to different loads of an induction motor or generator. The primary and the secondary constants, the magnetizing current and the core loss are also adjustable at will. The device permits the visualization of the performance of an induction machine and can be used for a study of a given machine or for a selection of the constants to give the desired performance characteristics of a new machine.

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Application of Current Locus to Single-Phase Induction-Motor Calculations

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Wagner Electric Manufacturing Company, St. Louis, Mo.

THE principal applications of the current locus of single-phase induction motors are the predetermination of the performance of a projected motor on the basis of its constants and the determination of the performance and constants of an existing motor on the basis of a few simple tests. In his original paper the author treats these problems by a method which is believed to combine accuracy with comparative simplicity—the latter at least, to the extent which can reasonably be expected when dealing with apparatus of such inherent complexity as the single-phase induction motor.

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Heating of Railway Type Motors in Service and on Test

G. E. LUKE
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THE heating and cooling characteristics of railway motors, with a brief analysis of their heating at standard ratings, were discussed in this paper. The author also developed the fundamental equations defining the temperature rise of a motor on a continuous or short-time load. Applications of these equations were made in several specific examples. In his concluding remarks the author made the following observations: The copper in the armature has relatively little thermal capacity which may result in high internal temperature gradients on short-time loads. As the ventilation of the motor is increased the ratio of the one-hour to the continuous rating approaches unity. The application of the ventilated motor on the basis of the average root-mean-square current to an intermittent duty is incorrect if the maximum internal temperature at the peak load is ignored.

The nominal rating as defined by the Standards of the A. I. E. E. is a fictitious rating since it specifies the run to be made under abnormal conditions of ventilation.

As an index of motor heating, M. R. Hanna recommended the use of the ratio of heat dissipated to the total heat absorbed. In considering the maximum temperature allowable during the peak load, the length of their period must be considered. Mr. Luke said that one-third to one-fifth of the total heat dissipated was by radiation.

F. W. Peters said that the percentage of failures due purely to overheating was small. Many failures that seemed to be due to overloads often were caused by defects in the motor itself, such as breaking down of insulation due to a loose coil or the accumulation of moisture.

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Causes of Flashing of Synchronous Converters

E. B. SHAND
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

HEAVY load surges in synchronous converters produce unbalanced armature reactions and abnormal voltage conditions on the commutator, thus constituting one of the chief causes of flashing, according to extensive studies made by the author. To increase the momentary overload capacity the following main lines of progress were suggested:

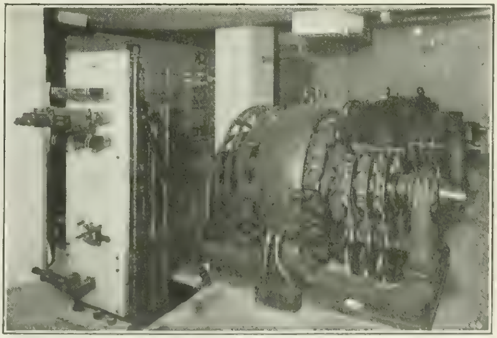
(1) The improvement of synchronous characteristics of the converter installation to obtain high stability and the reduction of the moment of inertia of the rotating masses of the converter.

(2) The reduction of the effectiveness of the unbalanced reactions in producing high voltages in the commutating zone. (High-reluctance commutating poles are an instance of this.)

(3) The prevention of the complete propagation or culmination of the arc by the insulation of conducting parts around the commutator by means of flash-guards and other devices.

(4) The limitation, by external means, of the maximum severity of the surges thrown on the machine (in which might be included the high-speed circuit breaker.)

These principles have been utilized in devising suitable means of improving the characteristics of commercial types of 60-cycle railway converters.



CONVERTER FLASHING CAN BE PREVENTED BY CONSIDERING FACTORS NAMED ABOVE

Heat Losses in Stranded Armature Conductors

Waldo V. Lyon
Massachusetts Institute of Technology, Cambridge, Mass.

THE solution of the problem of heat losses in stranded conductors embedded in rectangular slots may be accomplished by the use of complex hyperbolic functions. In using this method allowance can be made for the number of strands in each conductor and for the effect of insulation between strands. The currents in the strands are equal to those in corresponding divisions of a solid conductor of the same depth, making it possible to determine this current up to any strand by means of integration. If this were not so, the current would have to be found by a summation of vector quantities—a much more difficult solution.

The author gives a mathematical analysis of the problem in his original paper.

Analysis of Energy Loss in Polyphase Commutator Machines

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Metropolitan Vickers Electrical Company,
Manchester, England

THE energy losses in frequency changers having armatures similar to those of synchronous converters were analyzed in this paper. The author pointed out that these losses depend upon the degree to which the currents flowing into or out of the commutator or slip rings compensate one another. Taking account of the time and space overlapping of the currents, the author gave the results for different numbers of phases and power factors.

GENERAL ENGINEERING

Phenomena of Condenser Discharge Through an Air Gap

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THE usual equations of the condenser discharge through an inductive circuit, as given in textbooks, give an oscillation of progressively decreasing amplitude if the circuit resistance is less, and an impulse or unidirectional discharge if the circuit resistance is more, than twice the surge impedance. They apply only for the case in which the resistance of the circuit is constant—that is, independent of the current—and therefore do not apply to the very common case in which the discharge circuit includes a spark gap or consists largely of a gas path (as in the case with the lightning flash). Experience shows that the phenomenon is essentially different.

The author has made a mathematical study of this phenomena and developed some general discharge equations in a form somewhat different from previous publications on the subject. One of the conclusions arrived at was that the condenser discharge through an inductance of negligible ohmic resistance, but containg a gas circuit, is always oscillatory and consists of a finite number of half waves.

Professor V. Karapetoff offered an alternative equation to cover general electric circuits containing capacitance, reactance and variable resistance which has the form

$$L\frac{d^2i}{dt^2}+\frac{di}{dt}\left(r+\frac{dE}{dt}\right)+\frac{i}{c}=0$$

Amplifier and Loud-Speaking Telephone for Studying Corona Formation

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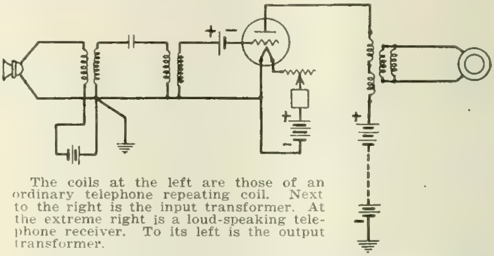
Johns Hopkins University, Baltimore, Md.

BECAUSE of the rectifying and amplifying properties of the three-electrode vacuum tube when this tube is used with the corona voltmeter, an instrument described in previous papers of the Institute, very accurate and reliable measurements can be made of the wave form of the discharge due to the alternating corona. Moreover, the sound due to corona can be amplified so that its first occurrence can be instantly detected by a loud-speaking telephone.



The coils at the left are those of an ordinary telephone repeating coil. Next to the right is the input transformer. At the extreme right is a loud-speaking telephone receiver. To its left is the output transformer.

APPARATUS USED TO AMPLIFY THE SOUND OF CORONA FORMATION

The method of detecting corona by means of the corona voltmeter, using a galvanometer with a telescope and scale, with or without a rectifying valve, while good, is inconvenient if the apparatus has to be moved from place to place. By amplifying the discharge with a vacuum tube a portable type such as the Siemens & Halske needle galvanometer can be used. In this way the corona discharge current is rectified and amplified so that a study can be made of the point where corona appears and also of the form the wave takes.

For amplification of the sound of corona the vacuum tube is connected as shown in the illustration. The greatest difficulty found in using this apparatus was to separate the pure corona note from other noises which were also picked and amplified in the loud speaker.

Five Hundred Tests on the Dielectric Strength of Oil

J. L. R. Hayden and W. N. Eddy
General Electric Company, Schenectady, N. Y.

WHILE developing a dependable method of obtaining experimental data by means of a sphere gap in transil oil, considerable study was made of the behavior of oil under disruptive dielectric stress. It was found that the nature and character of the dielectric breakdown of oil may be entirely different from that of air.

Five hundred successive breakdowns were taken on a sphere gap in oil at the same gap setting. Because of the well-known inconsistency of breakdowns in oil these observations showed wide variation. A curve was plotted to show the relation between the breakdown voltage and the number of breakdowns at each voltage. If the disruptive breakdown of oil is due to the voltage exceeding the dielectric strength of the oil, as is the case with air, it should be possible to represent such a curve of probable error, or "probability curve" as it is usually called, by an exponential equation. But this was found to be impossible, the most representative exponential curve being higher than the observations at higher voltages.

The explanation that suggests itself is that the disruptive breakdown of oil under dielectric stress is not due to the voltage exceeding the dielectric strength of oil, as is the case in air, but is due to something being carried into or produced in the dielectric field, which weakens the dielectric strength so as to cause a premature breakdown.

It was the opinion of most of those commenting on this paper that the tests on the dielectric strength of oil should be made with a different spark gap from that used by the authors, which consisted of two spheres of 1 cm. diameter with a gap of 2 mm. The gap, as proposed by the American Society for Testing materials, is made of 1-in. (2.54-cm.) flat disks, 0.1 in. (2.5 mm.) apart. Five tests on each of three samples of the same oil is deemed sufficient. F. W. Peek, Jr., said that tests made on oils with a gap of 10 mm. produced much more uniform results. Others discussing the paper were C. E. Skinner, A. B. Hendricks, F. M. Farmer, Dr. J. B. Whitehead, D. Du Bois, and Dr. C. P. Steinmetz.

◆

Solution of Alternating-Current Problems Simplified by Imaginary Quantities

Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

Cumbersome and unwieldy expressions often result when an attempt is made to solve alternating-current problems by means of trigonometry. To simplify the solution of such problems the author suggests the use of exponential expressions of the imaginary variables, such as emf., current and flux. These may be selected of such magnitude and phase that, with the real quantities, they will give simpler mathematical expressions than the real quantities alone.

◆

Skin and Proximity Effect In Tubular Conductors

Herbert B. Dwight
Canadian Westinghouse Company, Ltd., Hamilton, Ont.

The effective alternating-current resistance of tubular conductors is required by designers of radio installations, large underground cables with non-magnetic cores and electric furnace circuits. The skin-effect ratio for isolated tubes was given in one curve by the author. For stranded conductors the resistance must be multiplied by a ratio for the spirality effect. When the return conductor is near, a ratio for proximity effect must be used. A calculation of the proximity-effect ratio is compared with results of some tests.

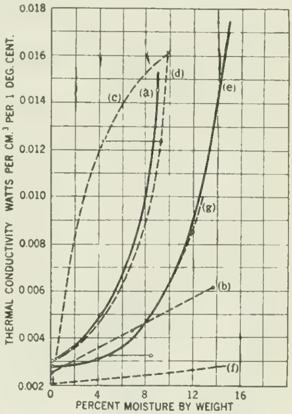
The conclusion was expressed that it seemed scarcely worth while providing a non-magnetic core with a 2,000,000-circ.mil, 25-cycle cable in order to reduce the skin effect, but that with the other cases considered, the tubular form seemed very advantageous.

Effects of Moisture on the Thermal Conductivity of Soils

G. B. Shanklin
General Electric Company, Schenectady, N. Y.

One of the methods to increase the carrying capacity of underground cables is to increase the thermal conductivity of the surrounding soil. Tests by the author prove conclusively that the presence of moisture in soils surrounding underground circuits is very effective in conducting away heat. However, it is immaterial what kind of soil surrounds the conduit so long as it will absorb and retain a sufficient amount of moisture.

Investigations with unsifted builders' sand of medium texture indicated thermal conductivities of 0.013 to 0.0154 watts per cubic centimeter per degree Centigrade for sand containing 9 per cent moisture, 0.0045 to 0.0055 watt with 4.2 per cent moisture, 0.0034 to 0.0039 watt with 1.6 per cent moisture, and 0.0026 to 0.0033 with 0.15 per cent moisture. From 9 to 10 per cent of moisture was the maximum that could be retained. Tests with pulverized yellow-clay subsoil showed a tendency to dry and cake around the heat-radiating source with a temperature as low as 50 deg. C. This caused a marked decrease in thermal conductivity.



MOISTURE IN SOIL* EFFECTIVE IN CONDUCTING AWAY HEAT

Much more satisfactory results were obtained with a mixture of two-thirds clay and one-third builders' sand. With 15 per cent moisture the thermal conductivity was 0.013 watt to 0.0194 watt per cubic centimeter per degree Centigrade, while with 8.5 per cent moisture or less the thermal conductivity lay below 0.0035 watt. It was found that finely divided sandy soil retains moisture much better than pure builders' sand.

In commenting on this paper, D. W. Roper said that a committee of the A. I. E. E. is studying this question in co-operation with the Massachusetts Institute of Technology. The primary object of the investigation is to determine the maximum working temperature of underground cable. R. W. Atkinson strongly advocated more research on the conductivity of soils. Commenting on the difference in results of various investigators, C. J. Fechheimer expressed the opinion that the reason for this divergence may be the heat-insulating action of air pockets and of air between the granules of soils. Others taking part in the discussion were W. A. Del Mar and G. E. Luke.

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*(a) Clean yellow builders' sand (author), (b) fine white quartz sand, mesh 0.25 mm. (Kennelly); (c) clean yellow sand (Teichmuller); (d) curve c reconstructed; (e) yellow sand clay soil (author), (f) fine sandy soil (Kennelly); (g) normal or average sandy soil (Teichmuller).

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Sheldon Memorial Fund

To the Editors of the Electrical World:

A few months ago, as already noted in your pages, the Sheldon Memorial Committee was organized to receive subscriptions toward a foundation in honor of the late Dr. Samuel Sheldon, professor of electrical engineering and physics at the Polytechnic Institute of Brooklyn, 1889-1920.

As chairman of the committee, I am glad to report that we are now turning over to the treasurer of the Polytechnic Institute $15,018, the sum so far paid in by more than 1,000 subscribers. There are still a few unpaid subscriptions, and we are hoping to secure enough further pledges to raise the fund to at least $20,000. Although the sum raised was hardly sufficient really to endow a laboratory, the corporation of the institute has ordered that the electrical measurements laboratory be known hereafter as the Samuel Sheldon Memorial Laboratory of Electrical Measurements, and its members have collected among themselves an additional $1,000 for immediate improvements and the installation of a memorial tablet. In this manner, the entire fund raised by our committee will be invested in the form of a trust and the income used perpetually for the maintenance of this laboratory, which will thereby become one of the best laboratories of electrical measurements in the country.

I wish also to note the general sentiments of esteem and admiration expressed concerning Dr. Sheldon, the loyalty of several hundred former students to his memory and the enthusiasm found within the splendid institution to which with such conspicuous success he devoted so many years of his life. T. C. Martin,

Chairman Sheldon Memorial Committee.

New York City.

Invention of Drawn Tungsten Wire

To the Editors of the Electrical World:

On page 99 of the Electrical World for Jan. 14, 1922, appears an anonymous article in which the following paragraph refers to the research that led to the production of the ductile tungsten-lamp filament:

"Dr. Coolidge of the research laboratory promoted a line of investigation and research in tungsten metal that covered a period of several years and resulted in the invention of drawn tungsten wire, a ductile, practically non-breakable filament. This advance in the art was patented Dec. 30, 1913."

The statement here made is misleading, as it was my own research and investigation and not that of Dr. Coolidge that led up to and "resulted in the invention of drawn tungsten wire, a ductile, practically non-breakable filament." Colin G. Fink,

New York City. Research Engineer.

Further Comment on the Jobber Situation

To the Editors of the Electrical World:

I was certainly glad to read your editorial of Dec. 31, which I think is one of the best I have ever read, and those of Dec. 24 and Jan. 28, which are also excellent. Frankly, I am somewhat surprised at your understanding of jobbing conditions and the clear grasp of the whole situation that you must have had to write these clear-cut editorials.

Your stressing the added service which the jobber renders in the selling of appliances is especially important and interesting and ought to be dwelt upon. There are two or three kinds of distributers—the warehousing distributer, the selling or pioneering distributer and the distributer who performs both functions. Anyway, I believe fully in your statement that the function of the distributer of appliances is largely in the "education and stimulation of the trade to the necessity of pioneering these commodities by creative selling and is one of greater detail and far greater cost.

The manufacturer who does not do his share toward maintaining permanent and economical distribution of electrical products during such a period of readjustment and liquidation of stocks as we have been going through by standing behind his regular distributers—who have probably done much to build up the market for his product by pioneering work at some time in the past—is making a mistake. The man who to artificially keep his output up to normal goes into the field and sets up other jobbers, with no protection to the old distributers and little attention to the permanent and economical methods of distribution, is certainly not on the right track to promote the good of the electrical industry.

Moreover, there is another "old-line" kind of manufacturer who depends upon "loyalty" far too much, and not enough on cold-blooded, sound business principles. This manufacturer is fairly loyal to his regular distributers, not often adding new ones to the detriment of the business of the regular distributers. He has the "loyal" support of his distributers. But he depends too much upon this loyal support regardless of competitive price conditions. In other words, both the manufacturer and his distributers suffer severely on account of the manufacturer's not keeping his prices competitive with the product of his competitor which has equal merit with his own.

I note your statement in your last editorial that the future of the electrical jobber is in the manufacturer's and his own hands. If the electrical jobber and the electrical dealer would get on more intimate terms and realize that their interest in the industry brings them naturally into a closer connection with each other than with any other branch, and that the particular job for them to do is to sell, exploit, pioneer and develop more successful plans of selling, it seems to me that many of our troubles with the manufacturer would take care of themselves and could be forgotten. If the selling end of the industry became in reality efficient, the old question of the manufacturer selling through other channels or to others than real jobbers would automatically disappear. Real selling, especially of appliances, is becoming more and more the one important function of the jobber and the retail electrical merchant. I am looking out for your editorials as they appear, and I am much interested in them. N. J. Harvey,

Illinois Electric Company, President.

Chicago, Ill.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Ground Pipe Installed by Use of Piledriver

TO AVOID the laborious method of driving ground pipes at the base of poles by hand, the writer recently constructed a portable piledriver which cuts the old working time of two hours to ten or fifteen minutes, depending on the nature of the soil. Previously the driving of these pipes was done only with extreme difficulty, since the usual method required a man supported on a pole by climbers and safety belt to swing a heavy sledge. In such an awkward position the sledge mashes and bends the pipe, and owing to the vibration the man has difficulty in striking the pipe, often missing it and damaging the pole.

This piledriver consists of an old piece of line shaft about 3 in. in diameter and 18 in. long attached to a steel guide rod 8 ft. long which will enter a 1-in. pipe without rubbing. At the other end an eyebolt allows a rope to run through a pulley, mounted from the crossarm, to the ground man. By pulling down on this rope, as shown in the photograph, and releasing it the weight drives the pipe from 6 in. to 12 in. at a stroke. This method does not batter or bend the pipe and does not damage the pole, and it is also much safer for the operator than the old method. GEORGE M. MILLER,

Superintendent Electric Distribution and Construction,
Louisville Gas & Electric Co.
Louisville, Ky.

Suggests Brush Change and Avoidance of the Presence of Oil

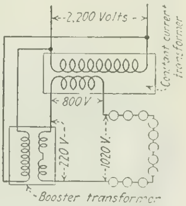
THE trouble which was related on page 289 of the Feb. 11 issue of the ELECTRICAL WORLD by E. C. Channing of Niagara Falls in the operation of a rotary converter is both unusual and interesting. It appears quite evidently to be due to mechanical rather than electrical causes. The filling up of the commutator slots with dust is not unusual, but rarely gives trouble owing to the width of the slots or the looseness with which the dust is packed. In this case, however, the dust appears to have packed in so tightly that the resistance between the bars became extremely low, causing a short-circuit. This may have resulted from the fact that the slots were too narrow, coupled with the presence of oil on the commutator, causing the dust to stick together and by degrees pack itself into a solid mass between the bars. The brushes would tend to deposit more dust in the slot, and the material probably built up in a sort of mound above the commutator level. The brushes in passing over this would spark and wear away the commutator by depositing a thin film of copper across the slot. This would appear to be the basic cause of the trouble.

As to the remedy. First, a brush engineer should be called in to determine whether a change in the type or quality of the brushes would not minimize the deposition of carbon dust, and, second, the experiment of "V-ing" out the commutator slots might be tried to allow more room for the secretions of dust and consequently a likelihood of its being dislodged readily. Above all, a very careful examination for oil on the commutator should be made. T. F. BARTON,

Lighting Engineering Department.
General Electric Company,
Schenectady, N. Y.

Standard Transformer Boosts Series Circuit Voltage

SOME time ago a central-station company in the Middle West obtained a street-lighting contract in a small town for a total incandescent lighting load of 5.5 kw. The lamp load required 1,000 volts plus the voltage lost in the line wires. In checking over the available stock of constant-current transformers the distribution engineer of the company discovered that the only transformer reasonably near the size required was rated at 4.4 kva., 2,200 volts primary and 5.5 amp. secondary. At its full-load rating this transformer gave only 800 volts. The first thought was to connect a booster in the primary circuit, but the load conditions required that the primary be raised approximately 550 volts, or 25 per cent. Two considerations made this impracticable—first, a 25 per cent increase in the primary voltage would work the transformer iron too high on the saturation curve, and second, there was no transformer at hand having a 2,200-volt primary and a 550-volt secondary. These objections were avoided by connecting a booster on the secondary side of the constant-current transformer, as shown in the diagram. A standard 1-kva., 2,200/110/220-volt line transformer was used and so connected as to raise the secondary voltage 220 volts or slightly more than 25 per cent. This gave sufficient margin to enable the constant-current transformer to take care easily of any fluctuations due to the variations of the supply voltage.



STANDARD TRANSFORMER BOOSTS LIGHTING CIRCUIT

Fargo, N. D. H. S. RUSH.

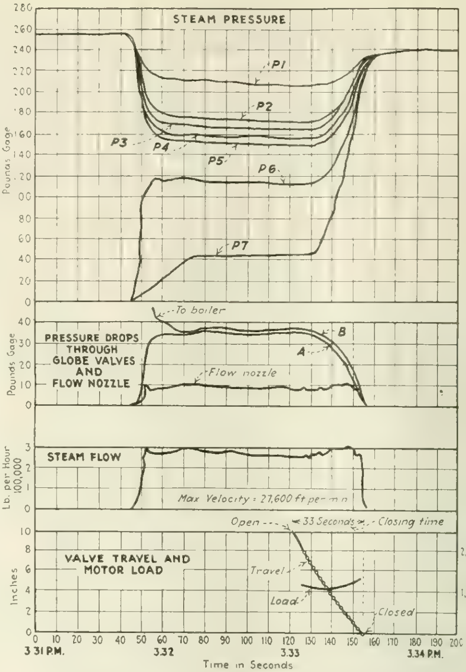
Emergency Closing Tests of Motor-Operated Valves

Although all the motor-operated valves subjected to the test reported on page 249 of the Feb. 4 issue of the Electrical World successfully shut off the steam after discharging to atmosphere under high pressure, subsequent internal examinations have indicated that certain features of construction are desirable, and possibly necessary, if valves are called upon to close a number of times without intermediate overhauling. For example, machining of interior guides is advisable to prevent the valve disks from dragging across their seat before they are entirely closed. It also seems desirable to round the entering edges of the valve disks to reduce the possibility of seizure. Since some previous attempts to close motor-operated valves discharging to atmosphere under high pressure have not been successful, it is also likely that other features incorporated in the valves recently tested are particularly desirable, notably the ball-bearing yokes, nuts and extremely powerful closing motors. More details regarding the construction of these valves are given in the accompanying table.

As reported before, the tests were conducted at the Essex station of the Public Service Company of New Jersey under the auspices of the prime movers committee of the N. E. L. A. Technical Section, of which N. A. Carle is chairman. The actual conduct of the tests was carried out by Peter P. Dean, who is the manufacturer of the motor-operating equipment.

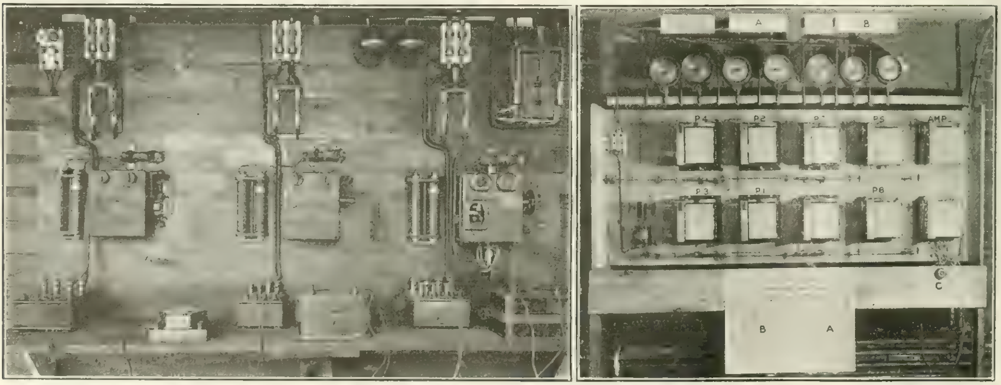
The test valves were controlled from a board arranged as shown in the accompanying illustration. The control at the right was permanently connected to the valve *A*, next to the main steam header; the control in the middle was permanently attached to the second globe valve *B*, and the control at the left operated the valve under test.

Graphic recording instruments, all driven from the same motor, were arranged as shown in another of the accompanying illustrations. The charts traveled uniformly at a speed of approximately 6 in. per minute during each test, registering the pressures at seven different points from the main steam header down to the valve under test. These points are marked *P*-1 to *P*-7 inclusive on the piping layout (shown below the instrument board), with corresponding markings on the recording instruments. The instrument at the right-hand side of the lower row was provided with twenty pens, of which eighteen were connected electrically to position contacts permanently attached to each valve ½ in. apart. Accordingly, an exact record of the time taken by a test valve to reach any point was recorded. The nineteenth pen on this indicator was connected electrically to a contact on the control switch operating the test valve, so that a record of the exact time of the closing and of the opening of the test valve-control switch was obtained. The twentieth pen was connected and during each test this button was pushed every ten seconds.



CONDITIONS WHICH EXISTED DURING THE TEST OF ONE 10-IN. GATE VALVE

In testing the gate valves steam was admitted from a



BOARD FROM WHICH VALVE TESTS WERE CONTROLLED AND INSTRUMENT BOARD ON WHICH CONDITIONS WERE RECORDED DURING TEST

22-in. main header, to which the 10-in. testing line was connected. Eight 1,278-hp. Babcock & Wilcox cross-drum, water-tube boilers with underfeed stokers were used during this test. In order to maintain full boiler pressure of 225 lb. and 150 deg. Fahr. superheat with free blow to atmosphere through one 10-in. opening, it was found necessary to operate these boilers at approximately 150 per cent of rating.

FEATURES OF FIVE VALVES WHICH WERE TESTED

A—10-in. cast-steel gate valve with "monel-metal" mountings, ball-bearing yoke nut and double-disk gate with taper seats.
B—10-in. cast-steel gate valve with "monel-metal" mountings, ball-bearing yoke nut and solid-wedge gate with taper seats.
C—8-in. cast-steel gate valve with "monel-metal" mountings, ball-bearing yoke nut and solid-wedge gate with taper seats.
D—6-in. cast-steel, single-seated gate valve with nickel trimmings with internally hinged disk closing with the pressure (special importation).
E—10-in. imported cast-steel gate valve with outside guides, parallel seats, double-disk gates and mountings of "platinum."

As reported in the Feb. 4 issue, the gate valves closed in forty-seven to fifty-five seconds, with a boiler pressure aproximating 225 lb. and a superheat about 150 deg. Fahr. One high-speed test was conducted with a 10-in. valve in which the closing time was reduced to twenty-seven seconds. Steam discharged at the rate of 308,000 lb. to 340,000 lb. per hour with the 10-in. valves entirely open. The maximum steam velocity was 27,600 ft. per second.

At some future date further tests may be conducted on larger size valves to ascertain if any further modifications in construction are desirable.

Public Service Production Co., T. W. STINSON,
Newark, N. J. Consulting Mechanical Engineer.

Non-Ventilated Units for Lighting Show Increase in Use

TESTS made on indirect and semi-indirect lighting units show that, when ventilated, the temperature of the lead-in wires is appreciably raised above that for non-ventilated units. A natural inference would be that the more a fixture is "ventilated" the cooler it will run, but experiments show that this is not always the case.

There is a growing tendency toward the unventilated unit since it has a decided advantage in that it may be made dust-proof and is usually of better appearance. There has for a long time been an erroneous impression abroad that the life of an incandescent lamp is appreciably shortened by a high surrounding temperature, owing to increased operation of the filament temperature. Theoretically the filament temperature is increased, but this increase is so small relatively at 2,500 deg. to 2,800 deg. C. as to be unnoticeable even on a precision life test. It probably is for this reason, to some extent, that inclosed units for gas-filled lamps have all been ventilated. The disproving of this idea and the general progress in design for cleanliness, maintenance of candlepower, appearance, accessibility, etc., account largely for the growing tendency toward non-ventilated units.

It has also been shown that ventilating inclosed units does not necessarily cool the wire entering the socket. Much depends upon the design and type of the unit. Ventilation frequently creates a "chimney effect" which causes the hot gases to rise around the parts of the base and socket which it is desired to keep cool. Heat can also be dissipated by radiation as well as ventilation, and in units which are well designed from the standpoint of radiation ventilating holes often actually cause an increase of temperature at the wire.

Some units have been designed to be used without ventilation. Ventilation holes allow dust to be drawn into the unit by hot-air circulation and defeat the purpose of the design, which was to eliminate the collection of dust in the semi-indirect bowl, to provide ease of maintenance and to prevent a rapid drop in efficiency.

A 200-watt unit having a metal housing of the socket at the top, a large broadly flaring glass bowl and a metal-bottom plate was tested under different conditions of ventilation to determine exactly what effect ventilation had upon the operating temperatures of the lamp and the lead-in wiring. This unit was made and intended for use with no ventilating holes. Five conditions were tested as follows: (a) Non-ventilated, in its ordinary commercial condition; (b) ventilated by holes in the top cap and in the bottom plate; (c) ventilated by holes in the top cap only; (d) ventilated by holes in the top cap, bottom plate removed; (e) ventilated by holes in the tube and bottom plate.

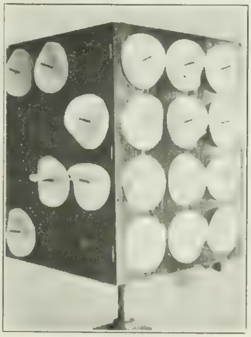
The results showed conclusively that the lamp-bulb temperatures were not unduly high and were reduced only about 6.4 deg. even by the maximum ventilation.

The important fact, however, is that ventilation in every case raised the temperature of the wire just above the socket, and the more ventilation there was the hotter this wiring became. Thus, under conditions (b) and (d), as described above, the wiring was 10 deg. hotter than in case (a), where no ventilation was provided.

The explanation is that the ventilating holes permit currents of hot air to rise through the fixture, carrying the heat to the top and thus heating the connecting supply wires. When there are no such air currents inside the fixture, this effect is avoided and the heat is dissipated chiefly by raidation from the outer surfaces.

National Lamp Works, CHESTER L. DOWS.
Nela Park, Cleveland, Ohio.

Revolving Chart Cabinet for Records



BY ROTATING CUBICAL PANEL, CHARTS CAN BE EASILY FILED OR INSPECTED

A CONVENIENT chart cabinet of simple but effective design is in use at the Webster Street Station of the Worcester (Mass.) Electric Light Company. As shown herewith, it consists of a box 42 in. square and 4 ft. 5 in. high, of ¾-in. stock, mounted on a 2¼-in. pipe pedestal which can easily be moved from one location to another. On the faces of the cabinet are inclined wooden pins for holding various circular charts from the boiler room and other apparatus. There are four interior shelves for holding supplies of any nature. One-half-inch pins 3 in. long are used for the most part, and the four faces equipped with pins will easily carry 13,000 charts, to say nothing of the inside storage space now used for coal-testing records, samples, etc.

Worcester Electric Light Co., E. H. PERRY.
Worcester, Mass.

Testing Installed Generators to Determine Temperature Ratings

SOMETIMES, especially in these days of both 40-deg. and 50-deg. machines, it becomes necessary to check the temperature ratings on generators after they are installed. Where extreme accuracy is not necessary the tests are comparatively easy to make by means of thermometers placed on different points of the core and winding. The hottest points should be selected, and the thermometer bulk must be covered with putty, waste or other heat insulator.

There are two satisfactory methods of making such a test on a direct-current machine. First, the generator can be loaded by means of a water barrel, the entire power generated being dissipated as heat; second, the generator can be loaded by short-circuiting the terminals and building up the field until full-load current is reached. The latter method can be applied only to interpole machines. The generator terminals are short-circuited at the bus so that the armature current can be read on the switchboard ammeter, and the shunt field is separately excited. In the case of a compound-wound interpole machine the series field must be reversed. After increasing the shunt-field current until the current in the armature is full-load current a run is made until the temperature readings are constant. The temperature of the armature winding, armature core, commutator and series field will be nearly but not quite what would be obtained under normal full-load conditions. If the generator has a shunt field with the coils divided in half so that they can readily be connected up independently and in such a manner that the fluxes generated by each half tend to oppose each other, then, if a little over half voltage be placed on one coil (the coil with flux opposed to the series-field flux) and the voltage on the other coil be adjusted to give full-load current in the armature, the heating conditions of the whole machine will be very close to those obtained under normal full-load conditions.

In the case of an alternating-current generator, if a rheostat of sufficient size is not available, the generator may be tested by connecting to a distributing system fed by other generators. The total rating of the other generators should be large compared with the tested generator, otherwise the tested generator may raise the frequency too high.

Where a separate generator may be used for the test, it must be at least as large as the tested generator. The two generators are brought up to normal speed and voltage and synchronized. By increasing the field on the generator to be tested and by decreasing the field on the other generator until full-load current is obtained at normal voltage, then the temperature of the machine under test will be a little higher than would be obtained under normal full-load conditions.

An example of the need of such a test and the readings taken are illustrated by the following recent case. A manufacturer shipped three 192-kw., 0.8 power factor, 2,300-volt, 52.2-amp., 60-cycle, two-phase generators which were supposed to be 40-deg. machines. Through an oversight at the factory these machines were supplied with nameplates stamped "50-deg. C. rise continuous." To check the temperature rating of these machines a test run was made as shown in the table accompanying. As will be seen, the maximum temperature rise was 33.5 deg. C. on the core, 28.5 deg. C. on the winding and 36.5 deg. C. on the field winding, which left no doubt as to the machines being 40-deg. machines.

HEAT RUN TEST ON ALTERNATOR

Rated 192 Kw., 0.8 Power Factor, 2,300 Volts, 52.2 Amp., 60 Cycles, Two-phase

				Alternator No. 2 (Overexcited)								Alternator No. 1 (Underexcited)				
				Temperatures, Deg. C.									Temperatures, Deg. C			
Time	Stator		Field Amp.	Core			Winding, Collector. Ring End				Winding *	Field Amp.	Core	Winding, Coll. Ring End.		Room Temp.
	Volts	Amp.		1	2	3	4	5	6	7	8		1	2	3	
11 30	2,300	42.2	66.5					.			..	4.0				30.5
12 00	2,275	52.0	67	52	51.8	54	54	55	55	54	..	4.5	50		52	32
12.30	2,275	52.2	68	60	59 2	61.5	59	59	59	58		4.5	56.7		55	32.2
1.00	2,275	52.2	68	63 5	62.5	65	61	61	61	59.5		4.5	59.5		57	33.5
1 30	2,275	52.1	68	65.2	64.2	67	62.5	62.5	62.5	61	..	4.5	61		58	34 8
2.00	2,275	52.2	68	66 7	66	68	62	62	62	61	..	5.0	62		57.5	35
2.30	2,300	52.0	68	66.5	65.8	68.3	62.5	62.5	62.8	61.3		5.0	62.2		58	35.5
3.00	2,275	52.5	67.5	67	66	68.8	62.5	62.5	63.5	62.2	. . .	5.5	62.5		59	35.5
3.30	2,275	52.2	68	67	66	69	62.5	62.5	63.5	62.2	. . .	6.0	62.5		58.5	35 5
Read at shut down only								..		....	61	.		58	..	
Temperature after shut down						fell	fell	64	fell	63	63	..				
Field-coil temperature				68	66.5	72	71	..	.			...			..	

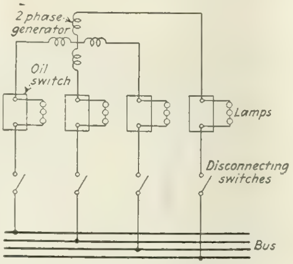
*Winding at flywheel end, temperature taken only after shutdown.

EUSTACE C. SOARES,
Electrical Engineer.

Ophuls, Hill & McCreery, Inc.,
New York City.

Phasing Out with Lamps

ALL that is needed to phase out a 440-volt circuit are a few lamps and weatherproof sockets. Four 110-volt lamps should be connected in series in each line across the terminals of the oil switch as shown. Before the generator is started the bus voltage will cause them to burn dim. As soon as it is brought to full voltage they will act as synchronizing lamps, alternately bright and dark. If those in phase *A* are bright at the same instant as those in phase *B*, the machine has the proper direction and may be connected to the bus. If those in phase *A* are bright while those in phase *B* are dark, the direction is wrong and it will be necessary to interchange the leads of one phase, before the machine can be paralleled with other generators of the system.



PHASING OUT 440-VOLT CIRCUIT

Four lamps should be shown across each switch.

Berlin, N. H.
RALPH MCKINNEY.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Running a Meeting—Electrical or Otherwise

By Kassandra

SOME meetings are for the purpose of allowing the speakers to exercise their voices while the audience takes a nap. These remarks do not apply to such meetings, but only to business meetings, as of committees where action is to be taken and when the number is so small that regular rules of order are cumbersome.

There is, or should be, a chairman in charge of the meeting whose business it is to guide the discussion so that in general the committee shall accomplish the results it really wants. It is a real art to run a meeting properly, and a few suggestions may be of benefit.

We are discussing only informal, or at least semi-informal, meetings, but even in these it is very important, although not absolutely necessary, to have a list of the matters to be taken up in turn. Without such a list important things are often omitted and time is wasted by devoting too much effort to unimportant things which happen to be brought up first. When this list of order of business can be submitted to members at or before the start, it is still more advantageous.

It is important, so far as possible, to stick to the list and to discuss but one item at a time. True, there will always be members of the committee who have ideas that they must expound whether they are pertinent or not. When this happens, the chairman should try to persuade the speaker to postpone his remarks until the subject under discussion is laid aside.

Another plan which helps discussion a great deal is always to start off with some definite proposition or motion. In informal meetings today there is a custom of first having a very general discussion without any motion. This is because at first the members of the committee have not crystallized their ideas sufficiently to wish to draw up a motion. If, however, the chairman will at the start insist that there be some motion before the meeting, it helps, and he can often help by himself stating not only one but several possible motions. This will clarify the situation much better than if they carry on a discussion without any motion before them at all.

Another plan which often helps to save time and helps the members of the meeting to clarify their minds and get together is for the chairman, after perhaps one or two of the members have spoken, to poll the meeting, that is, to ask each member in turn to state briefly his ideas. Often when each member of a committee has expressed himself it turns out that the meeting is so nearly unanimous that no further discussion is needed.

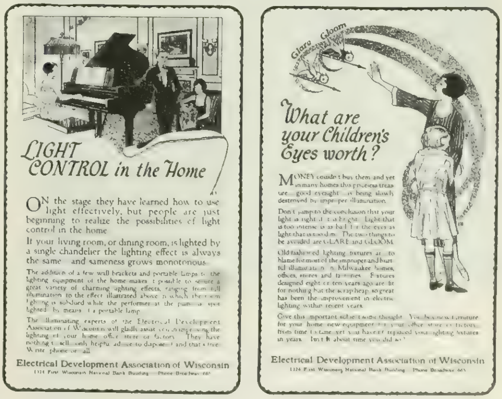
Still another time-saving method is that when some proposition is laid before the meeting the chairman shall call for an informal and preliminary vote without allowing any discussion whatsoever, stating that the vote is not to be binding, but is merely to indicate how the committee feels before the matter is discussed. The chairman takes the vote, announces the figure as so many for, so many against, and then may say that in order to save time the majority will not be allowed to speak until the minority have expressed their opinions.

Unless the minority by discussion can change the opinions of some of the majority, it would only be a waste of time for the majority to talk. After the minority have expressed their opinions the chairman can ask if any of the majority have changed their minds. If none have, it is obvious that the committee is ready for a definite vote, provided that it is a subject which the members are willing to decide by a majority vote rather than to wait for unanimity. This principle, of course, cannot be carried to an excess, but in small and informal meetings it will save much time.

In a formal legislative body the speaker entertains only motions made by the members. In an informal committee meeting the chairman can usually save time and help all along the line by himself formulating the motions. If he attempts to do this so as really to express the idea of the committee he can often accomplish a great saving in time in helping the committee to get their minds together.

A Better Lighting Campaign in Milwaukee

CONSTRUCTIVE advertising for better lighting in the home is being conducted in Milwaukee by the Electrical Development Association of Wisconsin. Thirty-inch advertisements, of which two good examples are shown here, have appeared three times a week. Other typical advertisements play up such ideas as "When the sun went down the caveman went to bed," "Lighting fixtures can make or mar a room," "How many convenience outlets have you?"


Glare
Gloom

LIGHT CONTROL in the Home

ON the stage they have learned how to use light effectively, but people are just beginning to realize the possibilities of light control in the home.

If your living room, or dining room, is lighted by a single chandelier the lighting effect is always the same—and sameness grows monotonous.

The addition of a few wall brackets and portable lamps to the lighting equipment of the home makes it possible to secure a great variety of charming lighting effects, ranging from full illumination to the effect illustrated above in which the room lighting is subdued while the performer at the piano is spot lighted by means of a portable lamp.

The illuminating experts of the Electrical Development Association of Wisconsin will gladly assist you in improving the lighting of your home, office, store or factory. They have nothing to sell—only helpful advice to dispense—and that's free. Write, phone or call.

Electrical Development Association of Wisconsin

What are your Children's Eyes worth?

MONEY couldn't buy them and yet in many homes this precious treasure—good eyesight—is being slowly destroyed by improper illumination.

Don't jump to the conclusion that your light is right if it is bright. Light that is too intense is as bad for the eyes as light that is too dim. The two things to be avoided are GLARE and GLOOM.

Old fashioned lighting fixtures are to blame for most of the improper and hurtful illumination in Milwaukee homes, offices, stores and factories. Fixtures designed eight or ten years ago are fit for nothing but the scrap heap, so great has been the improvement in electric lighting within recent years.

Give this important subject some thought. You buy new furniture for your home, new equipment for your office, store or factory, from time to time, yet you haven't replaced your lighting fixtures in years. Isn't it about time you did so?

Electrical Development Association of Wisconsin

ADVERTISEMENTS USED IN BETTER LIGHTING CAMPAIGN

Another Reason Why More Electrical Homes Are Needed

THE constant need of home electric demonstrations is shown in the following story related by an employee of the British Columbia Electric Railway Company. He says:

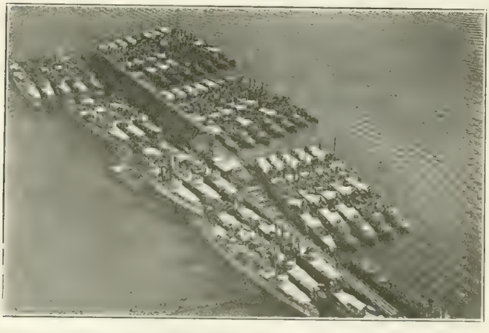
"Talking to a builder the other day, I asked him if any of his otherwise excellent houses had any baseboard outlets for electrical appliances. 'No,' he said, 'I don't bother much with those. The electrical work costs me too much. Why, in one house I built the other day the electric wiring cost me just $130.' I asked him what people would do who had standard or table lamps, as nearly everybody had. 'Shucks!' he said. 'What I would do in my case would be to bore a hole in the floor and run a wire down to the basement and connect it up there. Any one can do that. I wouldn't pay an electrician for that.' So thinks the world today. People put in the most expensive plumbing fixtures, but when it comes to electrical work they skimp and cut it to the bone."

Warships Use Central-Station Service in San Diego

BY P. P. PINE
Sales Engineer San Diego (Cal.) Consolidated Gas & Electric Company

ALTHOUGH during the last few years there has been an increasing amount and variety of load taken on by central stations from industries which formerly obtained power from their own plants, it is rather unusual even in this day for a public utility to supply warships with electricity. But in San Diego, the home port of the Pacific destroyer fleet, this service to naval vessels has come to be a considerable factor.

There are usually from thirty to sixty destroyers in the harbor of San Diego. These are grouped in "nests" and tied along the wharf, as shown in the accompanying illustration, which was photographed from an airplane.



"NEST" OF DESTROYERS SERVED ELECTRICALLY

It was found to be very wasteful for each ship to keep its own plant in operation to supply lighting and steam. The drastic reduction in the appropriation for fuel supply makes it necessary that every opportunity be seized to economize by efficient operation, and with this end in view a contract was entered into with the San Diego Consolidated Gas & Electric Company to supply lighting service at various points along the wharf.

The connected load of a destroyer averages about 4 kw. for lighting and 15 hp. for power, but the motors, which are of the direct-current type, are not ordinarily operated when the ship is in port. The ship's plant consists of two 25-kw. turbine-driven direct-current generators.

The blacksmith and machine shops, as well as the battery-charging plant which handles the work connected with the fleet, are erected on the wharf. These are served by two motor-generator sets of 90 kw. aggregate rating. There is a total connected load of more than 100 hp. in motors in the shops. The battery-charging load is heavy as there are a great number of batteries used on the destroyers. There have been as many as 750 floating on the line at one time, although the average load is about 300. This business has a very good load factor, the power and battery charging keeping the demand steady throughout the day. The consumption is about 100,000 kw.-hr. per month.

What Other Companies Are Doing

Binghamton, N. Y.—During the month of December, 1921, the Binghamton Light, Heat & Power Company showed a net increase in meters of 154, and thirteen new power customers were added, varying in demand from 1 kw. to 250 kw. For the year ended December, 1921, the total number of contracts handled was 4,794, of which 2,275 were new contracts. During this same period 2,294 meters were set and 543 removed, indicating a net gain of 1,751. The city of Binghamton is planning extensive additions to its ornamental street-lighting zone, a large portion of which will be completed in the current year.

Sandusky, Ohio.—Facts supported by actual demonstration to prove the increase in production through the use of high-intensity illumination in industrial plants were the feature of an interesting lighting conference and demonstration held in Sandusky, Ohio, recently. The demonstration was witnessed by three audiences composed of representatives of Sandusky's industries and commercial houses. The exhibit was arranged by the Sandusky Gas & Electric Company and the Edison Lamp Works of the General Electric Company and is part of a broad educational movement in behalf of better industrial and commercial lighting.

Rutland, Vt.—The Vermont Hydro-Electric Corporation reports a marked increase in its industrial power load as a result of the resumption of operation of the slate grinding mills in its territory, which are running twenty-four hours a day, as the demand for their product at the present time is beyond the capacity of the mills.

Reading, Pa.—Since Jan. 1, 1922, the streets of the cities of Lebanon and Reading, served by the Metropolitan Edison Company, have been lighted entirely by electricity. At the beginning of this year 581 gas lamps in Reading and twenty in Lebanon were discontinued. These have been replaced with electric lamps, which will mean a considerable saving in the cities' annual lighting bills.

San Diego, Cal.—The San Diego Consolidated Gas & Electric Company has begun the publication of a house organ, which has been named the *Glow* and is being circulated among the employees and security holders of that company in order to effect closer co-operation and a better understanding.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development, the Business and Economic Problems of the Manufacturer, Jobber, Agent, Contractor and Dealer

Export Trade a Question of Foreign Exchange and Hard Work

BY JOSEPH MCELROY 3D
Export Sales Manager Pass & Seymour, Inc.

THERE is no reason why the electrical industry of America should not export a good supply of its products during the coming year. For, speaking generally, it is not German competition, Japanese competition or any other competition that is causing the loss of export trade of America today. It is largely the question of exchange. This, of course, is a serious problem and cannot be settled by any special prescription which will bring the export trade back to life again. It will only come through strenuous work on the part of American manufacturers and the operation in full of the old law of supply and demand, and this is going to take some time to work out. Those countries which are not manufacturing countries and which have stocks of various materials, will find that their exchanges will come back nearly to normal as soon as they market these products at a price which insures a profit over the cost of production.

JOSEPH MC ELROY, 3D

There seems to be no other remedy for exchange except this. The placing of a loan, the extension of credit, the formation of international bank schemes, will all help to some extent, but they will not give the full answer to this question, which is a large one and goes right down to the bedrock of commercial trade. One country will, of course, improve faster than another, and it is better to state the truth, know the actual conditions and have the foresight and vision to look past them into the future rather than to close our eyes and delude ourselves or go to the other extreme and feel that we should quit the export trade altogether.

This is a time when American manufacturers of electrical material should put their backbone where their wishbone now is and warm their feet. Too many of the American manufacturers of electrical devices, as well as other lines of manufacturers, developed a bad case of cold feet during the year 1921 because of the slump in the manufactured exports from the United States. These manufacturers did not see during the years preceding 1921 that the abnormally successful conditions of those years could not last. No more can they see that the abnormally bad conditions of 1921 and the present time cannot last. Trade in this country has always gone more or less in waves, or, as some term it, in cycles. We are now at the bottom of the wave and therefore our vision is obscured and we cannot see the horizon, but with the beginning of 1922 I believe that we are starting to come up to the crest of the wave again, and there is little doubt but what the crest of the next wave will be higher than the last, so that we will be able to see further and have a larger business on a satisfactory basis than this country has ever had before. But instead of idly waiting for the water to carry us to the crest of the wave it is necessary for us to help ourselves.

It will be necessary for us to advertise in periodicals which will assist in securing and holding foreign trade; to keep on the job every minute of the twenty-four hours a day and to know our jobs, which means considerable study. Many of the export managers during the last four years have sat in beautiful offices and dictated more letters declining orders and explaining why they could not make delivery than they did in dictating letters to secure orders and new business. It is time for the export manager to go out and try his hardest to develop business.

HARD WORK WILL RESTORE TRADE

The possibility of American manufacturers organizing small export associations to handle jointly the lines of different materials, taking advantage of the Edge law, has been discussed very thoroughly in the electrical industry, and so far no feasible plan has been worked out. Without going into details, one of the principal reasons why such a plan has not met with favor is that if under the existing conditions such a combination was formed it could not hope to make any money for probably the next two years. Furthermore, if any one proposed to organize the combination under today's existing conditions it is doubtful if he would succeed in completing his organization; that is, if he insisted that the organization be inaugurated under proper lines of good business. It is possible that a fluent talker with a large vocabulary and a very small supply of facts could go before some manufacturers with a visionary plan and secure their promise of co-operation, but if he put the plan to them along lines which would eventually insure its permanent success he would have to demand financial guarantees which would frighten them off.

The electrical industry is still young and America is the home of its development. That is, we spend more money on research work in an endeavor to create new devices than any other country on the face of the globe. Furthermore, American quality is superior to that of any other nation, and with the other aids to business that exist in this country there is no reason why we should not secure our share of the foreign trade. But this will not come floating in on the tide to us. We must make a constant and strenuous fight for it.

Some Reasons for the Excessive Cost of Distributing Electrical Supplies

By W. I. Bickford
Secretary-Treasurer Iron City Electric Company, Pittsburgh, Pa

PRESENT methods of distribution of electrical material and supplies from manufacturer to consumer are uneconomical and involve excessive costs which leave very little margin of net profit in the majority of cases to the factors concerned. This condition has been caused partly by some of the manufacturers in their effort to maintain volume of business against a condition of decreased demand, and partly by distributers refusing to function as sales representatives of those manufacturers whose products they distribute. Something has got to be done to correct this situation.

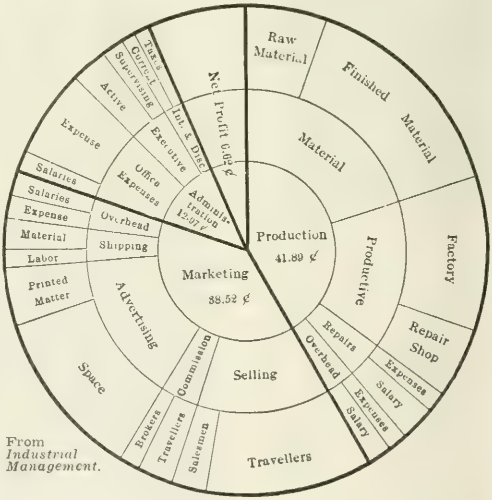
Some years ago this company made an analysis of the conditions of distribution in the electrical industry and as a result adopted a fixed policy of concentrating sales efforts on a selected number of products of manufacturers who among themselves were non-competitive. In turn we expected and received in most cases exclusive distribution for these products in our own particular territory. Thus we became a part of the sales organizations of these manufacturers and the only special sales effort we expected them to make was through our own sales organization. This arrangement provides only one middleman between the manufacturer and the dealer, making only three steps from the manufacturer to the consumer. It also obviates the necessity of the manufacturer's maintaining a local branch office. This means decreased selling expense all along the line and better net returns for distributer and dealer than when so many factors of selling expense are introduced.

I believe that many of the troubles which jobbers are encountering in the wholesaling both of large electrical appliances and some material lines is due to the fact that they are not rendering a complete and adequate service to the manufacturers in this way. If the jobber is to be the bridge between the production and the trade, he must be a bridge wide and strong enough to carry the goods all the way across. Moreover, his stock and service must have a balance that will make a going and well-grounded business that will function fully in the active creation of business.

One point that both manufacturer and distributer must bear in mind is that the margin to the distributer on different classes of material and appliances must vary with the cost of selling and handling of each commodity. In the case of a new specialty the distributer must have a margin several times that on a fixed and fast-moving article if he is expected to introduce and push its sale aggressively. Many manufacturers have overlooked this in providing for their distributers a margin which usually is no larger than that received on fast-moving items.

As soon as both manufacturer and distributer see the advantage of concentrated sales effort on lines on which the distributer receives the exclusive distribution and establishes this practice the sales expense of the manufacturer will be reduced. He will be able to give his distributer a sufficient margin to cover the expense of selling his product and leave a margin of profit for himself as well as the distributer, and the jobber himself, I believe, will find that his selling problem is not only simplified but made far more profitable.

Budget Division of a Business Dollar



From *Industrial Management.*

A GRAPHIC analysis of what becomes of the manufacturer's dollar based on a broad survey of industrial experience. The inner circle shows the main divisions and the outer circle further subdivisions in greater detail. An interesting background for comparisons in any manufacturing business.

Standardization of Dry-Cell Specifications

WITH the purpose of standardizing, so far as possible, specifications for and the sizes of commercial dry cells, the Bureau of Standards recently called a conference at which the majority of the manufacturers of such batteries, together with a large number of users, were represented. At this conference seventeen sizes of the larger dry cells were considered and seven of these were recommended as standard; thirty different sizes and kinds of flashlight batteries were considered and eight of these adopted as standard sizes, and two sizes of batteries for use with radio apparatus.

Dry batteries are used by almost every one for some purpose, either to ring a doorbell, furnish ignition for a gasoline engine, or in flashlamps and similar devices. In the latter field particularly a great variety of devices exists. Flashlamps in certain cases are regarded as novelties and are therefore made in distinctive styles in order to command a better sale. Heretofore this has meant that a large number of sizes of batteries must be used to fit the different sizes and styles of cases. There is no reason, however, why standardized batteries should not be used, the cases being made to fit them.

It is expected that the elimination of many sizes for which there is but little demand and which will no longer be considered as standard will result in a considerable saving in the cost of manufacture, and consequently in added economy and convenience to the public. When it is considered that on an average 150,000,000 dry cells are sold each year, this is a matter of considerable consequence. Beside the elimination of useless sizes, specifications were adopted for the performance of dry cells which will make for a more uniform product.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Power Factor Meeting of the V. D. E. in Essen.—MATTHIAS.—A number of valuable suggestions to overcome or at least to subdue phase displacement in large networks. For example, no oversized asynchronous motors should be used. The air gap of these motors should be kept as small as possible, preferably by using ball or roller bearings for the shaft. Squirrel-cage armatures are recommended for all motors as high as 30 hp., and to avoid excessive magnetic leakage flux there should be a speed as high as possible, if necessary with the use of a reduction gear. If a motor operates for an appreciable length of time on low load, it should be changed from delta to star connection, which can be done with a simple switch. Synchronous motors may be used for as little as 30 hp. They have a commutator and may therefore also be used as converters. A combination asynchronous-synchronous motor was developed with a high starting torque. With the use of synchronous condensers care must be exercised to determine their most effective location on the network.—*Elektrotechnische Zeitschrift*, Dec. 29, 1921.

Ball Bearings for Electrical Machinery.—H. A. ALLEN.—Ball bearings are discussed as used in direct-current motors, induction motors, machine-tool motors, portable tools, car-lighting generators and locomotive headlight generators. Curves showing motor characteristics with and without ball bearings are shown.—*Railway Electrical Engineer*, January, 1922.

How to Wind Fractional-Horsepower Direct-Current Motors.—A. C. ROE.—The author explains step by step just what to do from the start to the finish of the winding job, together with recommendations for adequate insulation under different operating conditions. The winder must know what data to take from the old winding, how to insulate the slots, what wire to use, how to put the coils in place and how to connect them. In this article these steps are explained for straight loop windings.—*Electrical Review and Industrial Engineer*, January, 1922.

Lamps and Lighting

The Eye as Affected by Illumination.—G. H. STICKNEY and A. L. POWELL.—A study of the various factors of illumination that affect the eye. Among these are intensity of light, distribution and diffusion, steadiness, color and glare. The problems of the bad conditions which cause ocular fatigue call for close co-operation between the illuminating engineer and the ophthalmologist.—*Bulletin L. D.* 130 *of the Edison Lamp Works.*

Illuminating Engineering Factors in Electric Sign Design.—C. A. ATHERTON.—A paper presented before the Illuminating Engineering Society devoted to an analysis of some of the factors that affect the attracting power and legibility of exposed-lamp electric signs. The effectiveness of an electric sign depends upon the power to gain attention, to make itself understood and to impress its message on the minds of those whose attention it has caught. Experiments were carried on by the author to determine the effectiveness of various arrangements of the different letter units.—*Transactions of I.E.S.*, Nov. 20, 1921.

Generation, Transmission and Distribution

The Question of Grounding the Neutral.—B. SZAPIRO.—The paper represents a mathematical investigation of the advantages and disadvantages of grounding the neutral of low-tension three-wire systems by either a single grounding at the station or a great number of well-distributed earth connections along the entire length of the neutral conductor. A single grounding at the generating or transforming station, it is claimed, possesses a number of advantages over the second method.—*Elektrotechnik und Maschinenbau*, Dec. 18, 1921.

Steel-Aluminum Conductors for Overhead Lines.—G. HILLER.—It is shown that properly dimensioned steel-aluminum conductors—that is, a stranded steel cable surrounded by one or more layers of aluminum wires—are mechanically superior and electrically equal to copper conductors, a fact which was recognized some time ago in America but was doubted in Germany. It is essential to use very pure aluminum, not less than 90 per cent, as otherwise heavy oxidizing will take place. The strength of the aluminum cable should be at least 85 or 90 per cent of the strength of the individual strands. The chief objections raised against a composition steel and aluminum cable were the electrolytic action between the two metals and the difference in the expansion coefficients. Practical experience showed that both objections are unfounded. In an attempt to compensate for the difference in expansion the inner steel cable was equipped with a hemp core, which resulted in a bad stretching of the cable and was therefore abandoned. The friction between the steel cable and the surrounding aluminum wires is so large that a relative motion between the two is impossible. No special precaution is therefore required in spanning such a cable. Bessemer steel wires having a tensile strength of 120 kg. per square millimeter are recommended for the steel core, and a double layer of aluminum wires should be used. The ratio of steel to aluminum should be for very important trunk lines one to four, for secondary lines one to six. These ratios will give cables of equal strength with equivalent copper lines. A tabulation of standard steel-aluminum cables for twelve sizes is given.—*Elektrotechnische Zeitschrift*, Dec. 15, 1921.

Possible Economies in Large Electric Generating Stations.—EMILE RAUBER.—Report of a French commission, under the Minister of Public Works, dealing with the economies that are possible in large generating stations. The author emphasizes the advantage of replacing of small plants by large ones, thereby reducing cost of generation. He advocates increased size of boilers, higher steam pressure and superheat, heating the feed water by "bleeding" the turbines and greater care to prevent heat losses.—*Engineer (London)*, Dec. 30, 1921.

Traction

Gasoline-Electric Railway Sets.—L. PAHIN.—During the war the French armies used a number of gasoline-driven generating sets mounted in railway cars for the operation of their artillery and searchlamps. These sets were made for 120, 240 and 300 hp. and may be used now advantageously as portable power plants in railroad yards and similar places. The general equipment of these cars consist of one main gas engine and a directly connected 500-volt direct-current generator, one auxiliary gas engine and dynamo rated at 30 kw. (for excitation, lighting, battery charging, etc.), one small starting storage battery, one or two car-propelling motors and the necessary switching and measuring apparatus. The complete service weight of the 240-hp. portable station is 46 tons. Its gas consumption averages 20 liters per hour, and 0.6 liter of oil is needed per hour. The car can travel on its own power at a speed of 12 km. per hour.—*Revue Générale de l'Electricité*, Dec. 31, 1921.

Summary and Forecast of Heavy Electric Traction.—A résumé of the electrification of steam railroads during the past year. The projects for the coming year in the United States, France, Italy, Switzerland, Austria, Portugal, Spain, South Africa, Brazil, Chile, Argentina, Philippine Islands, Jamaica and Japan are mentioned.—*Railway Electrical Engineer*, January, 1922.

Electrochemistry and Batteries

Recent Progress in Electrical Precipitation.—EVALD ANDERSON.—A brief description of the electrical field existing in a Cottrell precipitator. The reduction in efficiency has been found to be due to back ionization on a non-conducting plate. An equation is developed for the relation between electrode size and precipitation rate.—*Chemical and Metallurgical Engineering*, Jan. 25, 1922.

Units, Measurements and Instruments

Measurement of Surface-Condenser Leakage by Electrolytic Conductivity Method.—EARL A. KEELER.—The difficulties in applying electrical methods to measuring condenser leakage are enumerated. Methods are described for overcoming them and for securing the proper measurements. Factors that affect the accuracy of the measurements made are discussed.—*Power*, Jan. 24, 1922.

Electrical Instruments for Industrial Measurements.—EZER GRIFFITHS.—A résumé of the developments of electrical instruments now used in various industries. Among the instruments described are thermo-electric pyrometers, temperature indicators of the millivoltmeter type, recording pyrometers, recording potentiometers and the various apparatus used in optical pyrometry.—*Beama*, January, 1922.

Wave Form and Amplification of Corona Discharge.—J. B. WHITEHEAD and N. INOUYE.—Discussion of the methods used for increasing the sensitivity of the corona voltmeter and for adapting the ordinary telephone receiver and standard portable instruments to indicate the first appearance of corona. The corona-discharge current is rectified and also amplified by means of hot cathode tubes. The experiments on rectification include a study of the wave form of the discharge due to the alternating corona. It was found that the sound due to the corona could be amplified so that the first appearance of corona would be indicated on a loud-speaking telephone.—*Journal of the A. I. E. E.*, January, 1922.

Telegraphy, Telephony and Signals

Obviating Difficulties in Use of Strowger Automatic Exchanges.—C. MCHENRY.—Under present conditions in Strowger exchanges the caller has no indication whether a trunk line is available or not and consequently after removing the receiver proceeds to dial the number required. If all trunk lines are busy a caller is still in the same position as when the receiver was removed, but if congestion disappears while he is dialing, the call will be mutilated and actually lost so far as the caller is concerned. Methods are described for preventing this by insuring a dialing tone which will immediately on the removal of the receiver indicate if all trunk lines are busy.—*Post Office Electrical Engineer Journal (London)*, January, 1922.

Modulation Control of Radio Telephony.—HIDETSUGU YAGI.—The modulation systems of telephony may be classified into five kinds according to the following fundamental principles: (1) Resistance control, or the method of control by the microphone resistance in the aërial circuit; (2) detuning control, or the method of varying the frequency of the carrier wave by changing the inductance or the capacity; (3) absorption control, or the method with an inductively coupled absorption circuit; (4) grid potential control, or the method of varying the normal grid potential by means of a microphone; (5) plate potential control, or the method of varying the plate voltage microphonically. The author carried on experiments based on each of the five principles, the results of which are given.—*Technology Reports of Tohoku Imperial University*, Vol. 2, No. 3.

Miscellaneous

Welding Manganese Steel.—H. R. PENNINGTON.—Electric welding on frogs and crossing layouts of steam and electric roads is described. A table shows the effect of varying quantities of manganese and carbon on the physical quality of the product welded when cooled in air, oil and water. Data are given on the electrode material, polarity when using direct current, arc manipulation, water toughening, welding procedure and finishing be means of grinding.—*Welding Engineer*, December, 1921.

Properties and Characteristics of Insulating Materials.—R. T. FLEMING.—A study of insulating material, the subject being divided into four parts. Part 1 deals with the manufacture and properties of porcelain and describes the various processes in common use and their application to transmission and terminal insulators. Part 2 deals with mica insulation, the physical properties of mica, its use in its natural form as an insulator, and the various fabricated insulators in which it plays an important part. Part 3 treats fibrous insulation, including papers and cloths and various insulators made from these materials as a base. Part 4 deals with liquid insulation, including transformer and switch oils and varnishes employed in impregnation and dipping processes in connection with coils, etc., used in electrical apparatus.—*Journal of the British Institution of Electrical Engineers*, December, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Contractors to Take Up Proposed Amendments to Constitution

THE proposed amendments to the constitution and bylaws will probably be the most important topic to come up before the annual meeting of the national executive committee of the National Association of Electrical Contractors and Dealers, to be held at headquarters in New York City March 13 and 14. For the most part the changes proposed would enable the national association to get into direct contact with members rather than having to work through local organizations.

Considerable interest is expected to be shown in the reports of the code committee and of the cost data committee. The latter committee is proposing that the association publish a manual on estimating.

President J. R. Strong and Secretary Farquson Johnson are meeting with local members in Cincinnati, March 6 and 7, to make preliminary arrangements for the annual convention to be held in that city during the week of Oct. 9.

Ohio Report Avoids Detailed Rules on Inductive Interference

THERE was presented to the Ohio Public Utilities Commission on Monday the formal report of the general committee representing the railways, communication and power interests covering rules governing crossings of signal and power lines over steam and electric railways, and of crossings of signal and power lines over each other, as well as conflicting construction of all kinds, joint use and inductive interference. The construction rules covering crossing conflicts and joint use follow fundamentally the provisions of the National Electrical Safety Code, the method of presentation being the principal change. Each class of crossings and the rules for conflicts and joint use and inductive interference are covered in separate sections, each being complete in itself.

The inductive-interference rules are a departure from any that have been presented heretofore in that detailed rules are avoided. It was not felt that the time was ripe for the adoption of the detail requirements in that section. Co-operation through the exchange of all pertinent information on new or reconstruction work is insisted on. It was felt that remedies for interference troubles must be worked out jointly and the measures on all systems in conflict must be co-ordinated. Furthermore, due regard must be paid to the rights of later comers on highways. While a utility may build at a time when no other utilities are present on the highway in a way that public safety and its own needs seem to dictate, it does so at the risk of having to revamp its system later when other services come in. The principal of least cost, when there is more than one method of operating to prevent inductive troubles, is written into the recommended rules. The information developed by the California committee is included in the report as information, but is distinctly noted as not mandatory. The commission has indicated its intention of giving the report the widest possible publication before the formal hearing on March 2 and 3. It must promulgate the rules early in March.

Bill to Limit Jurisdiction of Federal Courts Over Commission Decisions

A BILL whose purport is to limit the jurisdiction of district and circuit courts in certain cases has been introduced by Congressman Bacharach of New Jersey and is now in the hands of the committee on the judiciary.

In it it is stipulated that "no district or circuit court of the United States or judge thereof shall have jurisdiction to entertain any bill of complaint to suspend or restrain the enforcement, operation or execution of any order made by an administrative board or commission in any state, acting under and pursuant to the statutes of such state, where such order was made after hearing upon notice, nor to entertain jurisdiction of any bill of complaint to suspend or restrain the enforcement, operation or execution of the statute under which such order was made in any case where under the statutes of that state provision is made for a judicial review of such order upon the law and the facts."

The bill has the backing of the Public Service Commission of New Jersey, which has circulated it widely and seeks to have the measure enacted into law. It is said that the Governor of New Jersey also indorses the measure and intends to write the governors of other states requesting their co-operation in the matter.

To Study Basic Causes of Non-Employment

THE fundamentals of non-employment and control of the business cycle are to be the subjects of a thorough investigation by a special committee of the President's Conference on Unemployment recently selected. Owen D. Young, vice-president General Electric Company, New York, was named as chairman. The other members of the committee are Joseph H. Defrees, president United States Chamber of Commerce; Clarence Mott Woolley, president American Radiator Company, New York; Matthew Woll, vice-president American Federation of Labor, and Miss Mary Van Kleeck, Russell Sage Foundation, New York. Edward Eyre Hunt, secretary of the President's Conference on Unemployment, was appointed secretary of the new committee, and Wesley C. Mitchell of New York field director of the study.

The committee is to report to the President's Conference on Unemployment and the public in about six months.

Indiana Considering Overhead Construction Rules

THE subject of construction rules to cover all overhead construction work and to include inductive interference is under consideration in Indiana. Some informal discussions with various interested parties have been held, and it is reported that a formal meeting will be called some time in March at which plans will be made for the formation of a committee composed of representatives of all the interests involved.

Oklahoma Commission to Establish Electric Service Rules

RECORDS of service interruptions, complaints, meter locations, meter reading and bill forms, as well as meter accuracy, voltage regulation, frequency of current supply and grounding of secondaries, will all be covered in rules that will be discussed at a hearing called by the Oklahoma Corporation Commission for March 20, 1922, at Oklahoma City. Consumers' deposits, extension of lines and the filing of maps and rate schedules will also be considered in the rules.

New City Line-Extension Rules for Oregon

A NEW set of rules, effective March 1, governing the financing and constructing of service line extensions in cities by all Oregon electric utilities has just been issued by the Oregon Public Service Commission. The utility shall bear all expense involving not more than one pole and one span of wire per customer. Where more is required the utility shall spend not less than $60 per new customer. The utility shall finance the construction above the free limit, but may collect in advance "an amount which will produce, in the form of an annuity, a sum sufficient to provide the carrying charges upon the additional investment during the development period." The mean effective development period is given as five years. During the first three years new customers on these lines must pay their pro rata share to existing customers.

All poles, wires, transformers, meters and other equipment furnished and installed by the utility remain its property.

Newton Muncipal Plant Sold to Utility Company

THE Iowa Southern Utilities Company of Davenport has purchased the Newton (Iowa) municipal electric plant. Considerable significance attaches to the purchase because for many years the Newton plant has been cited by the advocates of municipal ownership and operation as one of the most successful instances in the United States. Last year, however, a year in which utilities generally were flourishing, the Newton municipal company went bankrupt. A special election was held to validate the sale of the property, and the proposal was carried by a three-to-one vote.

A new distribution system has been installed, a new station erected, power is obtained from Des Moines through the construction of a new transmission line, and the old power plant has been abandoned and turned into a fire house. The operating personnel, it was announced, will be continued as before.

The purchase will increase the income of the Iowa Southern Utilities Company to approximately $1,000,000 gross annually. The company now operates utility plants in thirty-two towns.

Coal Miners and Railroad Men Form Alliance

AN ALLIANCE was agreed upon on Tuesday at a meeting in Chicago between representatives of the sixteen railroad brotherhoods and the United Mine Workers of America under the terms of which the coal miners and railroad men will co-operate "to more effectively protect union workers in wage struggles." The agreement will not become effective, however, until it has been ratified by each of the separate organizations.

There is no indication that the rail workers will be asked to go out in a sympathetic strike with the coal miners on April 1. The most that is called for at the present time is support. Should that support take the form of refusal to haul non-union mined coal or of hindering the movement of coal from pools or other large stocks, it will undoubtedly be of great benefit to the miners' cause.

The coal miners have asked the operators to meet them at Cleveland next Thursday to arrange details for negotiating a new wage scale. At the time of going to press the operators of the southern Ohio soft-coal mines had declined to send representatives.

California Commission Replies to Criticism by Governor Stephens

FUNDAMENTALLY the issue of regulation is far more important than the particular decision rendered in any special case, the members of the California Railroad Commission assert in reply to a criticism of their actions made by Governor Stephens and reported in last week's issue. In his letter the Governor said that the increased rates granted certain utilities were not in keeping with general conditions, and he urged the commission to reopen the case.

"Far exceeding in importance any question involved in these particular cases," the reply says, "is the fundamental issue of regulation as established by the people of this state. The success of this system depends upon public confidence and understanding. But it equally depends on full freedom under the law to do exact justice, uninfluenced by any other considerations whatsoever. We share with you a measure of anxiety for the future of regulation, but we have an abiding faith in the ultimate good common sense of the people when the real truth is known to them. Regulatory bodies should not be swerved from doing justice because of public criticism any more than they should be misled by the selfish claims presented by corporations. While regulation may be weakened by the temporary or local unpopularity of some decisions, it would be destroyed by even the suspicion that decisions were affected by any consideration or influence other than the real merits involved, ascertained after full and careful consideration of all the facts.

"The commission desires public approval, but it believes the only way it can secure or retain public confidence is by being fair and just. If it must choose between being right or being temporarily popular, it must choose being right."

The commission states that no better, fairer or more equitable system than that of regulation as it now exists has been suggested or can be devised. It maintains that the system of regulation administered in California for ten years has been the most important single factor in the growth, development and prosperity of the state. During this period the utilities have been permitted to earn a fair return and nothing more, but that fair return has enabled them to function and provide necessary service. No greater disaster could occur to California than to weaken confidence in regulation.

In discussing the particular cases referred to by the Governor, the commission states that the cases have been re-examined in accordance with law and that there appears to be no good reason why the increased rates as approved should not be allowed to stand. Under the decisions and because of them, the commission says, the companies involved have been able to raise funds to provide improved service and this money will be spent with the utmost energy and efficiency.

In conclusion the commission observes that in all cases the commission must look beyond the mere question of present rates to that of permanent service. In an expanding state like California service can keep pace with demand only by the constant investment of new capital, but this could not be supplied by earnings except by rates which should not be and are not allowed. This outside capital cannot be had unless the companies are permitted to earn enough to pay interest on it, and adequate service cannot be rendered without it.

West Penn Power Again Expanding Generating Capacity

THE expenditure of approximately $6,000,000 has been authorized by the West Penn Power Company for the purchase of two additional 30,000-kw. units for the Windsor (W. Va.) plant. The company is also contemplating large extensions to its Springdale plant, only recently opened. There is now 30,000 kw. installed at the company's Windsor plant, 42,000 kw. at Springdale and 56,500 kw. at Connellsville. The new Windsor units will bring the company's installed capacity up to 188,500 kw. At the Windsor plant there is, besides, 90,000 kw. installed and operated by the American Gas & Electric Company. The new units will therefore bring the entire rating of this plant up to 180,000 kw.

Easton (Pa.) Plant to Be Enlarged

WORK has been started by the Pennsylvania Edison Company on an enlargement to its power plant in Easton, Pa., which will increase the rating of the plant by one-third. The total cost will be approximately $800,000. The improvements include the installation of a new 10,000-kw. steam turbine together with additional boilers.

Officials of the Pennsylvania Edison Company feel that an increase in the plant's capacity is demanded by the improved business conditions in the territory which the company serves.

Plans are under consideration looking toward the construction of transmission lines in 1922 which will connect the Easton plant with other large plants in adjacent territory, including that of the New Jersey Power & Light Company at Dover, N. J.

Oil-Burning Standby Plant for Maine Water-Power Company

CONTRACTS have been let by the Cumberland County Power & Light Company of Portland, Me., for the construction of a steam standby plant. This will be an oil-burning plant equipped with two 6,250-kva. units. The plant will be built on the unit plan so that it can be extended as conditions warrant. The actual construction work is expected to start next month and is to be completed by Nov. 1.

The construction work will be done by the Foundation Company and the engineering work by Charles O. Lenz, both of New York.

Large Development Planned on Ottawa River

ON FEB. 15 the private bills committee of the Quebec Legislature unanimously approved the bills presented in behalf of the syndicate headed by E. A. Robert, president of the Montreal Tramways and Canadian Light & Power Company, enabling the latter to acquire the National Hydro-Electric Company, which owns the power site on the Ottawa River at Carillon, Quebec, half way between Montreal and Ottawa. The bill also gives the distributing company controlled by the above syndicate, the Montreal Public Service Company, the right to sell power in twenty-three counties. It is understood that one transmission line is planned to run through Broome County to Vermont.

Mr. Robert, addressing the committee, asserted that 2,000 men would have work on the project all the year around for the next four or five years and that between $30,000,000 and $40,000,000 would be spent on construction.

Power a Vital Factor in Reconstruction, Says A.I.E.E. President

TO COMPETE with other countries in the economic struggle growing out of the war, electric power in the United States must be "on tap" everywhere, said President William McClellan of the American Institute of Electrical Engineers last week at Hartford, Conn. Addressing the Connecticut Section of the Institute, President McClellan reviewed recent efforts to make the organization of greater use to the membership and touched upon the joint conferences with committee chairmen from other associations to prevent overlapping detailed investigations of prime-mover problems.

"I think we have struck bottom industrially," the speaker said in discussing the economic situation in the United States. He pointed out the necessity for selling to a larger market in order to attain prosperity and indicated that Americans should prepare to meet European competition when it is "going strong"—a greater problem than the one presented by existing conditions of underproduction overseas. The higher scale of living in America, he said, is to be preserved and increased only by intensive work, and this involves the recognition by trades unions of the blighting effects of restriction of output, the reduction of overhead expenses, and the utilization of all the best methods of co-ordinated production under "super-management," electrified industry and rehabilitated transportation facilities.

Big Order Given for Electric Trucks for Express Service

WITH the purchase recently of 104 electric street trucks, the American Railway Express Company has still further strengthened its claim to be the largest user of electric trucks in the world. The company now has in service throughout the United States, in addition to other kinds of vehicles, more than 1,200 electric trucks. The new equipment is for service in New York, Philadelphia and Buffalo. The New York allotment comprises twenty trucks of the 5-ton size, Philadelphia is to have fifty 2-ton trucks, while the thirty-four for Buffalo are of the 2-ton and 3-ton sizes.

It is planned to use the New York trucks on a twenty-four-hour basis. This will be accomplished by means of standardized interchangeable batteries, each truck being provided with two storage batteries. Thus at the end of the first shift the exhaused battery will be removed and a freshly charged one put in its place. The battery boxes are designed for rapid changing, and special devices for battery handling have been installed at the charging stations.

Fundamental Business Conditions to Improve

ON THE whole, business and industrial activity showed further decline during both December and January, according to the "Survey of Current Business," issued by the Department of Commerce. However, there was a continued improvement in fundamental conditions, and a spirit of optimism prevailed in virtually every industry that augurs well for the future. It is believed in trade channels that as soon as the period of inventory and tax adjustment has passed there will be renewed activity, and this was already evidenced toward the end of January.

The iron and steel industry is still without definite trend, although activity in certain lines was greater during January than in December. Textiles likewise showed little change. The automobile industry showed the usual seasonal dullness during January. Both the grain and the live-stock markets showed some depression during the first week of January, but since that time there has been a gradual improvement. The purchase of corn for Russian relief has been of material aid to the corn market. Those industries which depend upon purchases from the rural population have shown little recovery, and not much is to be expected until the new crop year. This is particularly true of agricultural implements.

Meter Problem Conference at Worcester

MORE than 125 central-station engineers, testing experts and manufacturers' representatives attended an all-day conference on meter problems at Worcester, Mass., Feb. 7, under the auspices of the Meter Bureau of the New England Division, N.E.L.A. Charles H. Ingalls of the Edison Electric Illuminating Company of Boston presided, and the Worcester Electric Light Company threw open its Faraday Street substation and club rooms to the gathering. A comprehensive résumé of the latest practice was given in the following talks: "Theory and Methods of Handling Indicating Instruments," by B. P. Romain, Weston Electrical Instrument Company, Newark, N. J.; "Meter and Instrument Pivots," illustrated by microscopic and other slides, by B. W. St. Clair, General Electric Company, West Lynn, Mass., and "Remote Metering and Load Dispatching," by B. H. Smith, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

No Decision Reached on Water-Power Depreciation Regulation

AN EXECUTIVE session of the Federal Power Commission was held in the office of the Secretary of War on Feb. 20. Except to state that three legal matters had been under discussion, Secretary Weeks declined to comment on what took place. It is understood that the matter of depreciation was considered, and it is thought that Secretary Wallace favors the depreciation regulation more or less in its present form, while Secretary Fall favors a more liberal form of accounting. The determining vote will be cast by Secretary Weeks. It is believed that he has not as yet made up his mind upon the merits of the conflicting contentions.

A Public Protest Against a Commission's Decision

FOLLOWING their newly elected Mayor, Lew Shank, the people of Indianapolis, like Coxey's Army, marched to the State House, on Jan. 28 in protest against a decision of the State Public Service Commission. In other cities besides Indianapolis there has been great dissatisfaction with this order of the commission, which permits the merger of a number of utilities into the Indiana Electric Corporation and the issuance of $17,496,000 of securities. Already a petition for a rehearing has been filed. The first time the application for permission to merge came before the commission it was refused because the proposed capitalization was excessive. The crowd is here shown listening to Mayor Shank denounce the order from the steps of the State House. A committee saw the Governor, but he refused to interfere.

Refilled Lamps Unacceptable to Boston Edison Company

NEW lamps are always purchased by the Edison Electric Illuminating Company of Boston and "refills" have no standing, declared L. R. Wallis, superintendent of the sales department, at the rate hearing recently before the Massachusetts Department of Public Utilities. A brief inquiry into the disposal of returned lamps was conducted by counsel for the petitioners against the company, during which the question was asked whether the Edison company had any agreement with the General Electric Company or other manufacturer regarding the use of refilled lamps. Mr. Wallis denied knowledge of any such agreement and said he was sure no agreement exists in regard to exhausted lamps. Refilled lamps, the witness declared, are not considered good, because they are not photometered, they are not accurate as to voltage, are not standard and are not considered standard by any one. The witness gave as his recollection an allowance of about 2 cents each for turned-in lamps at the factory.

Alabama Power's Muscle Shoals Offer Makes Favorable Impression

A BOMBSHELL has been cast into official and legislative circles in Washington by the offer of the Alabama Power Company to complete the Wilson Dam at Muscle Shoals without further advances or expenditures by the United States government. An important member of Congress, who cannot be quoted in advance of the speech he intends to make on the floor of the House, is authority for the statement in private conversation that the offer the Alabama Power Company has made has put Mr. Ford's offer in a completely new aspect and brought about a definite revulsion of feeling against the Ford proposals.

This sentiment is crystallizing in a number of directions. Many Southern members of Congress who have been leaning toward the Ford offer in advance of the technical and legal examination of its provisions which Congressional committees are now making are now actuated solely by their intense desire to assist in bringing about a great new industrial development of the whole South in connection with a suitable development of Muscle Shoals, from which power will be sent long distances throughout the South, and in connection with the development of the navigation resources of the Tennessee River and the waterways it leads into, including the Ohio and the Mississippi. These Southern members have been much disturbed by the apparent inability of the House military affairs committee to get from Mr. Ford's representatives any guarantee that he will continue to make fertilizer at Muscle Shoals, if the project is turned over to him, unless he can do so at a profit. They realize that while it has been continually brought out at the hearings that Mr. Ford hopes to continue to make fertilizer, it has also been continually brought out that this is merely an expectation and a hope and that there is no guarantee whatever attached to it. Another source of anxiety to those Southern members of Congress has been Secretary Weeks' repeated official statements, in his report to Congress and at the hearings, that in order to turn Muscle Shoals over to Mr. Ford and complete it for him it will be necessary for the government and the taxpayers to advance a large amount of new money, estimated by the engineers at from $45,000,000 to $50,000,000. This fact alone has been as bald and as arresting as a dash of cold water to those members of Congress, from all sections of the country, who are charged with the administration of the appropriations and with the responsibility, in these days of bonus talk, of finding sources of new revenue.

Realizing the eager desire of members of Congress to have the facts of the Alabama Power Company's offer before them, Thomas W. Martin, president of the company, has written to each member of the Senate and the House a letter inclosing a copy of the offer as he transmitted it to Secretary Weeks. In his letter to the members of Congress Mr. Martin calls attention to the fact that the Alabama Power Company is a public utility operating in a large field, that its rates and service are regulated by public authority, that it is bound to serve every one without discrimination either in service or in rates, and that natural resources belonging to the public are not diverted to private use when administered by public utilities. An analysis of both the Alabama Power Company and the Ford offers is given in skeleton form herewith:

ALABAMA POWER PROPOSAL

1. No further expenditure for the completion of Dam No. 2 (known as the Wilson Dam) except for locks, and no advances will be required on the part of the government as the power company agrees to complete Dam No. 2 at its own expense.
2. The power company will accept a fifty-year license under the federal water-power act, which provides for recapture by the government at the end of the license period.
3. The power company will buy from the government the steam station at Nitrate Plant No. 2, the government unit at the Gorgas plant and the transmission line connecting Gorgas with Muscle Shoals, and will pay the Government $5,000,000 for same.
4. The government will retain ownership and title to Nitrate Plants No. 1 and No. 2 and the Waco Quarry, which has cost more than $70,000,000, and the power company will furnish free 100,000 hp. for the operation of these plants for the manufacture by the government or others of fertilizer or munitions of war.
5. The remainder of the Muscle Shoals power will be made available to all industries of the region by means of high-tension transmission lines operated by a public service company.
6. The government is relieved of the operation and maintenance of the dam and the crest gates thereon and is required only to maintain and operate the locks.

In summary: The proposal of the Alabama Power Company not only completes the dam and power house without expense to the government; it also provides free power for nitrates for war purposes and fertilizers; it leaves the nitrate plants under the full control of the government; it harmonizes absolutely with all plans the government may have for improving navigation; it provides a cash payment the interest on which will maintain the nitrate plants in a state of preparedness; and a great natural resource is devoted to the use of the public rather than to a private enterprise.

THE FORD PROPOSAL

1. Mr. Ford's proposal requires the completion of Dams Nos. 2 and 3 at government's expense, estimated on incomplete data at about $50,000,000. Mr. Ford will have the benefit of the government financing the entire cost, whatever it may be, for one hundred years or more, at 4 per cent. No interest, however, will be paid on the cost of acquiring lands and storage rights necessary for Dam No. 3 (estimated at from $1,500,000 to $5,000,000) nor on the cost of acquiring the property of Alabama Power Company which Mr. Ford requires to be turned over to him. Mr. Ford

constructs the dams for the government. No limit to the cost of completion is provided, nor any control insured against extravagance or errors of judgment of Mr. Ford or his sub-contractors.

2. Mr. Ford proposes to form a corporation and receive a hundred-year lease of Dams Nos. 2 and 3, with renewal privilege. This is contrary to the policy heretofore fixed by the government in the water-power act, which limits rights on navigable streams to fifty years, and the acceptance of Mr. Ford's offer would be a discrimination against the many companies which are required to operate under the federal water-power act.

IMMENSE COST OF NITRATE PLANTS

3. Mr. Ford's offer provides that on payment of $5,000,000 he will receive possession, not only of the steam plants at Nitrate Plant No. 2 and Gorgas and the transmission line from Gorgas to Muscle Shoals, but also of Nitrate Plants Nos. 1 and 2 and the Waco Quarry, which have, exclusive of the steam plants and the transmission line, cost the government over $70,000,000. The Warrior plant and transmission line are on lands of the Alabama Power Company. That company has a contract that gives it the right to purchase this plant and transmission line. Mr. Ford insists that ownership of the plant and transmission line is essential to his plans. Extended litigation to dispose of the claims of the Alabama Power Company is at least possible. If the government were to lose this litigation, Mr. Ford would not be bound, and it is probable that he would not enter upon a performance of his obligation until this matter had been disposed of.

4. A similar situation exists with reference to the option on Nitrate Plant No. 2 contained in the contract of the government with the Air Nitrates Corporation.

5. While Mr. Ford pays $5,000,000 to the government for property which cost the government over $80,000,000 and which can be salvaged, in the opinion of the army engineers, for from $8,000,000 to $16,000,000, he retains the right to sell all the property so acquired, except Nitrate Plant No. 2. The army engineers are confident that Mr. Ford can reduce his investment to approximately $400,000 by the sale of property so acquired by him from the government.

6. Although the Ford proposal is assumed to insure the manufacture of fertilizer, the recent hearings before the committee of the House of Representatives make it plain that Mr. Ford does not undertake to manufacture fertilizers or any definite quantity of fertilizer compounds, or to operate at all unless in competition he can make cost plus 8 per cent.

7. There are at present two plants for the production of nitrates. Mr. Mayo, who is Mr. Ford's engineer, made it plain to the committee that one of the plants would not be operated as a nitrate plant at all, but would be converted into an auto factory. For breach of his contract Mr. Ford does not forfeit the rights which he acquires from the government, as is true in the case of companies operating under the federal water-power act, but in the opinion of the acting Judge Advocate General of the army the sole remedy of the government would be to sue Mr. Ford or his company for damages, in which case the government would have to prove, not that the farmers suffered damage from Mr. Ford's failure to produce fertilizer, but that the government itself suffered monetary damages from that default. Such damages would seem necessarily highly speculative.

FERTILIZER AGREEMENT INDEFINITE

8. In the hearings before the military affairs committee, Mr. Ford's representatives have declined to commit him to an agreement to manufacture any minimum amount of fertilizers or fertilizer compounds, and they have refused to commit him to the obligation to devote the whole or any definite part of Nitrate Plant No. 2 to the production of fertilizer. He could, accordingly, devote 10 per cent of the plant to fertilizer and 90 per cent to industrial uses, or he could devote the entire plant to the production of a substance—like lime, for instance—used in small quantities by farmers and in much larger quantities in industries, taking 8 per cent profit on the amount sold to the farmers and any profit he could get on the amount sold to industries.

9. Testimony before the military affairs committee brings out the fact that all Muscle Shoals power is to be used solely by Mr. Ford for manufacturing purposes and none of it will be available to the public in general. A great natural resource, owned by the public, would be accordingly diverted from the public use to the use of an individual whose business and profits are not under the control of the government and who is in competition with some of the people at least who bought bonds and paid taxes with which to develop the property.

10. Mr. Ford's company will pay to the United States annually the sum of $35,000 on Dam No. 2 and $20,000 on Dam No. 3 for repairs, maintenance and operation of the dams, gates and locks. The government must maintain the dams with these amounts and replace them if destroyed in 100 years or during renewal period.

11. Semi-annual sinking-fund payments of $19,868 on Dam No. 2 and $3,505 on Dam No. 3, for the purpose of retiring the cost of Dams Nos. 2 and 3 at the end of the 100-year period, are provided. No business house would accept an investment on this basis.

12. Mr. Ford's company is to maintain Nitrate Plant No. 2 in its present state of readiness for immediate operation for the production of explosives, and is to turn it over to the government on demand, together with such of its personnel as may be required for the national defense; but no provision is made in the contract for the costs to the government of taking over the plant in the event of such an emergency.

13. To determine the correct apportionment of cost, a board is provided for to be selected from persons nominated by three farm organizations, "or their successors." Farmers' organizations are notoriously transitory. No criterion is provided for determining which organizations of the future shall be the successors to the three now named.

14. This board, nominated by the farmers' organizations, has no power to control costs. The amounts paid for labor, salaries, services, power and materials are beyond the control of the board. It can only determine whether these have been correctly apportioned to the fertilizer compounds produced as compared with other products of the plant.

HUGH COOPER ATTACKS FORD OFFER

Acceptance of the Ford offer, declared Hugh L. Cooper, consulting engineer for the government on the Muscle Shoals project, before the House military affairs committee, would handicap the water-power development of the South and in this respect would be like removing the vertebræ from a man "you expected to get along." Mr. Cooper attacked the Ford offer from many angles, saying that it would be a calamity to take the greatest water power of the South from the field of public utility for a hundred years. He felt that fifty years was sufficient time for the lease to run.

Under the terms of the Ford offer it would be possible, Mr. Cooper asserted, for Mr. Ford to obtain power at Muscle Shoals at approximately half the cost per unit of energy of its development at Niagara Falls or at Keokuk, on the Mississippi, and at less than half the unit cost for the same kind of energy developed in the commercial power territory within reach of Muscle Shoals.

It was Mr. Cooper's belief, he said, that, although the people of the South were now "crying for the consummation of the Ford offer," before the lease had expired the same people would be crying for its abrogation. Personal experiences in the development of large water powers in the past thirty years led him to this belief. At Niagara Falls, for instance, he said, the power had been used for chemical purposes not unlike the plans he understood Mr. Ford had for Muscle Shoals, and yet the city of Buffalo, about 23 miles away, had been compelled to build a steam-power plant to serve its needs.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Massachusetts Company Changes Name.—The Tyngsboro Electric Light Company of East Pepperell, Mass., has changed its name and is now the Middlesex County Electric Company.

An Indiana Electric Company Dissolves. — The Browne-Mills Electric Company of North Manchester, Ind., is in the process of dissolution. The company recently sold its holding at North Manchester to the Bippus Utilities Company of Huntington, which will furnish North Manchester with electricity.

New York Contractors Report Prosperous Year in 1921.—More than $25,000,000 worth of business was transacted in the State of New York during 1921 by the 453 members of the State Association of Electrical Contractors and Dealers, according to statistics reported by the secretary, J. P. Ryan, at the annual meeting, Jan. 18 and 19. These figures represent an increase in sales of more than $3,000,000 over 1920.

Proposed Power Development on Ebro River, Spain.—An irrigation and power development on the Ebro River in Spain is being given serious consideration in the Spanish Parliament. By the construction of a dam in the headwaters of the Ebro River at Reinosa, in the Province of Santander, it is said, the development of 185,000 hp. and the irrigation of 275,000 acres of land would be made possible.

Only Cash Payments Entitled to Discount in Idaho.—According to a decision which has been rendered by the Attorney-General of Idaho, political subdivisions of the state are not entitled to the discount offered by utility corporations for prompt payment of bills when these bills are paid by warrant not convertible into cash until some future time. This ruling was made in the case of Madison County against Utah Power & Light Company.

Proposed Electric Railway in Nagano, Japan.—Application has been made to the Nagano prefectural authorities, according to *Commerce Reports*, for approval of the establishment of the Iizu Denki Kido Kaisha (Iizu Electric Railway Company), a transverse line through the southern Japan Alps, projected by persons in the cities of Tokyo and Nagoya and in Gifu and Nagano prefectures. The proposed road is to be about 42 miles long, branching from Nakatsugawa station, on the Chuo line and terminating at Iida-machi, Shimo, Inagun, Nagano prefecture. The cost is estimated at 10,000,000 yen ($4,985,000).

Proposed Municipal Electric Plant for Hermosillo, Mexico.—Plans are under consideration for the installation of an electric light plant, waterworks and other improvements in the city of Hermosillo, State of Sonora, Mexico, the expense of the projects to be borne by the Mexican federal government, according to *Commerce Reports*. The Chamber of Commerce at Hermosillo has been authorized to negotiate with contractors in regard to the installation of the proposed works.

Massachusetts Electrical Contractors Help Defeat Repeal of License Law.—A bill introduced into the Massachusetts Legislature, at the instance, it is said, of the American Federation of Labor, to repeal the statute governing the licensing and supervision of electricians has been defeated as the result largely of the strong opposition of the State Association of Electrical Contractors and Dealers. A delegation from this body appeared before the committee of the Legislature to which the bill had been referred and made clear its undesirable nature.

China to Have Immense Radio Station at Shanghai.—Negotiations between the Chinese government and the Federal Telegraph Company have been completed whereby China will have within the next two years a complete network of radio communication facilities which will include one station as large as any at present in existence. The contract covers the erection of five radio stations, the first to be built in Shanghai. This station will consist of six towers each 1,006 ft. in height. The equipment will include two 1,000-watt Federal arc sets and will operate on a single-wave system.

Oklahoma Cities Abandon Municipal Plants.—Ramona, Okla., has voted to abandon its municipal electric light plant and go back to the service obtained from the privately owned plant at Sand Springs. A survey for a high-tension transmission line is now being conducted to serve Barnsdall, Pershing, Wynona, Nelagoney and Pawhuska. The municipally owned plant at Pawhuska, upon which the community had recently voted to spend $113,000 in improvements, will also be abandoned. On Jan. 14 the voters in Locust Grove voted to spend $20,000 for constructing a transmission line connecting with the plant at Pryor.

Skating, Dairy Products and Electricity.—The *Edison Monthly* for February draws renewed attention to the penetration of electric service into almost every cranny of present-day life. How electric tractors are used in resurfacing the ice at the skating rinks of New York City is the subject of one article, and the great importance of motor drive in modern dairies, where cows are milked, cream separated and pasteurization aided by its agency, is the subject of another. The assertion is made that throughout the United States an annual gain of $200,000,000 is made because of the introduction of electricity into the dairy business.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Philadelphia.—This club announces the election of the following officers: President, Philip H. Ward, Jr.; vice-president, George G. Young; treasurer, August Mandel, and secretary, William S. Eaton.

American Association of Engineers.—The first "annual conference of practicing engineers," under the auspices of the A. A. E., was held on Washington's Birthday at the Congress Hotel, Chicago, with morning and afternoon sessions.

Section Meetings of the A. I. E. E.—March section meetings of the Institute announced include: Schenectady, March 3 (joint meeting with other engineering societies), discussions on heating and ventilation, including papers by Thornton Lewis, vice-president and general manager York Heating & Ventilating Corporation, Philadelphia, and F. Paul Anderson, Pittsburgh, director of experiment station of the American Society of Heating and Ventilating Engineers; Vancouver, B. C., March 3, "Storage-Battery Locomotives for Mine and Industrial Haulage," by T. H. Crosby; New York, March 15 (joint meeting with civil, mining and mechanical engineers), "The Port of New York"; Pittsburgh, March 15, A. C. Cummings, electrical superintendent of the Carnegie Steel Company, and E. R. Roberts, mechanical superintendent of a large department store, will speak at a meeting planned to bring manufacturers and users of electrical machinery and suppliers of electric power together for frank discussion; Schenectady, March 17, "Recent Developments in High-Tension Practice and High-Voltage Phenomena," by F. W. Peek, General Electric Company, Pittsfield, Mass.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia, March 4, Cleveland, March 13; Chicago, March 15; Pittsburgh, March 18; Youngstown, March 25; Birmingham, March 25.

A. I. E. E. Section Meetings—Vancouver, March 3; Schenectady, March 3 and March 17; New York, March 15; Pittsburgh, March 15.

American Physical Society — New York, Feb. 25; Washington, April 22.

Prime Movers Committee, N. E. L. A.—Pittsburgh, Feb. 27-28.

Electrical Supply Jobbers' Association—Atlantic Division, New York, Feb. 28.

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

American Electrochemical Society, Baltimore, April 27-29.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Rural Lines Donated by Consumers Excluded from Rate Base.—The value of rural electric lines donated by consumers was excluded by the Illinois Commerce Commission from the rate base of an electric utility for immediate rate-making purposes, without prejudice to the company in the future.

Relation of Ice Department to Electric Power Company.—Electricity furnished to an ice department operated by an electric power company should, according to a decision of the Illinois Commerce Commission, be metered and accounted for at regular power rates, thus placing the ice department upon the same footing as any other power consumer of the utility.

Pole Erected in Street Not Part of Line Extension.—A pole erected in a street to support service wires is not properly a part of a line extension, in the opinion of the Illinois Commerce Commission, and the cost of this pole and of a reasonable amount of service wire should be borne by an electric company rather than by a consumer who bears part of the expense of a long extension.

Service Quality as Basis for Rates.—The Michigan Public Utilities Commission has issued a ruling fixing the rates of the Lenawee County Telephone Company on the basis of quality of service rendered rather than property investment. Original cost and reproduction cost less depreciation as a rate basis were refused. W. W. Potter, commissioner in telephone matters, declared: "The test of the reasonableness of telephone rates is not that such rates yield a fixed return upon the original cost or reproduction cost less depreciation, but whether such rates yield a fair return for the service rendered."

Reproduction Costs and the War Period.—"We are of the opinion," the West Virginia Public Service Commission recently observed in permitting an increase of rates for water service, "that for the purpose of ascertaining present fair value little weight should be given to reproduction cost based upon average prices prevailing during the war period except in cases where a substantial part of the construction work was done during that period." Nor, said the commission, can market value, as such, be logically used as a basis of the ascertainment of present fair value. "The market value of the property of a public utility, as well as the market value of any other property, is ordinarily based upon an estimate of the net earnings that may be realized from the use or operation of such property. The market value of this property would be entirely dependent upon the present or prospective rate of return to the owner from the operation of the property in the conduct of its public service business. Earnings are entirely dependent upon the rates and market value upon earnings; hence it would be arguing in a circle to base fair value upon market value where rates are in question."

Franchise Value in Rate Fixing.—In determining rates for the gas service of the Georgia Railway & Power Company at Atlanta, the Georgia Railroad Commission said: "The company has contended that there should be included in its rate base large values for its franchises, the original cost of which was granted by the State Legislature, without charge. This claim we have not allowed in our estimates. These franchises, it is true, are taxable and are taxed as property, but it is also true that the taxes paid thereon are repaid to the company in the rates it charges the public. The public having granted these franchises in order that it might be served should not be required to pay a return on them as company property in addition to returning to the company in rates every dollar of taxes it pays. The public taxes the company; the company charges the tax back to the public and the public repays it in rates. It seems to us that the process should stop at this point."

Should Twenty-four-Hour Service Be Supplied in Small Communities?—In arranging a rate schedule for the Speed Electric Company to apply in the city of Poplar—a county seat with 1,200 population—the Montana Public Service Commission refused to compel twenty-four-hour service, holding that there was no reasonable assurance that it would bring in enough to repay the company for the expense involved. The commission said of such demands by consumers: "The consumers feel aggrieved because twenty-four-hour service is not furnished them. Without examining the question of whether such service is justified, balancing benefits against costs and efficient operation, electrical development has progressed so far in Montana today, with twenty-four-hour service the rule and not the exception, that communities not so served feel that they are the objects of unreasonable discrimination, or that local plant operators are unprogressive and indifferent. In many instances the benefits of twenty-four-hour service are more imagined than real, but a growing Western community is constantly making civic comparisons and when its residents cannot light their basements by electricity during the day, its housewives run washing machines, clothes irons and vacuum cleaners at will, and its business houses, particularly hotels, garages, repair shops, bakeries and meat markets, turn a switch to operate the many electric motor-driven devices from mangles to sausage grinders, hardships are alleged which would never be conceived had not electrical energy become one of the chief mainstays of social existence."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Status of Texas Commission.—Under the state constitution and the statutes of Texas the Railroad Commission is a quasi judicial body and an arm of the government, and a communication to it in answer to a complaint filed with it was absolutely privileged and one which permitted no remedy in a civil action. This declaration of the law was made by the Texas Commission of Appeals in Aransas Harbor Terminal Railway Company vs. Taber. (235 S. W. 841.)*

Deprivation of Reasonable Returns Is Confiscation.—Declaring that the deprivation of the right to earn a reasonable return upon the full fair value of its property amounts to confiscation and that a public utility remains the owner of the entire property which it devotes to public service despite the existence of indebtedness upon it, the Supreme Court of Appeals of West Virginia suspended an order of the Public Service Commission of that state on the suit of the city of Huntington in the matter of water rates. (110 S. E. 192.)

Sample of Wire Admissible to Show Negligence.—In affirming judgment against the Michigan State Telephone Company, from which the Wayne Soap Company had recovered the sum paid by the latter's insurer because of the death of an employee of the soap company who came into contact with a broken telephone wire that had short-circuited a high-tension electric conductor, the Supreme Court of Michigan ruled that no error was committed in admitting as evidence a sample of the telephone wire cut in the vicinity of the accident, though it was not shown to be a piece of the wire which caused the death. (185 N. W. 805.)

Compensation Due Holder of Franchise to Dam Stream When Rights Are Appropriated by State.—In Waterford Electric Light, Heat & Power Company vs. State of New York, a suit to recover compensation for lands and flowage rights appropriated and destroyed by the state, the Court of Claims of New York found that a franchise to build and maintain a dam and to acquire the title of the state to the riverbed and the land under the overflow caused by the dam, having been accepted and acted upon, cannot be revoked or destroyed by appropriation without compensation; nor does the failure of the grantee to get the consent of Congress to erect the dam, it being in a river declared navigable, affect his right to compensation. (191 N. Y. S. 657.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

R. W. SCOTT

Rumsey W. Scott was elected president of the Chemical National Bank of New York at the annual election of officers in January. Mr. Scott has been manager of the industrial department of the Chemical Bank since its establishment in 1920. This department makes careful investigations, reporting on the management, plant facilities, financial condition and such other items as show the true condition of an enterprise in which any particular borrower is engaged. Mr. Scott was born in Kentucky and was graduated from the Rose Polytechnical Institute as electrical engineer. In 1897 he came to New York City and became associated with the C. & C. Electric Company, first in the engineering department and later for several years in the sales department. He was connected with the Otis Elevator Company for seventeen years, first as its Washington representative, later as New England manager, and for the last five years in the main office in New York as assistant to the general sales manager and as manager of the government division.

R. C. Starr has recently been appointed chief engineer of the Merced (Cal.) Irrigation District project. Mr. Starr will continue as chief engineer of the San Joaquin Light & Power Corporation, with headquarters at Fresno, Cal. He achieved large success as chief construction engineer for the San Joaquin corporation in the building of its Kerckhoff power plant. Other engineering work in which he figured prominently was the construction of the Huntington Lake dam for the Southern California Edison Company and the building of the San Joaquin & Eastern Railway. As chief engineer of the Merced Irrigation District Mr. Starr will have charge of the design and construction of its twelve-million-dollar irrigation project.

Prof. Francis Hartmann has recently been elected first dean of the Day Technical School of Cooper Union, New York City. This appointment is in recognition of his long service at that institution as head of the department of physics and applied electricity.

W. G. VINCENT, JR.

W. G. Vincent, Jr., formerly executive engineer of the Pacific Gas & Electric Company of San Francisco, has recently been elected a vice-president of that company. He will have charge of all studies made by its engineers which pertain to the economic factors affecting its construction program, operation, valuation and rate making. Mr. Vincent was born in Louisiana in 1882 and was graduated from Tulane University in 1902 and from Cornell University in 1904. In 1905 he became assistant to the electrical engineer of the Ocean Shore Railroad of San Francisco. In 1907 and 1909 he was engaged in consulting practice with Dean C. L. Cory of the University of California, and during 1909 and 1910 he was superintendent of the power and light works of the University of California. In 1911 and 1912 he was employed by the J. G. White Company as valuation engineer, being afterward transferred to the Pacific Gas & Electric Company as valuation engineer, a position which he held until his promotion to executive engineer in the latter part of 1920. Mr. Vincent has always been very active in the work of the local public utility associations.

F. E. CHASE

Frank E. Chase has been appointed manager of the Lynn Gas & Electric Company, succeeding J. Frank Dubois. Mr. Chase has filled probably every position in an electric light and power generating system, having started as oiler and dynamo tender in the company of which he is now manager. Mr. Chase was born in Medford, Mass., and educated in the public schools of that city. He spent two years with the Thomson-Houston Company, studying the lighting branch of the electrical industry, and in 1892, at the close of his course with this company, he was connected for a short time with the Malden Electric Light Company. He became connected with the Lynn Gas & Electric Company in the spring of 1892 as oiler and dynamo tender at the electric station. Three months after taking this position he was transferred to that of stockkeeper, and from then on he held every position in the station at different times. In 1900 he moved to Danvers and in 1907 became interested in local politics, causing an investigation of the municipal electric light plant. He was subsequently elected Utility Commissioner and served in this office for six years, assisting in putting the municipal plant on a paying basis. During this period he also assisted in the appraisals of the electric stations at Fitchburg, Lexington and Holyoke. In 1908 Mr. Chase was appointed superintendent of the generating station of the Lynn Gas & Electric Company, holding that position until the recent retirement of Mr. Dubois, which resulted in the appointment of Mr. Chase to the managership of the company, as already stated.

D. W. Blakeslee, electrical engineer with the Jones & Laughlin Steel Company, Pittsburgh, has received a six months leave of absence from that company in order that he may take up work as an instructor in electrical engineering at Yale University. Prior to the war Mr. Blakeslee was instructor in electrical engineering at the University of Arkansas, and later he was assistant professor of electrical engineering in the same university.

L. C. Steger has been appointed director of purchases and stores of S. F. Bowser & Company, Inc., Fort Wayne, Ind.

L. A. de Marrais has been placed in charge of sales of Ohio electric cranes and locomotive cranes of the Bedford Foundry & Machine Company for J. N. Kinney, 30 Church Street, New York.

L. W. Marso has been placed in charge of the Pittsburgh office of the Hardinge Company of New York. Mr. Marso was formerly with the Quigley Furnace Specialties Company.

E. E. Creed has been assigned to the San Francisco office of the Gilbert & Barker Manufacturing Company and will have charge of the Western territory, including the Pacific Coast retail sales division.

William W. Davies has been made general manager of the recently formed Davies Glass & Manufacturing Company, Martin's Ferry, Ohio. Mr. Davies has been connected with the design and manufacture of lighting glassware for the past twenty years. He was formerly operating manager of the Haskins Glass Company and for two years operated the Cumberland plant belonging to the Wellington Glass Company.

W. H. Patterson, who has been associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for the past sixteen years, has resigned to become vice-president of the Kaestner & Hecht Company, electric elevator builders, Chicago. Mr. Patterson was graduated from the electrical engineering course of Purdue University in 1905. He has been prominently identified for a number of years with the development of motors and control apparatus for application to cranes, compressors, elevators, hoists and machine tools. Mr. Patterson is a member of the American Institute of Electrical Engineers, the American Society of Heating and Ventilating Engineers and several other technical associations.

W. H. PATTERSON

Obituary

William J. Barker, vice-president and general manager of the Denver Gas & Electric Company, died on Feb. 15, of pneumonia, after an illness of only one day. Mr. Barker had been a leader in the electrical and commercial development of the Intermountain region for nearly half a century. He was a strong advocate of good-will publicity, and during his forty years as an executive of the Denver Gas & Electric Company built up an organization known throughout the West for its courtesy and service to customers. Mr. Barker, who was born in London, England, Dec. 31, 1855, came to this country as a young man with considerable technical education and soon established himself in the electrical industry with the Brush Electric Company of Cleveland. He was sent to Denver by this company in 1880 to install a system of arc lights for the Colorado Electric Company, this system being said to have been the third of its kind in the United States. The Colorado Electric Company was so favorably impressed with Mr. Barker's ability that he was engaged as chief engineer of the new system and later was advanced to the position of superintendent. After the reorganization of the company as the Denver Gas & Electric Company Mr. Barker was elected second vice-president and general superintendent and in 1913 was elected first vice-president and general manager. During his forty years service with the company he saw the city of Denver grow from a population of 40,000 to 256,000 and his company develop from an isolated concern to a twelve-million-dollar corporation controlling the gas, steam, electric light and power of the community. Mr. Barker naturally entered into the civic activities of the city in a big, constructive way and was always ready to work for the advancement of Denver.

W. J. BARKER

Charles Luther Olds, one of the founders of the Jenny Electric Company, Fort Wayne, Ind., the predecessor of the Fort Wayne works of the General Electric Company, and one of the best-known residents of the city, died recently at his home as the result of a stroke of paralysis suffered last June. He was sixty-six years of age. Mr. Olds was one of the two original promoters of the Jenny Electric Company, and the organization meetings of that firm were held in his office, which was where the plant of the Fort Wayne Foundry & Machine Company now stands. He was actively interested in the Jenny Electric Company as long as it existed and was prominent in it at the time of its reorganization, when it became known as the Fort Wayne Electrical Works. Although actively engaged in business of his own, he took an active part in the management of the electric corporation up to the time it was taken over by the General Electric Company a number of years ago.

J. J. Hemler, one of the oldest executives in point of service of the Sprague Electric Works, died on Dec. 31 last. At the time of his death he held the position of works accountant. Mr. Hemler was born in Albany, N. Y., in 1856 and spent his early years there. From early in 1885 to October, 1887, much of his time was spent in Central and South America and Mexico, where he was engaged in railroad construction and in work on the Panama Canal, which the French company headed by Count de Lesseps was at that time endeavoring to build. In 1887 he went to Cleveland, where he became connected with the Brush Electric Company, leaving there in 1896 to go to the Lynn (Mass.) works of the General Electric Company. He went to the Watsessing plant of the Sprague Electric Company at Bloomfield, N. J., in 1898, taking charge of the cost keeping. Mr. Hemler was a member of the Quarter Century Club of the General Electric Company and was much interested in all other interplant activities connected with that company.

J. J. HEMLER

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Hand-to-Mouth Buying Persists, Say Outlet Box Manufacturers

ELECTRICAL jobbers are still buying outlet boxes and other wiring supplies in a hand-to-mouth way, according to several manufacturers of these specialties interviewed lately, and sales are reported to be from 10 per cent to 30 per cent under those of six months ago. Orders continue to be placed spasmodically, and the largest percentage of orders placed call for small lots. This is probably caused by sudden increases in building construction at various times when milder weather permits.

Those manufacturers who make boxes mainly for residential construction are finding a fairly good demand and expect this to continue for at least the next eight months. The basis for this hope can be found in the volume of home building as compared with the totals for all classes of building. In January the percentage of homes to the total was 45, while residences built during 1921 formed only 37 per cent of all building. Under these circumstances the producers of this class of wiring material can afford to sit back and wait until the jobber is forced to do real buying. Industrial wiring material prospects, as was pointed out last week, are not quite as promising.

The market has been more or less unstable for several months, and it is doubtful whether a permanent price level has been reached yet. As one manufacturer expressed himself, "some of the low prices being quoted today are due to the fact that certain manufacturers were overstocked with raw material and were forced to liquidate to keep in business. A readjustment of that matter is merely a question of time, and then these low prices will once more rise above the production cost."

Good Prospects on Pacific Coast for Switchgear

THE outlook for sales of switchgear, including oil switches, high-tension fuses and line switches, is particularly favorable, according to the views of a representative manufacturer expressed to the ELECTRICAL WORLD. All the large power companies of California are planning heavy expenditures on transmission and distribution lines, most of this construction to start early this spring. There undoubtedly will be a good deal of construction in other parts of the country, but this California development work is expected to be the largest to be undertaken this year and to make heavy demands upon switchgear and line-material manufacturers all over the country.

Current sales there even now are reported to compare very favorably with those of six months ago. Much of the apparatus is of special manufacture and is not so indicative of sales movement as standard apparatus would be. However, manufacturers have obtained some good orders lately.

Under circumstances of more active demand the main trouble experienced by producers was inability to increase deliveries on raw materials. This is at an end now and materials can be obtained promptly so that delivery of the finished apparatus is limited to the time required for manufacture. One concern has become overloaded with raw material ordered on the assumption that several months would elapse before it could be shipped.

It is likely, manufacturers state, that prices will remain approximately at the present level for some months to come. Labor cost and porcelain prices are large factors in the list cost of the finished apparatus. Wages can only be deflated very gradually if controversy is to be avoided. A reduction in porcelain, and particularly in freight rates, before the spring construction starts would be of great aid to the jobbers and manufacturers whose territory takes in the Pacific Coast.

German Lamp Bulb Prices Remarkably Low

THE excellence of German and Austrian glass lamp bulbs was generally recognized in this country and in England, where before the war large quantities were imported. Hostilities put an end to this and each country had to manufacture bulbs for itself. Naturally an inferior glass product was made at first, owing to the inexperience and lack of proper ingredients, but this handicap was soon overcome so that today in both England and the United States glass bulbs claimed to be as good as those formerly obtained from Germany and Austria are available in enormous quantities. Having made ourselves independent of foreign manufacturers for glass lamp bulbs, the trend of development abroad, particularly with reference to glass-bulb prices, has not concerned us much. The testimony recently taken in England, however, reveals the remarkably low cost of Austrian and German lamp bulbs as compared with the British product.

It has always been possible to purchase German bulbs more cheaply than English bulbs. Before the war the relative prices of similar bulbs were: English bulbs, 53 shillings per 1,000; foreign bulbs delivered at London, 44 shillings per 1,000, less breakage allowance and export rebate, making it 36 shillings 6 pence per thousand. Since the war this discrepancy in price in England has increased. The present price of German glass bulb No. .0362 is 46 shillings 6 pence, plus 9 shillings 10 pence freight, or 56 shillings 4 pence delivered, as against the British total cost of manufacture of approximately 135 shillings, of which 63 shillings 11 pence, or 48 per cent, is represented by labor and the balance by fuel, materials and overhead charges. In other words, German glass bulbs can be delivered in London for less than the price of the labor for manufacturing the English glass bulbs.

On complaint of the British Flint Glass Manufacturing Association and the British Flint Glass Makers' Society, a hearing was held before the committee appointed under part two of the safeguarding of industries act on the detrimental effect upon British industry of imported glass bulbs and on the imposition of a tax of 33⅓ per cent upon imported goods. Mr. Wilson, director of the General Electric Company, which has facilities for turning out 600,000 glass lamp bulbs a week, said that since the war the British price had increased 150 per cent and that of the foreign glass bulbs 50 per cent, owing to the greater costs of material and labor. The witness said that during the last six months he had placed an order in Germany for a million bulbs and a similar order in Holland. Three reasons were given for this action: (1) The coal strike; (2) a desire to test the quality of the foreign glass lamp bulbs; (3) to bring home to the British workman the nature of foreign competition. The intimation was made that a 33⅓ per cent tax, while it would be of very great help, would be of little assistance unless British works put in modern furnaces and become more efficient. Mr. Wilson, in reply to a question, said that his company had always lost money on its glass works and that the Germans' ability to turn out glass bulbs cheaper was due in a large measure to the greater technical knowledge of the German industry and to the better training of the German workman. The equipment of German factories was in most cases better than that of the average British factory, but even so Mr. Wilson felt that if the exchange were normal his company could compete. More recent quotations cited by Mr. Wilson for glass lamp bulbs were 53 shillings 8 pence per 1,000 for those of German make, while the Dutch, for a much inferior article, were asking 115 shillings 1.5 pence per 1,000. The average price of American lamp bulbs of sizes most generally in use is approximately $30 per 1,000 at the present time.

British Show Interest in Electrical Apartments

SOME of the most prominent English architects are showing considerable interest in the American plan of fitting apartments with complete electrical equipment, according to a report to the Department of Commerce made by United States Consul Coulter at London. As explained by one architect, it is realized that every household labor-saving device found to be of practical use must be installed to save expense of servants and to give maximum comfort at minimum expense. The standard equipment furnished would consist of electric range, clotheswasher, dishwashing machine, telephone, and convenience outlets for vacuum cleaner, toaster, iron, percolator and electrical toilet devices. These apartments, in spite of the fact that there is a large housing shortage in urban England, will probably not be built in large numbers immediately because of the expense. The attitude, however, shows a greater interest in electrical household devices and is encouraging to the American manufacturers of these products.

Demand for Wiring Devices Improving

THOUGH nothing spectacular in the way of betterment in the demand for wiring devices is evident at present, New England manufacturing plants are more than holding their own in this branch of electrical production. Several establishments are now running almost full time as a regular policy; orders are coming into factory sales offices at a somewhat better rate than was the case a few weeks ago, and February business has on the whole totaled larger than was anticipated. One large house in New England is now operating at about 70 per cent of its normal capacity. Some readjustments in employee distribution are going on, but by and large no further reductions in personnel have occurred on any material scale since the cuts made necessary by the December slump in demand. On the whole there is a decided upward trend in wiring-device sales, and this is expected to improve as the winter's end draws near. It is still too early for any sporadic or broader increase in building operations to affect the sale of wiring devices materially from present stocks or early completed outputs.

Raw material is exceedingly plentiful now, and the efficiency of labor is being maintained at better levels than was the case in many establishments during the war. Several manufacturers expressed the wish to a representative of the ELECTRICAL WORLD last week that conditions in the jobbing field might become more satisfactory. Hand-to-mouth purchasing continues in many localities. The jobber's resale price, notably on pull sockets, is held by some manufacturers to be unduly low, although it is recognized that sharp competition for the modern volume of business offered is a factor in this situation. One well-informed sales representative said that the importance of distributing through jobbers performing a complete service is in need of wider appreciation. Last summer a good deal of production for factory stock was undertaken, but at present the output in representative plants is just about even with the demand. A very modest improvement in foreign trade can be seen in wiring devices, although the gain is sufficient to justify any throwing up of hats. There is a widely held opinion that domestic business in wiring devices is bound to improve still more as the year advances, not only in connection with the wiring of buildings on a somewhat more extensive scale than last year, but through the development of a more active electrical appliance business all over the United States. As one sales manager put it, "Business can be had by going after it," in this line as well as in not a few others.

Metal Market Situation

VERY little copper is being purchased and prices continue weak, with sales by second-hands reported at 12⅞ cents delivered. It is not believed that any purchaser is willing to go below 13 cents on domestic deliveries or 12⅞ cents alongside ship. The opinion is held in the English market that little buying may be expected of Europe until France adopts a different attitude on a number of points. Domestic buying is held up, it seems, owing partly to starting up of mines, but largely to tariff uncertainty and bonus legislation.

Brass companies are obtaining fairly good orders, but the keenest competition exists for whatever business is offered. Brass founders seem still to be meeting their orders by scrap melting and use of virgin metal bought several months ago in excess of their booking needs. An officer of one of the largest valve companies reports that his jobbers are so low in their stocks that they fill orders from his branch warehouses. He stated that his own stock of finished valves is far below its usual size as his plant is working on a four-day week basis only.

In the face of this dullness, it is believed in several quarters that copper prices are scraping bottom and will go no lower. It is a saying that there is always either a "feast or a famine" for the copper producer; last August saw the beginning of a sales "feast" that lasted until December and as suddenly was transformed to the "famine." The market is one of sudden reactions, and it seems that one is due now and once the market halts its downward march sales will undoubtedly pick up. Deliveries during February on contracts placed last quarter were at a rate of 70,000,000 lb.

The porphyry mines, it appears, have decided not to rush into production again even though a number of other producers have taken this step. With the American Brass Company as an outlet Anaconda may break even under present prices, but it is difficult to see how some of the smaller producers can operate successfully at 13¼ cents per pound.

The lead market is firm but otherwise shows little of new interest. The steady demand maintains a good statistical position with no necessity of price cutting to obtain business. Some producers are tentatively marking up on new inquiries with the encouragement offered by liberal bookings over the last six weeks. The New York price is strongly held at 4.70 cents.

NEW YORK METAL MARKET PRICES

	Feb. 14, 1922	Feb. 21, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	60 2 6	58 0 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25–13.37½	13.00
Electrolytic	12.87½–13.00	12.75
Casting	12.62½	12.50
Wire, base	14.50–14.75	14.25–14.50
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.40	4.35
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.85	4.87½
Tin, straits	30.37½	29.25
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	Feb. 14, 1922	Feb. 21, 1922
Heavy copper and wire	10.00–10.50	10.00–11.00
Brass, heavy	4.75–5.00	4.75–5.00
Brass, light	4.25–4.50	4.25–4.50
Lead, heavy	3.50–3.75	3.50–3.75
Zinc, old scrap	2.00–2.12½	2.00–2.12½

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THERE has been little increase in volume during the past week, and with the exception of some wavering on wire and flexible armored conductor, prices have been steady. A note of confidence has just been sounded by a Chicago bank which on Feb. 7 placed an order for all the lighting equipment for its new building, deliveries to be in one year at present prices.

The whole trade is waiting in a rather breathless manner for the opening of the construction season, which should take place in six weeks or so. It is a certainty that there will be plenty of home building and central-station extensions, but the outlook for industrial and commercial building does not seem so brilliant. Heavy demand for radio apparatus is reported from all centers, and deliveries, long a month ago, are now uncertain. Chicago observes a more active call for parts than for complete sets. Boston reports a better tone in the motor market, with withdrawals from factory stocks helping the situation, and lamp sales there have been surprisingly good. Local interests in Atlanta are preparing to launch a home-building campaign there to relieve unemployment, which should mean good orders for wiring materials. Appliance sales are reported good in most sections of the country though the small, less-expensive types continue to lead in demand. In New York washers and cleaners have sold well, though electric flatirons show the only approach to normal. Boston notes some improvement in the higher-priced lines but in Atlanta inclement weather has cut down retail sales. Sales of ranges, washing machines, vacuum cleaners and some heating devices have been good, with sewing machines still failing to show activity.

On the Pacific Coast sales of all household appliances remain quiet.

NEW YORK

Little or no change was noted in conditions in the electrical trade this week. Jobbers report that the volume of sales continues at about the same level and that there are no lines showing unusual activity. This condition, however, is attributed to the usual dull period which is expected at this season of the year. Much confidence is expressed in the probable revival of building activity this spring, which will bring a quickening of business in electrical lines. This is looked for within the next six weeks. Building is already on the increase in the outlying districts as indicated by the greater number of orders from small contractors in these sections. While this has not yet materially affected the total sales it may well be interpreted as a forerunner of the better times just around the corner. A great deal of it undoubtedly is residence building and not the industrial type for which supply houses are earnestly hoping, but even so it keeps sales of wiring materials up to a fairly steady proportion.

Prices remain virtually unchanged. A slight weakness in the quotations on rubber-covered wire was offset by stiffening in the price on flexible armored conductor. In some quarters price concessions have been made to move stocks. This does not appear to be general through the whole line of supplies but seems to be confined mostly to certain items of schedule material. Jobbers' stocks are good, but a sudden revival of demand would soon deplete them.

Rigid Conduit.—Demand is moderate and no large orders are being placed. Jobbers' stocks are ample in nearly all sizes. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in. $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft.

Rubber-Covered Wire.—A slight softening of prices on wire was reported but just what caused this no one seemed to know as the general opinion is that quotations on copper would not go lower. No. 14 rubber-covered is quoted at $6.25 and $6.30 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—This material is moving fairly well, the demand coming from contractors in the outlying and residential sections. No change in price was reported although there is less inclination to shade quotations to move stocks. No. 14, two-wire, single-strip, was quoted from $43 to $45 per 1,000 ft. and double-strip from $45 to $47 in that quantity. Stocks are ample and shipments from manufacturers are coming through promptly.

Sockets.—Pull-chain sockets in standard package lots are quoted at 33 cents, although it is reported that this price has been shaded to move stocks. Price concessions to obtain orders are not unusual.

Loom.—This material is moving a little better as there apparently has been a moderate resumption of building activity in outlying districts. The $\frac{7}{32}$-in. size is quoted at $14.85 per 1,000 ft. and the ¼-in. size at $16.20 per 1,000 ft. in 5,000-ft. lots.

Heating Appliances.—Sales of heating devices are sluggish and jobbers state that with the exception of flatirons and toasters the demand is very light. Stocks are good.

Washers and Cleaners.—There is a fair demand for these devices because of the general intensive sales effort that is being made.

Radio Apparatus.—Announcement of additional broadcasting service soon to be started in the East has intensified the demand for radio equipment. Jobbers so far have been unable to obtain any great amount of material from manufacturers and such equipment as comes through usually has been sold far in advance.

CHICAGO

While the demand for electrical goods has been fair this week, the only commodity that is moving rapidly is radio equipment. Many electrical houses are adding this line to their stocks and are pleased with the speed at which it is moving. The one difficulty all dealers are contending with is uncertain and constantly increasing deliveries. Dealers report that while complete sets are selling well, the favorite line seems to be spare parts. Whether this is an indication that the purchasers are beginners or are veterans reconstructing their old sets no one feels qualified to say.

Wiring materials have held their previous levels and outside of a few trifling reductions the weakened copper market has not produced any permanent change as yet. Poles and cross-arms are sluggish, but dealers are looking for greater activity when spring arrives and the utilities can start reconstruction of their lines.

Wire.—Market conditions on wiring materials have changed little from those existing during the past weeks. The majority of dealers say that business is poor, though occasionally a case of increased activity may be found. The weakness of the copper market has not been reflected in the price of copper wire so far, the No. 14 rubber-covered still selling for $6.75 per 1,000 ft. in 5,000-ft. lots. Stocks are fair to good. Weatherproof wire still sells for 16¾ cents per pound in 1,000-lb. lots. The base on bare wire is 16¾ cents.

Conduit.—The demand for conduit has been fair with few large orders. No price change has been reported and stocks are in fair condition.

Flexible Armored Conductor.—No price reduction has been announced on this conductor as yet. The No. 14 two-wire, double-strip sells for $45 per 1,000 ft. in 5,000-ft lots. The demand is fair but not startling and stocks are fair to good.

Lamp Cord.—Sales are moderate and dealers have ample stocks. The No. 18 cotton parallel sells for $16 per 1,000 ft., while the silk parallel is quoted at $27.50 per 1,000 ft.

Safety Switches.—Nearly all dealers state that business on these switches has been good. The large sizes are reported as moving the best. Dealers' stocks are in good condition.

Poles.—A quiet market on poles exists at this time, but since the inquiries are increasing, most jobbers feel that the spring will see a much better call for this line. No price change has been recorded and the 7-in.-top, 30-ft. Northern white cedar sells for $8.40 f.o.b. Chicago.

Cross-Arms.—The quietness in the pole demand is also found to apply to the cross-arm business, and jobbers feel that the sales curve on cross-arms will rise along with the sale of poles. There has been no price change since the last advance in January, and the 3¼-in. x 4¼-in. 3-ft. fir arm, in lots of 100, sells for $45.68 f.o.b. Chicago.

BOSTON

Trade showed little change in volume last week, business being chiefly confined to small orders with considerable variation in sales from day to day. Some breaks have occurred in the textile strikes which are hampering New England production, and many mills continue to operate satisfactorily. Building and engineering contracts for the week ended Feb. 14 in New England totaled $1,882,100, against $1,387,300 for the corresponding week of last year. Considerable scattered residential construction is evident in this district. Retail appliance trade is confined mainly to the lower-priced items, but some improvement is noted in the heavier lines. Release of "frozen" stocks of previously ordered goods is also beginning to show a better trend to business. Jobbers' stocks find no difficulty in meeting current demands except in the radio field, where deliveries are running into several weeks in typical cases. Underlying financial conditions are fairly good, barring apprehension lest the passage of bonus legislation by Congress strike business a staggering blow during this convalescent period. Prices show a tendency toward readjustment, with weaknesses in flexible armored conductor and cuts in the fixture field.

Flexible Armored Conductor.—Demand has picked up somewhat and prices are easier. No. 14 single-strip is quoted at $44.20 per 1,000 ft. in 1,000-ft. lots. Moderate improvement in building work absorbs more of this material.

Wire.—Sales are rather spasmodic. Local supplies are plentiful. Rubber-covered No. 14 wire sells at $6.75 per 1,000 ft. in 5,000-ft. lots and at $7.75 in 1,000-ft. orders. Weatherproof wire is moving slowly at slightly lower prices, and the latest price sheet runs as follows on sizes from No. 4-0 to No. 8 solid, per 100 lb.: Less than 25 lb., f.o.b. Boston, $26.25; 25 lb. to 100 lb., $21.25; 100 lb. to 200 lb., $19.25. An addition of 50 cents per 100 lb. is charged on slow-burning wire. Very little bare wire is moving at present.

Motors.—A better tone in the motor market is apparent, and withdrawals from factory stocks on suspended shipments held sometimes many months have begun to help the situation. Proposition work is active and while distributers' sales are spotty and on the whole light, an upward current in demand appears to have set in. Competition is sharp.

Fixtures.—Aggressive sales effort is moving fixtures in fair volume, but prices are unstable in retail circles. Stocks show little evidence of being broken to any great extent, and manufacturing has not yet hit a normal pace.

Porcelain.—Light movement of insulating material of this class is noted. "Nail-it" knobs are selling at $15.50 per 1,000 in barrel lots and $\frac{5}{16}$-in. x 3-in. tubes at $4.50 in the same volume. No shortages have been reported in this material for a long time.

Air Heaters.—Sales have been fair in retail circles, considering the season, but no difficulty in maintaining stocks has been heard of. These devices are slowly getting into the staple class and move in response to vigorous merchandising methods.

Linemen's Tools.—No further complaints as to shortages are being voiced, following the late exhaustion of the local market as a result of the great sleet storm of early winter.

Lamps.—A surprisingly good trade continues to show the value of replacement business and to reward sales efforts in new fields. Improved house-lighting methods are attracting attention in this district and the industrial lighting work fostered by various electrical interests in the old Technology Building's exhibit continues to stimulate business.

ATLANTA

Continued inclement weather is interfering with the resumption of nearly all lines of business. The retail mercantile trade is, of course, suffering because of the disinclination of customers to come out, while construction has been held up by heavy rains followed quickly by freezing weather, so that nothing but interior construction has been continued during the past ten days. Electrical jobbers, therefore, have felt the reflection of this in their lines of construction materials, while the general quiet of trade has had a dampening effect upon the purchases of seasonal specialties by retail merchants and electrical dealers. Prospects for a revival are fair as building permits continue to be taken out in good volume, and a number of large central-station companies in this section are announcing considerable improvements and additions to plants and distribution systems. Local interests are preparing to launch a home-building campaign which will tend still further to stimulate local construction and relieve to some extent the lack of employment.

Farm-Lightning Outfits.—Jobbers report that a sales campaign in this line is productive of a fairly satisfactory volume of business, despite the continued poor financial condition in the rural districts. Inquiries in satisfactory number are being received. Stocks have fallen somewhat below normal.

Interphones.—With the exception of the more inexpensive type, few purchase orders are being received for interphone equipment. General stocks are good to heavy, with no change in price.

Poles.—There has been a slackening in pole purchases as danger of sleet has passed, but spring is not near enough at hand to permit of general line construction. Prices remain steady, with pole-yard stocks in good shape.

Pole-Line Hardware.—While still slow, a slight improvement in the movement of this line is to be noted during the past month. Increased sales are anticipated, however, as soon as line construction gets under way. Local stocks are in good condition with no price changes reported.

High-Tension Transformers.—The market at present is very dull, though there is every reason to anticipate a brisk movement in the spring as the plans of power companies in this section materialize. All jobbers report stocks fair with shipment at from four to twelve weeks.

Distribution Transformers.—The demand continues to hold up fairly well, particularly for the popular sizes. The large sizes are somewhat slow, owing to inactivity in industrial lines. Stocks are in fine shape in all lines.

Rigid Conduit.—Good to heavy stocks are reported on hand by all jobbers, and the market has slumped somewhat within the past ten days. There are a few inquiries for large quantities of special sizes reported, but they have not yet developed into definite sales.

Cross-Arms.—This item is following in the paths of poles and pole-line hardware, with local stocks reported as good to heavy. No changes in price are reported.

Lightning Arresters.—Anticipation of summer electrical storms is being reflected in the orders for this line and the activity will probably continue on the increase until late spring. Stocks are in good shape with prices steady.

ST. LOUIS

Jobbers noted some improvement in business last week, and it was fairly well distributed over all lines. However, there is still lacking any specific evidence of sustained improvement. All buying, whether by jobber, dealer or consumer, is on a hand-to-mouth basis, and extreme caution seems to mark every move. The general sentiment is improving nevertheless, and inquiries for prices on larger jobs are becoming more numerous, some developing into orders. The local steel companies, as a result of increased business, are now making plans for obtaining more economical plant facilities. The steel companies will also take advantage of the new plant which cokes Illinois coal to develop this territory as a steel center and consequently should soon be good buyers of electrical goods. Other industrial concerns have in mind numerous changes, but are awaiting improved business conditions, which are slowly developing. Residential wiring goods continue to sell in comparatively good volume. Merchandising goods are, on the whole, rather quiet, but improved activity is noted in ranges, washing machines, vacuum cleaners and fans. It is thought by most of the jobbers that business will show considerable improvement after the middle of March.

Washing Machines.—A fine business is generally reported. Jobbers' stocks are in good shape and dealers' stocks are as a rule low. One jobber reports that his stock was turned over three times in the last thirty days.

Vacuum Cleaners.—Business is spotty, but on the whole better than a month ago. Dealers are not stocking to any extent and jobbers are maintaining low inventories. The supply of one large jobber is exhausted, with a quantity of machines on back order.

Sewing Machines.—Sales are slow but fairly steady. Sewing-machine motors have virtually no demand. Stocks everywhere are in good condition.

Ranges.—Sales in the smaller communities have been comparatively good for some time, and sales in St. Louis, where the business has been dormant for about a year, are showing substantial improvement without special solicitation. Stocks are well in line with market requirements.

Flatirons.—Sales are about the same as they were a year ago and are good, considering the general condition of the market. Stocks of both dealers and jobbers are maintained on a low basis.

Curling Irons.—The demand has changed from the activity of a few months ago to quietness. Stocks are not unduly heavy.

Lamps.—While the sales are materially less than when the industrial plants were in full operation, a thriving business continues, with stocks in excellent condition. Nitrogen-filled lamps are continually increasing in demand. A large number of 50-watt and 60-watt type B lamps are sold here because of the central-station renewal policies.

Wire.—Price recessions were made last week. A grade of No. 14 rubber-covered which formerly sold for $6.70 per 1,000 ft. in 10,000-ft. lots now sells for $6.60. The base price on bare was reduced from 16½ cents per pound to 16.35 cents per pound, and that on weatherproof was reduced from 17 cents per pound to 16 cents per pound. Rubber-covered in the smaller sizes is selling well, and there have been good inquiries on weatherproof, but no orders of magnitude.

SEATTLE—PORTLAND

Progress toward recovery in business is rather slow. Business is generally conceded to be rather dull so far as the electrical jobbers in the Puget Sound region are concerned, while jobbers and manufacturers of Portland, although they report business as quiet, have no apprehension for the future. In fact, the general tone is very optimistic and inquiries are coming in very satisfactorily. A few good orders have been placed within the past week and many more are expected in the near future. Manufacturers report an appreciable activity in motor sales. Manufacturers' and jobbers' stocks are in good shape, although they are not overstocked. New enterprises now starting up are few in number and relatively unimportant except in the building field, where considerable activity is found. A number of projects which have been under way in Seattle for some time are progressing. Among these are the improvements to Seattle's water-supply system, involving the expenditure of about $2,000,000, the Skagit power project of the city of Seattle, and the Cushman power project of the city of Tacoma, on which preliminary work is being done.

Contracting and fixture installation work in Portland seems to be very active at present. Dealers' sales, while better than last month, are not so active as was anticipated for this time, but prospects are very good for the near future. During 1921 Portland issued permits for 2,890 residences with a total value of $10,100,700. Apartment-house building, however, was not so active proportionately. The outlook for 1922 is exceptionally promising and many apartment houses are in prospect. All of the better class probably will be equipped with electric ranges throughout. The soldiers' bonus bill has stimulated activity in residence building, and it is predicted that 7,000 residences will be constructed under this act. Jobbers of Portland report a drop of 7 to 7½ per cent in pole-line hardware.

Insulators.—Quotations on insulators are as follows: No. 9, pony glass, $52.85 per 1,000 in lots of 10,000; No. 20, deep-groove, double-petticoat insulators, $81 40 per 1,000 in lots of 10,000.

Household Appliances.—Washers and cleaners maintain a fair volume of sales. Demand for ranges in Seattle has slowed up a good bit. In Portland, however, the volume of range sales is fair, owing probably to a co-operative selling campaign between the dealers and the local power companies.

SAN FRANCISCO

Roughing-in material and pole-line construction material are the most popular lines at present. Appliance sales are slow and where made are almost in spite of the public.

Porcelain Material.—Radical price changes have been made in practically all standard porcelain material, averaging about 40 per cent on the whole line. No. 334 unglazed cleats are now being quoted at about $15.50 per 1,000, while No. 5½ split knobs are selling at $10.80 per 1,000 and 3-in. x $\frac{5}{16}$-in. tubes at $5 per 1,000. The demand for knobs and tubes is very good, running about 20 per cent better than last year. Cleat sales, however, are rather slow and there are large local stocks. "Nail-it" knobs are unchanged in price, selling for about $24.50 per 1,000 for the tenpenny size. This kind of knob is far outselling the old split style.

Bushings.—A 10 per cent decrease is effective in bushings and lock nuts, 1½-in. bushings selling for $1.25 per 100 in cartons or packages and ¾-in. for $1.75 per 100. The ½-in. lock nuts are quoted at 54 cents per 100 and ¾-in. for 72 cents per 100 in cartons or packages. The demand is very good, but stocks have kept pace with it.

Rubber-Covered Wire.—The market has dropped about 25 cents per 1,000 ft. for the No. 14 single-braid solid, approximately $7.25 per 1,000 ft. being generally quoted on 5,000: ft. quantities. No. 14 duplex is selling for about $10 per 1,000 ft. in the same lots.

Storage Batteries.—This is the quiet season, but it is also a season of transition. Many of the smaller service stations have gone out of business, and several of the unsteady ones have considerably unsettled the market by their quotations. Keen competition exists among the manufacturers, each one striving to place its product seemingly at any terms.

Tools.—It is reported that the power companies are working on a standardization scheme for linemen's tools, such as belts, climbers, safety straps and the like.

Household Appliances.—Vacuum-cleaner sales have been fairly good, principally because of low payment terms—in some cases as low as $1 down and $1 per week. It is all solicited business, very few sales being made from the stores, and electrical dealers who do not maintain sales crews are reporting very poor business. The same condition applies on washers except that they have been rather neglected in favor of vacuum cleaners. The smaller appliances in general are moving rather slowly and this condition is even worse from the jobber's standpoint because of the large, well-assorted stocks carried over by most dealers from the holidays.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Acme Wire Increases Production

The Acme Wire Company, Hamden, Conn., is increasing production at its plant and has recently added more than 100 persons to the force. Orders have been taken for 150,000 coils of wire from the Ford Motor Car Company, Detroit, Mich.

Allis-Chalmers Reports Fourth Quarter Sales

For the fourth quarter of 1921 sales billed by the Allis-Chalmers Manufacturing Company, Milwaukee, amounted to $4,645,054, which was about 12 per cent under those for the third quarter. Net profit after provision for federal taxes amounted to $384,032. Of this $100,000 is the result of an adjustment on the contingency and tax reserve set up in excess of requirements in the early part of 1921 and now written back to earnings. Unfilled orders on hand as of Dec. 31, 1921, are large, amounting to $7,300,574. This compares favorably with those at the end of the third quarter, totaling $7,260,574. On the basis of the company's quarterly reports sales in 1921 are shown as $24,685,257, compared with $31,513,209 in 1920 and with $30,224,082 in 1919, while net profits in 1921 were $2,215,466, against $3,564,348 in 1920 and $3,599,713 in 1919.

Casting Manufacturer to Have New Plant

The Electric Foundry & Equipment Company Philadelphia, is erecting a two-hundred-thousand-dollar plant at Tacony and Bleigh Streets in that city. Announcement has been made by William P. Cunningham, president, that the first work will be turned out about April 1. Steel castings up to 200 lb. will be manufactured on completion of the plant.

Pole Producers' Convention Sees Fair 1922 Prospects

Members of the Northern White Cedar Association at their convention held in Minneapolis on Jan. 31 and Feb. 1 expressed themselves to a representative of the Electrical World as believing that 1922 holds good but not phenomenal prospects. There are, they stated, a number of stumbling blocks on the road to prosperity, among them high freight rates, lower prices and high production costs, agricultural and general business depression, but these conditions will gradually readjust themselves, it is hoped. On the bright side is the greater prosperity of a large number of utilities and their avowed intention of line construction this summer. Business, during 1921, it was declared, was much below normal, in some cases amounting to under 50 per cent of 1920 business, but at present inquiries are picking up, particularly for telephone-line work. One concern, it was reported, has been able to increase the working day of its preservation plant to sixteen hours.

New officers of the association were elected as follows: President, W. B. Thomas, White Marble Lime Company, Manistique, Mich.; vice-president, W. H. Schuessler, Coolidge-Schuessler Company, Minneapolis; treasurer, Harry F. Partridge, P. M. Partridge Lumber Company, Minneapolis.

Electrical Jobbers' Club Elects Officers for 1922

At the annual meeting of the Electrical Jobbers' Club, held Feb. 7 at the Hotel Breslin, New York, officers for the coming year were elected as follows: President, G. L. Patterson, Stanley & Patterson, Inc.; vice-president, W. H. Vogel, W. R. Ostrander & Company; secretary and treasurer, W. J. Kroeger. The executive committee comprises W. J. Kranzer, Crannell, Nugent & Kranzer, Inc.; H. T. Hochhausen, Brooklyn Electrical Supply Company; H. O. Foreman, Sibley-Pitman Electric Corporation; G. V. Weir, Fullerton Electric Company; L. D. Baily, Baily Electrical Supply Company, and M. Zucker, A. Shemel & Company.

Anaconda and American Brass Formally Merge

At the annual meeting of the stockholders of the American Brass Company, held on Feb. 14, the formal merger of the company with the Anaconda Copper Mining Company was effected. John G. Ryan, chairman of the board of directors; C. F. Kelly, president of the board, and Benjamin F. Thayer, vice-president of the board, all three officers of the Anaconda company, were chosen as members of the board of the American Brass Company. Officers of the American Brass company were elected as follows: Chairman of the board, Charles F. Brooker; vice-chairman and first vice-president, John P. Elton; president, John A. Coe; executive vice-presidents, Edward I. Frisbie, Thomas B. Kent and Gordon W. Burnham; treasurer, Clifford F. Hollister; assistant treasurers, Major W. Judge and A. B. Terry; secretary, Edmund H. Yates; assistant secretary, Elton G. Wayland.

Catton-Neill See Better Hawaiian Business

Although construction in the Hawaiian Islands is not particularly active, there are signs of a substantial improvement in general business conditions which before long will be reflected in the electrical trade, according to a statement made recently to a representative of the Electrical World by John Hood, assistant manager of Catton, Neill & Company, Ltd., Honolulu. Mr. Hood, who was formerly engineer for the General Electric Company in San Francisco and has been visiting in California during the past few weeks, expressed himself as being quite optimistic over the outlook in the islands. With the increase in trade between the Far East and the Pacific Coast which is bound to come, it is foreseen that the islands will benefit proportionately.

Edison Lamps Now in Six-Lamp Carton

The Edison Lamp Works of the General Electric Company, Harrison, N. J., have announced that from now on all of their lamps, except the S-14 bulb, will be packed in six-lamp cartons. This step was taken after many months of research into the best method of packing and was put into effect during January in nearly all the Edison factories.

The plan is, with the exception noted, to pack all lamps rated at from 10 watts to 75 watts inclusive in six-lamp cartons and to pack either ten or twenty of these cartons in a case, making the packing quantity either 60 or 120 lamps. The cartons will be in three sizes. The design and coloring have been made attractive in order to fit display purposes.

General Railway Signal 1921 Sales Under Normal

Sales during 1921 of the washing machines and foundry products made by the General Railway Signal Company, Rochester, N. Y., were far below normal, according to the annual report of the company, just made public. The report also states that the company is able to furnish the automatic stop and control devices required on forty-nine railroads by the order of the Interstate Commerce Commission. The report reads as follows:

"Owing to the general business depression in 1921, sales of our washing machines and foundry products were far below normal. It is our belief that such sales will increase in substantial conformity with improvement in general industrial and agricultural conditions. The earnings of railways not having been up to normal in 1921, their purchases of all kinds of equipment have been small; but with improvement in earnings it is believed buying of much needed equipment will be resumed.

"In January, 1922, the Interstate

Commerce Commission issued an order providing that forty-nine railroads subject to the interstate commerce act are required to install on or before July 1, 1924, an automatic train stop or train-control device to be applied to or operated in connection with all road engines running on or over at least one full passenger locomotive division of each one of these forty-nine railroad properties.

"For more than ten years our company has been engaged in the development of both automatic train-stop and automatic train-control devices and has made and patented many valuable inventions, and has by purchase and license acquired rights under many other patented inventions in these fields. We are, therefore, in an excellent situation to furnish dependable devices of the required character as well as the block signaling systems in conjunction with which they should be employed."

New Lamp Company Established

The Salem (Mass.) Lamp Company has opened a factory on Saunders Street in that city for the refilling of lamps. Charles S. Breslan, who has had twenty-five years' lamp-making experience, is president.

Central and Atlantic Jobbers to Hold Meetings

Plans have been announced for holding the next regular meetings of the Central Division and Atlantic Division of the Electrical Supply Jobbers' Association, the latter in New York Feb. 28 and the other in Chicago Feb. 27 and 28. The New York meeting will be at the Hotel Commodore, the first session being called to order at 10:30 a.m. and the final session adjourning before 5 o'clock in the evening of the same day. It was announced that an interesting and instructive program had been arranged, and a large attendance is expected to be present at this first meeting of the year.

The Hotel Sherman, Chicago, will be the scene of the Central Division meeting, which will open at 10:30 a.m. Feb. 27 and will adjourn at 11:30 a.m. Feb. 28. The tentative program for the first day is as follows: "Financing Motor Cars for Salesmen," by P. A. Borly, vice-president G.-Q. Electric Company, Milwaukee; "Credit Conditions as They Exist After an Interval of Six Months," by Frederick P. Vose, general secretary N.E.L.A.; "Sell 'Em Something More," by R. W. Sherman, merchandise director of the Automotive Equipment Association. On the second day there will be a talk on "Turnover" by F. D. Van Winkle, president of the Post Glover Electric Company, Cincinnati. A general discussion of reduction of operating expenses is on the program to close the meeting.

Following these two division meetings there is scheduled a meeting of the executive committee of the national association, to be held in Atlantic City, March 1 and 2.

Westinghouse Official Sees Good Foreign Trade Prospects

A statement issued by E. D. Kilburn, vice-president and general manager of the Westinghouse Electric International Company, evinces optimism over the prospects for American exports of electrical equipment in 1922 and declares that European and especially German competition in the electrical field cannot seriously affect America.

"America leads the world in many electrical lines," the statement declares, "and, as has been proved on a number of occasions recently, can compete with any nation in these lines in spite of her high labor costs. Another reason for not fearing German competition is that the manufacturing capacity of Germany is limited and that when she has obtained a certain amount of electrical business her deliveries will become uncertain and her prices will rise.

"We should be optimistic over the propects for American exports of electrical equipment during 1922, for during the past year both Chile and Japan placed large orders for electrical material in America and there is every reason to believe that we shall receive an increasing amount of business of the same character. Every generator installed immediately creates a market for at least three times its capacity in smaller apparatus, such as transformers, meters, industrial motors and domestic ware. Hence the demand for electrical appliances increases in a geometrical ratio and America is in a fair position to get its full share of this rapidly growing business.

"There is, however, a problem that still faces the exporter," Mr. Kilburn goes on. "Unless the American public, led by American financiers, becomes interested in investing money in foreign securities, American exporters are bound to be handicaped. Many European countries habitually buy large amounts of such securities each year, and the money thus raised is naturally spent in the country of its origin. We have made great strides in this direction, as the numerous foreign loans floated here testify, but there is still ample room for constructive educational work on the part of bankers along these lines."

Western Instrument Company Increases Capacity

The Western Instrument Company, 1001 Washington Boulevard, Chicago, has acquired 8,000 sq.ft. of factory space at this address. This company was recently incorporated to manufacture surgical, veterinary, dental and electrical therapeutical instruments, dies, tools and patterns. They are also engaged in brass finishing, polishing and plating. Julius Severus, vice-president and general manager, stated to a representative of the ELECTRICAL WORLD that there had been a gradual but steady increase in business in the last two months. While he was not over-optimistic about business in the future, he felt that things were on the mend and business would pick up, not by spurts, but in a gradual slow upward climb. The officers of the company are: William Ganschow, president; Julius Severus, vice-president and general manager; Charles F. Johnson, secretary, and Lewis B. Mahon, treasurer.

The P. A. Geier Company, Cleveland, has a new distributing office for Royal Electric Cleaners and other products at 1,400 Broadway, New York, under the management of Harry A. Bell.

The Maring Wire Company, Muskegon, Mich., manufacturer of magnet wire, has made Charles A. Etem, 917-A Marquette Avenue, Minneapolis, sales engineer for Minnesota and North and South Dakota.

The McLain-Simpers Organization, 210 West Washington Square, Philadelphia, has moved its Charlotte (N.C.) branch office to Greenville, S. C., where it will be more centrally situated in the Southern textile field. A. R. St. John has been made manager of the New York office and will temporarily remain in charge of the Boston office.

The McClave-Brooks Company, Scranton, Pa. manufacturer of stokers, grates, etc., has appointed K. S. Holmes, Jr., Cincinnati representative. He will have an office at 511 Gwynne Building.

The Kerite Insulated Wire & Cable Company, 30 Church Street, New York, incorporated in Connecticut, has filed notice of increase in capital from $200,000 to $350,000.

Henry D. Sears, 80 Boylston Street, Boston, general sales agent of the Weber Electric Company, Schenectady, N. Y., manufacturer of electric wiring devices, announces the opening of a sales office at 342 Madison Avenue, New York City, to cover the metropolitan district. It will be in charge of Henry E. Nickerson, who for the past eleven years has been New England representative of the company.

The Whitlock Coil Pipe Company, Hartford, Conn., has appointed George D. B. Van Tassel to represent its interests in Detroit and vicinity in addition to its regular agents and representatives.

The Chillingworth Engineering Corporation, 143 Liberty Street, New York, has associated with itself Messrs. Frank H. Plum, Herbert Pluemer, George E. Mellin and Harold Von Thaden, all formerly of the C. W. Hunt Engineering Corporation. It announces that this step has been taken with the approval and consent of the Hunt company.

Coleman-Shoemaker, Inc., power machinery repairers, Philadelphia, have moved to their new plant at Twentieth and Clearfield Streets, that city. There the company has a private railroad siding and an overhead traveling crane, making it possible to handle both light and heavy machinery with greater facility than at the old plant. The company has also announced that it is in a position to store machinery either in its warehouse or outdoors.

Foreign Trade Notes

THE METROPOLITAN VICKERS ELECTRIC COMPANY, Manchester, England, the *Journal of Commerce* states, has obtained the contract for material for the electrification of the South African Railways, amounting to about £1,000,000. The contract will include at least seventy locomotives. This is regarded as breaking German competition in electrical equipment trade in South Africa.

HYDRO-ELECTRIC SCHEMES FOR NEW ZEALAND—Extensive hydro-electric projects are under way by the New Zealand government, according to *Commerce Reports*, involving an expenditure of approximately £20,000,000, the work to be evenly divided between the two islands. The present plans provide for a high-tension transmission system for both islands which will connect all the main supply points of the power board districts and local power authorities. Each of these transmission systems will be fed from three or four hydro-electric stations, existing steam and hydro-electric plants being incorporated in the general scheme. The standard three-phase, 50-cycle system has been adopted in all the recent installations, and some of the older plants are being converted to standard. A list of the government projects in New Zealand now under construction or being contemplated, together with the name of the government electrical engineer, may be obtained on application to the electrical equipment division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to miscellaneous exhibit No. 232.

ITALIAN ELECTRIC LAMP TAX.—A decree establishing a tax on the manufacture of electric lamps, according to reports to the Department of Commerce, has been passed in Italy, to be imposed as follows: (a) Lamps for illumination by any system, up to 10 watts, carbon filament, 0.25 lira, other 0.50 lira; from 11 to 50 watts, carbon filament, 0.75 lira, other 1.50 lire; from 51 watts to 200 watts carbon filament, 1.50 lire, other 3 lire; from 201 upward, carbon filament, 3 lire, other 6 lire, (b) Arc lamps, excluding pure or metalized carbon, 3 lire per kilogram, (c) Pure or metalized carbon, or any other system of electric illumination by arc, 2 lire per kilogram.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired by a firm in Spain (No. 806) for the sale of electric vehicles, storage batteries and electrical supplies for automobiles.

Catalogs are desired by a transportation company in Brazil (No. 809) with a view to purchasing and also securing an agency for heavy electric trucks for hauling baggage and freight over streets paved with stone. It is expected that fifty trucks will be purchased by this company alone for its own use.

A commercial agency firm in Sweden (No. 828) desires to secure the representation of firms for the sale of automobile accessories, particularly for improving the lighting facilities of a low-priced automobile.

There is a market in Spain (No. 837) for wood pipes for use in hydro-electric developments, water conduits and irrigation canals.

EQUIPMENT FOR ELECTRICAL PLANT IN DURBAN, SOUTH AFRICA.—Bids will be received by the Corporation of Durban, Electrical Department, South Africa, until April 12, according to the *Electrician*, for two 500-kw. rotary-converter automatic substation equipments. Alternate bids for mercury-arc rectifiers may be submitted instead of rotary converters, the switchgear to be completely automatic.

ELECTRIFICATION OF BOLOGNA-MONFALCONE (ITALY) RAILWAY.—The Director General of Italian State Railways, according to *Commerce Reports*, announces that the administration is desirous of receiving bids for the electrification of the Bologna-Venice-Monfalcone Railway, which work is to be intrusted to private enterprise. Bids will be opened on April 30, 1922, at the Direzione Generale Ferrovie dello Stato, Rome, where full details regarding the work may be consulted.

BAYCROFT BROTHERS, Victoria Street, Cambridge, New Zealand, would like to receive catalogs from manufacturers of electrical equipment as follows: Alternating-current motors, 400 volts, 50 cycles, three-phase; fractional-horsepower motors, single-phase; household electrical appliances and electrical fittings.

New Apparatus and Publications

RANGE—The George D. Roper Corporation, Rockford, Ill., has recently placed a new electric range on the market.

GEAR SHIFT.—The Cutler-Hammer Manufacturing Company, Milwaukee, has brought out a new type of gear-shift device (electrically operated) for motor cars.

COUPLING.—The Kay Manufacturing Company, Norwalk, Conn., is distributing circular No. 1922, describing the "Whitney" free floating coupling.

INSULATING MATERIAL.—"An Electric Test" is the title of a small booklet published by the Rogers Fibre Company, 121 Beach Street, Boston, which contains a report made by the Electrical Testing Laboratories of New York, showing the comparison of two processes of treating paper for insulating purposes, "Leatheroid" treated with sulphuric acid, and the other with chloride of zinc, and the method used in making tests.

RADIO MATERIAL.—The Manhattan Electrical Supply Company, Inc., 17 Park Place, New York City, is distributing its new "Wireless Manual", which is a catalog of radio material. It is also a textbook and contains a brief survey of the science, giving valuable information for the amateur.

INSULATING VARNISH—The Acme Wire Company, New Haven, Conn., has issued engineering bulletin No. 1, in which it calls the attention of engineers and manufacturers of coils to the changed requirements in the treating of coils for protection against moisture.

GATE VALVE. — Bulletin 100-A issued by Payne Dean, Ltd., 103 Park Avenue, New York City, describes and illustrates the "Dean" controlled gate valve.

DRILL AND GRINDER.—The Wodack Electric Tool Corporation, 23-27 South Jefferson Street, Chicago, has recently developed a new "Wodack" combination portable electric drill and grinder.

LIGHTING PLANTS. — The Matthews Engineering Company, Sandusky, Ohio, has added to its line of lighting plants sets up to 40 kw. in direct-current and up to 75 kva. in alternating-current.

SIGNS.—A leaflet describing its "Radio" electric signs is being distributed by the Efficient Electrical Display Company, Inc., 26 Court Street, Brooklyn, N. Y.

STOVE.—The Simplex Heating Company, 85 Sidney Street, Cambridge, Mass., is distributing bulletin No. 104, describing its "Simplex" electric breakfast stove, recently placed on the market.

ILLUMINATION.—"Brascolite Bulletin," architectural series No. 4, issued by The Brascolite Company division of the St. Louis Brass Manufacturing Company, St. Louis, gives illustrations of various salesrooms equipped with "Brascolites," "Aglites" and other "Brascolite" products.

LIGHTING FIXTURES.—The St. Louis Brass Manufacturing Company, St. Louis, is distributing an eight-page catalog covering its "Polynamel" line of lighting fixtures.

New Incorporations

THE VECO MANUFACTURING COMPANY, Norwalk, Conn., has been incorporated to manufacture and sell wiring devices with a capital stock of $50,000. The incorporators are Joseph A. Volk, Jr., South Norwalk, George G. Ernst and J. W. Ernst, both of Norwalk.

THE ELECTRICAL DEVELOPMENT CORPORATION, Butte, Mont., has been incorporated with a capital stock of $50,000 by A. Blaustein, E. N. Genzberger, J. Fischer, Louis Pohndorf, G. W. Mikel and S. Genzberger.

THE MORRIS LIGHT & POWER COMPANY has been organized with a capital stock of $10,000 by Joseph Weisenbach, John Nordmeyer, C. J. Bramlage, Aloys Bischoff and Anthony Haskamp.

THE TARGHEE POWER COMPANY, Pocatello, Idaho, has been incorporated with a capital stock of $300,000. N. P. Bean, James M. Ingersol and E. C. White are incorporators.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 31, 1922)

1,404,885. Polymorphous Dynamo Electric Machine; Alexander Nyman, Wilkinsburg, Pa. App. filed June 19, 1918. Produces high-frequency currents for wireless.

1,404,900. Trolley Hanger; William Schaake, Pittsburgh, Pa. App. filed Feb. 4, 1918. Supports plurality of conductors from messenger cable.

1,404,910. Magnet-Locking Device; Olof Thompson, New York, N. Y. App. filed Nov. 10, 1917. Movable part of solenoid locked when closed.

1,404,932. Electric System; Mark C. Cosgray Port Clinton, Ohio. App. filed Dec. 29, 1915. Battery system for feeding electrical devices.

1,404,933. Electric Regulation; John L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. On storage-battery charging sets.

1,404,953. Electrical Receptacle; Walter M. Gilbert, East Hartford, Conn. App. filed Oct. 11, 1917. Safety-switch cabinet.

1,404,979. Electric Heating Unit; Henry Kruesheld, New Washington, Ohio. App. filed Feb. 1, 1921. Self-contained fuse.

1,405,041. Operating Direct-Current Motors; Isidor Kitsee, Philadelphia, Pa. App. filed March 21, 1919. To start and stop at predetermined speeds.

1,405,043. Electric Cooking Utensil; Henry Kruesheld, New Washington, Ohio. App. filed Feb. 1, 1921. Waffle iron, griddle and toaster combined.

1,405,060. Apparatus for Recording the Duration of Sounds and Intervals of Silence; Frank E. Mosley, Shettleston, Glasgow, Scotland. App. filed Nov. 29, 1920. For the description of moving pictures by phonograph.

1,405,117 to 1,405,130. Methods and Apparatus for Dehydrating Petroleum Emulsions; Ford W. Harris, Los Angeles, Cal. Applications filed from May 29, 1917, to June 28, 1921. Fourteen patents describing methods and apparatus for taking water out of petroleum oils by means of an electric current.

1,405,133. Electrical Instrument Board; Bryson D. Horton, Detroit, Mich. App. filed Jan. 29, 1918. Made of sheet metal.

1,405,175. Telephone System; George A. Yanochowski, Chicago, Ill. App. filed Aug. 22, 1919. Ringing on automatic system.

1,405,217. Dental Film Holder; William O. Houser, Lincoln, Ill., App. filed March 3, 1920. Used with X-ray apparatus.

1,405,267. Telephone and Wireless Telegraphy Installation; Leon N. Brillouin, Paris, France. App. filed June 19, 1918. Connections of tubes.

1,405,270. Guide for Current Collectors; Cyrus B. Buchanan, New York, N. Y. App. filed Nov. 17, 1921. For double trolley wires at intersections.

1,405,287. Electrical Lamp; Joseph A. Clifford, Washington, D. C. App. filed Jan. 21, 1921. For illuminating theater stages.

1,405,338. Automatic Switch; Ludwig Schon, Essen-on-the-Ruhr, Germany. App. filed April 20, 1912. Alternately closes and opens in definite intervals.

1,405,345. Means of Control for Petrol Electric Vehicles; Percy F. Smith, Kent, England. App. filed Aug. 9, 1917. Combined gas engine and electric drive on automobiles.

1,405,348. Trolley Retriever; Sidney H. Springman, Torrance, Cal. App. filed April 27, 1920. To maintain connection when wheel disengages.

1,405,369. Automatic Magnetic Lock; Edwin M. Watson, Boston, Mass. App. filed June 20, 1919. For double doors in forced-draft boiler room on ships.

(Issued Feb. 7, 1922)

1,405,428. SIGNAL-TRANSMITTING SYSTEM; Harold S. Osborne, New York, N. Y. App. filed June 21, 1918. Corrects wave form of impulses at intervals along communication line.

1,405,455. ELECTRICAL PROTECTIVE DEVICE; Robert M. Spuck, Schenectady, N. Y. App. filed Oct. 10, 1917. Relay of retarded or time-limit type.

1,405,469. AUTOMATICALLY OPERATING MEANS FOR CONTROLLING RHEOSTATS OR EQUIVALENT DEVICES; Pliny K. Westcott, New York, N. Y. App. filed Jan. 17, 1920. Motor operated by variations in voltage.

1,405,472. TELEPHONIC RECEIVER; Alfred Williams and Leo D. Williams, London, England. App. filed Jan. 12, 1917. Use made of the thermophone effect.

1,405,475. ELECTRIC LIQUID HEATER; William A. Andrews, Detroit, Mich. App. filed March 11, 1920. Employs liquid to be heated as resistor element.

1,405,493. MOTOR CONTROLLER; Allan J. Cline, Chicago, Ill. App. filed Dec. 30, 1918. For variable-speed motors.

1,405,497. ARMATURE BRUSH HOLDER FOR ELECTRIC TOY DYNAMOS; Joshua L. Cowen, New York, N. Y. App. filed April 15, 1920. One-piece construction of sheet metal.

1,405,501. REPEATER NETWORK SELECTING APPARATUS; Charles S. Demarest, Brooklyn, N. Y. App. filed July 9, 1919. Means for balancing telephone line.

1,405,502. ELECTRIC MOTOR; Lee L. Dodds, Brooklyn, N. Y. App. filed June 26, 1920. Step-by-step clock mechanism.

1,405,506. METHOD OF AND MEANS FOR HEATING PRINTED SHEETS; James E. Doyle, Cleveland, Ohio. App. filed Nov. 11, 1919. Removes static electricity and dries the sheet of paper.

1,405,519. BRUSH MOUNTING; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed April 11, 1919. Auxiliary brushes to operate with main brushes.

1,405,523. AUDION OR LAMP RELAY OR AMPLIFYING APPARATUS; Marius C. A. Latour, Paris, France. App. filed Dec. 28, 1917. To determine the construction of transformers used.

1,405,532. ELECTRICALLY LIGHTED VANITY CASE; Louis Marko, Dayton, Ohio. App. filed April 6, 1921.

1,405,536. ELECTRICAL SYSTEM; John L. Milton, Louisville, Ky. App. filed Feb. 26, 1919. Magneto frame with polar members spaced axially.

1,405,596. BRUSH HOLDER; John D. Karle, Roselle Park, N. J. App. filed May 10, 1919. Tubular type for small machines.

1,405,608. SECTIONAL INSULATOR; Samuel S. Matthes, Mansfield, Ohio. App. filed Aug. 3, 1921. For sectionalizing high-voltage trolley conductors.

1,405,609. CONDUCTOR SUPPORT; Samuel S. Matthes, Mansfield, Ohio. App. filed Sept. 3, 1921. Supports trolley conductor from a catenary cable.

1,405,616. DYNAMO-ELECTRIC MACHINE; Paul A. H. Mossay, London, England. App. filed Sept. 12, 1919. Designed with channels for cooling.

1,405,624. ELECTRICALLY HEATED FIRELESS COOKER; Ralph J. Patterson, Boston, Mass. App. filed Oct. 5, 1920. Attachments for heating fireless cookers.

1,405,627. BATTERY; Earnest J. Petrie, Los Angeles, Cal. App. filed Nov. 22, 1920. Amorphous silica between plates and casing of storage battery.

1,405,630. FLASHLIGHT; Francis M. Rosenfeld, Elberon, N. J. App. filed May 2, 1918. Tubular light with hook to attach to object.

1,405,640. ELECTRICALLY CONTROLLED TRANSMISSION; Max Taigman, New York, N. Y. App. filed May 17, 1918. For machines subjected to rapidly reoccurring intermissions in their operation.

1,405,673. FIRE-ALARM TELEGRAPH; Lewis Degen, Oakland, Cal. App. filed Nov. 13, 1919. One mechanism for alarm code, another for trouble code.

1,405,702. STORAGE BATTERY; William H. Wood, South Euclid, Ohio. App. filed March 31, 1920. Lead oxide plate impregnated with animal hair.

1,405,703 STORAGE BATTERY; William H. Wood, South Euclid, Ohio. App. filed June 1, 1920. Lead compound plate impregnated with short fibrous sections of animal matter.

1,405,762. FURNACE; Thomas S. Curtis, Providence, R. I. App. filed Dec. 13, 1919. Electric furnace adapted for sintering or calcining ores.

1,405,767. CHANGEABLE EXHIBITOR, Thomas L. Easley, San Antonio, Tex. App. filed Sept. 25, 1919. Plurality of signs intermittently and successively displayed.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

CONCORD, N. H.—The Board of Aldermen are considering petitions for better lighting facilities from residents of Dimond Hill, Loudon Road, Iron Works Road, Elm Street, Penacook and the Plains district.

CAMBRIDGE, MASS. — A one-story power house, 50 ft. x 60 ft., will be erected by the Mason & Hamlin Company, 492 Boylston Street, Boston, at its new piano plant comprising six buildings, in Cambridge, for which bids have been taken. Monks & Johnson, 99 Chauncey Street, Boston, are engineers.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has commenced work on its new substation, 80 ft. x 180 ft., for which general contract has been let. Bids for electric equipment, etc., will be asked in about sixty days. French & Hubbard, 210 South Street, Boston, are engineers.

EVERETT, MASS.—Motors and other electrical power and mechanical equipment will be installed in the power department of the new high school to be erected on Broadway, to cost about $750,000. Ritchie, Parsons & Taylor, 15 Ashburton Place, Boston, are architects.

WALTHAM, MASS.—The Edison Electric Company has entered into an agreement with the city authorities whereby the company will spend $20,000 annually for the next five years for placing its wires underground.

BRIDGEPORT, CONN. — Steps have been taken by residents of the East Side to secure the installation of an ornamental lighting system on a portion of Stratford Avenue.

MANCHESTER, CONN.—The Board of Selectment is considering the installation of a new police signal system, to cost about $6,000.

NEW HAVEN, CONN.—A movement has been started by the Grand Avenue Business Men's and Property Owners' Association for extension of the ornamental lighting system on Grand Avenue from East Street to James Street.

Middle Atlantic States

BUFFALO, N. Y.—A rotary generator, transformers, 300,000 ft. of conduit, eight electrically operated passenger elevators and four electric freight elevators and other electrical equipment will be installed in the new hotel now being erected by the Statler Hotel Company.

NEW YORK, N. Y.—The New York Edison Company has filed plans for the erection of a two-story substation, 25 ft. x 100 ft., at 33 Attorney Street, to cost about $75,000.

YONKERS, N. Y.—The Yonkers Electric Light & Power Company, 9 Manor House Square, has taken bids for the erection of its new power plant to cost about $250,000. Thomas E. Murray, 55 Duane Street, New York, is engineer.

MORRIS PLAINS, N. J. — The street-lighting committee of the Hanover Township Committee is considering extensions to the street-lighting system, including a total of seventy-two lamps.

NEWARK, N. J.—Electric power equipment, motors, etc., will be installed in the proposed county vocational school to be erected at Bloomfield, to cost about $500,000. Guilbert & Betelle, 546 Broad Street, are architects.

NEWARK, N. J.—The Department of Parks and Public Property, City Hall, is arranging an appropriation of $117,200 for the construction of the proposed new power plant at the municipal market, of which about $36,000 will be used for alterations in the present building to provide for the station. It is also proposed to install a complete refrigerating plant to cost about $135,000, of which amount over $120,000 will be expended for machinery. Frank Grad, 245 Springfield Avenue, and George B. Hooper, 116 Market Streets, are architects.

PERTH AMBOY, N. J.—The Board of Aldermen is considering plans for the installation of an ornamental street-lighting system on New Brunswick Avenue.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has arranged for an increase in capital stock from 50,000 to 150,000 shares. A portion of the proceeds will be used for extensions and improvements to its system.

ALLENTOWN, PA.—The M. & G. Ice Cream Company will construct a 1,500-kw. substation at its new local plant, now in course of erection. The motor installation at the factory will approximate 1,000 hp. The H. N. Crowder, Jr., Company, Allentown, has charge of the installation.

GREENSBURG, PA.—A power house will be built in connection with the erection of an addition to the Westmoreland Hospital. Edward L. Tilton, 52 Vanderbilt Avenue, New York, N. Y., is architect.

PHILADELPHIA, PA.—The Bloch Go-Cart Company, 1136 North American Street, has completed plans for the erection of a power house at its plant. W. E. S. Dyer, Land Title Building, is engineer.

PHILADELPHIA, PA.—A power house will be built in connection with a group of buildings to be erected at the Presbyterian Hospital, in Philadelphia, to cost about $3,000,000. Dr. H. G. Paul is president of the board.

PHILADELPHIA, PA. — Bids will be received at the office of William S. Twining, Director Department of City Transit, 1211 Chestnut Street, until Feb. 28 for constructing signal towers and remote control houses (Contract 586) and for furnishing and installing underground cables (Contract 608) along the Frankford Elevated Railway between Arch and Bridge Streets.

POINT PLEASANT, PA.—The Plumstead Township-Buck County Electric Company is being organized by officials of the New Jersey & Pennsylvania Traction Company, Trenton, N. J., to operate a power plant at Point Pleasant and other parts of Plumstead Township.

READING, PA. — The Berks-Lehigh Electric Company has been organized to take over and merge the Lynn Township, Krumsville and Kempton Electric companies. The new company plans extensions to its system.

BALTIMORE, MD.—The Calvert Building & Construction Company, Calvert Building, will build an addition to its power plant. Henry Adams, Calvert Building, is architect.

HAGERSTOWN, MD.—The installation of an ornamental lighting system on West Franklin and East Washington Streets is contemplated at a cost of about $9,000. A. B. Grubmyer is superintendent of the municipal electric light plant.

GILBERT, W. VA.—The Gilbert Water & Light Company, recently organized with a capital stock of $25,000, contemplates the installation of electric light and water systems. Electricity will be furnished by the Kentucky & West Virginia Power Company of Logan. J. A. Berry is treasurer and general manager of the new company.

ALEXANDRIA, VA.—Steps have been taken by the Chamber of Commerce to secure the installation of an ornamental lighting system on King Street, to cost about $12,000.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, War Department, until March 4, for 8,500 ft. of wire, SC type, W-18. (Circular R9388-A12 CP.)

WASHINGTON, D. C.—The Treasury Department, Auditors' Building, will take bids until March 15 for supplies for the fiscal year from July 1, 1922, to June 30, 1923, as follows: Class 6, electrical and engineering supplies; Class 15, incandescent electric lamps.

North Central States

GREENVILLE, MICH.—A power plant will be built in connection with a canning factory to be erected by the Michigan Canned Food Company, 817 Book Building, Detroit, in Greenville, to cost about $150,000. The Industrial Construction Company, Eau Claire, Wis., is preparing plans.

LANSING, MICH.—Work will soon begin on the erection of the proposed municipal electric plant, general contract for which has been let to Frank H. Davis, 1838 Penobscot Building, Detroit. The plant will have a capacity of 55,000 kw. and will cost about $1,500,000.

OWOSSO, MICH.—The City Commission is considering the construction of a municipal electric light plant to be operated in connection with the municipal waterworks.

POWERS, MICH. — The Consumers' Power Company, Jackson, will begin work at once on a power plant at Powers, to replace the station recently destroyed by fire. The cost is estimated at $400,000.

CLEVELAND, OHIO.—The City Council has requested an estimate prepared for the installation of an ornamental lighting system on West Twenty-fifth Street from the New York Central & St. Louis Bridge to Woodbridge Avenue. The Council has also authorized the installation of electric lamps on various streets in the city.

PORT CLINTON, OHIO.—The Northwestern Ohio Railway & Power Company contemplates the erection of new transmission and distributing lines on certain highways in Carroll and Erie Townships. Application has been made for a franchise for the erection of new transmission lines in Danbury and Catawba Island Townships.

OWENSBORO, KY.—The municipal electric light plant is reported to have been destroyed by fire.

WEST POINT, KY.—The Louisville Gas & Electric Company has obtained franchises to furnish electricity in West Point.

CONNERSVILLE, IND.—The Interstate Public Service Company, Indianapolis, is preparing a report relative to plans for further development of the power possibilities of a hydraulic canal through Connersville. The plans under consideration call for deepening the canal and equipping it with hydraulic turbines at three points. The question of installing a waterpower plant or a steam plant will also be considered. The company is planning to erect a 33,000-volt transmission line to connect Connersville and Newcastle. The present line to Cambridge City will be changed to the same voltage and a new line will be erected between Cambridge City and Newcastle. William Insull is manager.

NEWCASTLE, IND.—A power house will be built at the Indiana Village for Epileptics, near Newcastle, in connection with the new erection of buildings, at the institution, to cost about $300,000. Dr. W. C. Van Nuys is superintendent.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has applied to the Public Service Commission for permission to issue $40,000 in stock, the proceeds to be used for extensions and improvements.

AURORA, ILL.—The Chicago, Burlington & Quincy Railroad, Chicago, is preparing plans for the erection of a power plant at Aurora, to cost about $100,000. William T. Krausch is architect.

PESHTIGO, WIS.—Budget appropriations for 1922 amounting to $825,000 have been granted to the Wisconsin Public Service Company, Green Bay, for new construction, equipment and development. The plans include the erection of a 6,200-hp. hydro-electric plant at Johnson Falls on the Peshtigo River near Peshtigo, to cost about $500,000. Bids, it is understood, will be asked about March 1 by Mead & Seastone, Madison, consulting engineers. C. R. Phenecie, Green Bay, is vice-president and general manager.

FRAZEE, MINN.—The Otter Tail Power Company, Fergus Falls, is receiving bids for materials for approximately 40 miles of three-phase, 40,000-volt transmission line extending from Frazee to the towns of Detroit, Audubon, Lake Park and Hawley. The cost of the equipment is estimated at $100,000. Construction will be started about April 15. C. S. Kennedy is vice-president and general manager.

MINNEAPOLIS, MINN.—The Northern States Power Company is arranging for line extensions to furnish service to Valley Springs, Lester, Beaver Creek and Ellsworth.

RED WING, MINN.—The City Council has adopted an ordinance authorizing the construction of a municipal electric light and power plant, for which bonds to the amount of $350,000 have been voted.

RUTLAND, IA.—The Union Utilities Company will soon call for bids for the construction of a hydro-electric power plant, estimated to cost about $150,000. Toltz, King & Day, Inc., 1410 Pioneer Building, St. Paul, Minn., is engineer.

WATERLOO, IA. The Roth Packing Company contemplates building a power house at its local plant.

JOPLIN, MO.—The Ozark Power & Water Company is considering issuing $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements to its plant and system.

ST. JOSEPH, MO.—At an election to be held April 11 the proposal to issue $300,000 in bonds for extensions to the municipal electric light plant will be submitted to the voters.

CLAY CENTER, KAN.—The Williamson power plant and dam on the Republican River at Clay Center has been purchased by the United Light & Power System. The new owners plan improvements to the property.

DOWNS, KAN.—The United Light & Power Company contemplates the erection of a new power plant, 50 ft. x 77 ft., in Downs.

HAMILTON, KAN.—The Council has awarded a contract to the Merkle Machinery Company, Kansas City, Mo., for the construction of a transmission line from Madison to Hamilton, about 11 miles, for local service. F. E. Devlin, El Dorado, Kan., is consulting engineer.

LUCAS, KAN.—The Council has approved a bond isue of $15,000 for the construction of a transmission line for local light and power supply.

LURAY, KAN.—The Council is considering the erection of a transmission line to secure electricity for local service.

McCRACKEN, KAN.—Bids will be received by the city of McCracken, care of L. L. Ryan, city clerk, about March 1, for power plant, two motor-driven pumps and two oil-engines, Diesel or semi-Diesel type. The Ruckel Engineering Company, Hutchinson, is engineer.

TOPEKA, KAN.—Steps have been taken by property owners on Topeka Boulevard for the installation of an ornamental lighting system on that thoroughfare from Fourth Avenue to Seventh Street. W. H. Kemper, 723 Topeka Boulevard, is interested.

Southern States

FORT PIERCE, FLA.—A power plant will be erected at the proposed new sugar mill to be built in this section by the Gulf Sugar Corporation. The Jamestown Electrical Engineering Corporation, Jamestown, N. Y., is in charge.

LEESBURG, FLA.—The Ocklawaha Reclamation Farms is planning the erection of from 20 to 30 miles of transmission lines to connect Leesburg and other cities. J. D. Young, Leesburg, is engineer.

TAMPA, FLA.—An electric street-lighting system will be installed in nine different sections of the city, replacing present gas lamps. A. W. D. Hall is city manager.

WEST PALM BEACH, FLA.—Plans are under consideration for improvements to the electric light plant and waterworks system, for which $75,000 in bonds has been authorized. Karl Riddle is city manager.

ALTOONA, ALA.—The City Council is considering the construction of electric light and water plants.

NEWTON, ALA.—The Houston Power Company will build a new transmission line from Hartford to Geneva, Ala., about 11 miles, for electrical service in Geneva.

BATESVILLE, ARK.—Improvements to the electric light and water plant, to cost about $25,000, are under consideration by the City Council.

CHARLESTON, ARK.—The City Council has granted to E. C. Linly a franchise to construct an electric plant in Charleston.

OPELOUSAS, LA.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until March 14, for wiring, etc., at the United States Post Office, Opelousas.

BROWNFIELD, TEX. — The Council contemplates improvements to the electric light system, for which $34,000 in bonds have been voted.

DALLAS, TEX.—The Dallas Power & Light Company has applied to the city for permission to change a present one-phase and two-phase distributing system to three-phase; construction of a transmission line to connect with the system of the Texas Power & Light Company; new transmission line to the Terrell district and additional reserve power line connecting with the Jackson Street power plant. The cost is estimated at about $167,000. C. W. Davis is general manager.

VERNON, TEX.—The City Commissioners have authorized plans prepared for a municipal electric power plant, for which bonds recently were voted.

MEXIA, TEX.—An election will soon be held to vote on the proposal to issue $800,000 in bonds for public improvements, including electric lighting system, incinerator, jail, purchase of the waterworks system at $112,500, and improvements to same, to cost about $300,000.

Pacific and Mountain States

PUYALLUP, WASH.—The City Council is considering the construction of a municipal power plant.

TACOMA, WASH.—The City Commissioners are considering the installation of an ornamental lighting system and the removal of poles and wires on Commerce Street from South Seventh to South Seventeenth Street.

FRESNO, CAL.—The San Joaquin Light & Power Corporation Fresno, and the Southern California Edison Company, Los Angeles, have made joint application to the Railroad Commission for approval of a contract whereby the San Joaquin company agrees to furnish to the Edison company 80,000,000 kw.-hr. of electricity between Aug. 1, 1922, and June 1, 1923. A new unit, consisting of a 20,000-hp. Allis-Chalmers turbine and generator, to cost about $1,250,000, will be installed to serve the Edison company.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation has plans under consideration for extensive improvements to its electric and gas systems. The company has applied to the State Railroad Commission for permission to issue $2,000,000 in stock.

MODESTO, CAL.—The board of directors of the Modesto Irrigation District has engaged Louis F. Leurey, electrical engineer of San Francisco, to investigate the cost of the distribution of electricity to be generated at the Don Pedro Dam, now under construction.

PLACERVILLE, CAL.—The El Dorado Power Company a subsidiary of the Western States Gas & Electric Company of Stockton, has been authorized by the Federal Power Commission to build a 100,000-hp. hydro-electric plant on the south fork of the American River in the vicinity of Placerville. The project includes six storage reservoirs on the headwaters of the river, with an ultimate capacity of 90.000 acre-ft.

SAN FRANCISCO, CAL.—The California-Oregon Power Company, San Francisco, has had plans prepared for the extension of its high-tension transmission line north from Algoma to Chiloquin, a distance of 22 miles, to cost about $75,000.

SESPE, CAL.—The Sespe Light & Power Company has entered into an agreement with the Shattuck Construction Company whereby the latter will undertake financing the construction of the light and power company's water-power and irrigation projects on the Sespe and Piru Rivers in Ventura County, and in consideration of this the Shattuck company is to receive a half interest in all the properties now owned and controlled by the Sespe company. The unit to be developed includes what is known as the Hammel reservoir and power plant, the Bradfield reservoir and main power plant and the Kellerman dam. The total capacity of this first unit will be 30,500 hp.

BOISE, IDAHO.—The City Council plans for the construction of a new hydro-electric power plant on the north and south forks of the Fayette River, with an initial capacity of about 8,000 hp., later to be increased to 12,000 hp. Permission has been received from the Federal Power Commission, Washington, to utilize the site and water power.

STOCKTON, CAL.—The Western States Gas & Electric Company, Elks' Building, is planning to erect a new transmission line from Stockton to Lodi, Cal., to cost about $70,000. Samuel Kahn is general manager.

DENVER, COL.—The Denver Gas & Electric Light Company has arranged for a bond issue of $3,000,000, part of the proceeds to be used for extensions and improvements to its system.

FORT BAYARD, N. M. — Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until March 6 for lighting fixtures for the Public Health Service Hospital Fort Bayard.

Canada

BRIGHT, ONT.—The establishment of an electric light and power plant in Bright is under consideration. George Oliver is clerk

COURTRIGHT, ONT.—A bylaw authorizing $11,000 for the erection of a transmission line to Courtright has been approved by the ratepayers. The line will be extended from Sarnia.

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Inspection or Obstruction?

FRESH emphasis is given by the recent resolution of the Western Association of Electrical Inspectors to the fact that the spirit of the underwriters' service is not in tune with the electrical industry. Present inspection practice is inadequate. Now comes this proposal that no appliances should be used until approved by the fire insurance men. It might be well to raise the question—What is the real function of the underwriters' inspection anyway?

When a man puts up a building and desires insurance, an inspection is made. The purpose is clear. The inspectors examine it. On the basis of the character of the building and the neighborhood, they appraise the degree of apparent hazard and they fix the rate that he must pay for fire insurance. The owner may build of frame or stone; he may use oil lamps; he may use gasoline; he may do what he will. The underwriters make no effort to control him; they simply charge in accordance with the hazard.

THE insurance man's attitude toward electrical inspection, however, is quite different. He does not examine the use of electricity in the home as a basis of appraisal. He inspects and passes the initial wiring, that's all. Lamps may later be increased in size, or heating devices attached to every socket or heavier fuses put in. He never knows it.

Yet, if underwriters' inspection is to mean anything, it should embrace the building and its entire contents. If conditions are unsafe—be the risk in the wiring, a flue or an appliance—insurance may be withheld or the rate increased, and the central station may shut off the current. This is the protective function of fire insurance inspection.

But the use of electricity *is* safe—safer than stoves or candles. The insurance man knows this in his own home.

THEN why do many fire-insurance policies carry a clause prohibiting the use of electricity for light, heat or power (and then consent in the next paragraph)? This scares people. It hurts the electrical business. It is discrimination—for no printed word appears against matches, open fires or other greater hazards. And now comes this suggestion to restrict the sale of appliances by making approval necessary. This would also hurt electrical men and interfere in everybody's home.

Clearly something should be done. We need a more intelligent and sympathetic inspection that will appraise the risk and safeguard the public but not *prohibit* progress. Much more can be accomplished for fire prevention by constructive co-operation with the public and the industry than by obstruction. And to oppose the growing popularity of electricity is feeble folly.

Inspection must be made effective. But it must not hinder electricity's great service to mankind.

Harry Phillips Davis

A designing and manufacturing executive who has contributed largely, individually and through direction, to the development of numerous types of electrical apparatus.

ON THOSE men who are intrusted with the power of decision as to the development and progress of the electrical art there rests a tremendous responsibility. Their judgment determines the course of progress and thus has not only an immediate effect but one of years. These men must have a breadth of conception that embraces the entire industry, a vision that carries them well beyond the mere needs of the moment, and the power to inspire others and direct their enthusiasm into channels productive of benefits to mankind. Such a man is H. P. Davis, vice-president of the Westinghouse Electric & Manufacturing Company, in executive charge of all of the company's production and engineering. Most of his individual attention as a designer has been given to so-called supply apparatus.

To such devices as switches and insulators Mr. Davis has applied the same engineering skill and painstaking care that are bestowed on the larger and more complicated apparatus. He has taken out seventy-seven patents, mostly covering resistance coils, circuit breakers, controllers, fuse blocks, solenoid brakes, trolley clamps and similar devices. It was, in fact, largely due to his efforts that the Westinghouse company changed from being a builder merely of heavy machinery to becoming a manufacturer of complete lines of apparatus. A troubleless transmission line has been his ideal, and he has done much to remedy those defects in minor details that were so conspicuous in the early days of electrical engineering. In addition, he has accomplished excellent creative work with arc lamps and meters. His arc lamp set a standard in the days when this form of illumination was dominant, and his alternating-current meter (in which Frank Conrad was co-inventor) superseded the original Shallenberger type.

Not only is Mr. Davis known as a designing engineer of high rank but he also has achieved prominence as a manufacturing executive. One of the studies to which he has given constant attention is that of obtaining quantity production through standardization without sacrificing quality. He has the reputation of getting results regardless of difficulties. This was admirably illustrated during the war when, being in charge of the company's East Pittsburgh works, he was intrusted with the fulfillment of the government munitions contracts.

Mr. Davis was born in Somersworth, N. H., in 1869. He was graduated from the Worcester Polytechnic Institute, with the degree of B. S. in electrical engineering, in 1890. After a trip to Europe and a few months spent with the Thomson-Houston Electric Company, he entered the detail engineering department of the Westinghouse Electric & Manufacturing Company in 1891. In 1896 he was placed in charge of this department, and in 1908 he was made manager of the engineering department. This position he held until 1911, when he was elected a vice-president of the company.

Editorial Comment

Electrical World, March 4, 1922
Volume 79 Number 9

Engineers Worship Idols Too Often

THE power transmission engineer on the Pacific Coast, as we have often intimated, has the courage of his convictions and an inclination to do things first and inquire into their possibilities afterward. In particular, when it comes to the matter of voltage the sky is his limit, and with each upward step he gains confidence for a succeeding leap. One of the interesting phases of last year's work in power transmission is the steady working upward of line pressures toward the next plateau, so to speak, that around 220,000 volts. In each instance provision is made for static shields on the strings of suspension insulators in order to equalize the strain along the string instead of throwing most of it on a very few disks. Having long known the insulation limitations imposed by non-uniform voltage distribution and the severity of occasional flashovers, it is surprising that engineers have not tried static shields on a considerable scale before. While the grading of insulators may appear in a form considerably different from any now known, it is one of those theoretical advances that must of necessity work, and it has been tried out sufficiently to show that it does work. Static shields are going into service on several of the Pacific Coast lines very soon and during the next decade we may have other examples of grading if any superpower lines are pushed through.

If engineers do not want to be kicked forward again by our friends in the West they will have to stop burning their joss sticks before the gaudy idol bearing the inscription "Our Standard Construction."

Standardization is much to be commended, but it must never stand in the way of progress.

N. E. L. A. Campaign Gains Strength with Broader Vision

THE National Electric Light Association's campaign, in which it is expected that the forces of the entire industry will be marshaled in a concerted movement for the stimulation and development of better business, seems to be definitely taking shape. The idea apparently was sprung without much preliminary thought, and neither the purpose nor the plan has been very clear. Rather, it has been a spontaneous expression on the part of many men that the time at last is right for the re-establishment of central-station commercial departments and the reawakening of the electrical business. It is a good and cheerful sign.

Now all this hope and confidence is being organized into a plan, on the best possible basis, which is to provide help to those who are willing to help themselves. Committees are collecting and compiling experience, information and ideas which may be presented to communities of every character for their inspiration and assistance in local work. Machinery for national executive direction is being set up. And the whole of it is being shaped into the pictured vision of an opportunity that may be measured.

The slogan that was first announced was an unfortunate choice and has been abandoned. "More business—better business" does not sound the true purpose and the spirit of this movement, for it has within it something finer and bigger than a bald desire to increase immediate sales. It is not to be just another short, high-pressure drive for orders. Rather, the need is to carry to the men and women of the electrical industry itself the confident realization that good times are here again and through them relay this welcome message to the people of each town. And this is not to be a trick of salesmanship. It is not sophistry. It will be predicated soundly on the steadily improving economic status of the country and the world. Organized into this well-sponsored movement, it will administer that vital impulse to the mass psychology and give us confident belief at last that it is time to go ahead and buy and build. And all the nation will be prospered by the increased business activity that will result.

Some Startling Figures on Available Water Power

THE mere fact that most of the nearer and more easily developed water powers in this country have already been exploited need not in these days discourage the engineer from looking further afield. Transmission distances of several hundred miles are now sufficiently familiar to raise few doubts as to the availability of powers of which even a decade ago the development would have been held impracticable. Under these conditions a good deal of interest attaches to some of the recent power surveys in Canada, and in particular to the examination of the undeveloped water power in the Province of Manitoba, just across our northern boundary and a most friendly and prosperous neighbor. A survey of this single province shows in the sum of the available sites more than 3,000,000 hp. on a minimum scale of development and above 5,000,000 hp. if a reasonable maximum of development is assumed. Hydro-electric resources of this extent bring almost measureless possibilities of active industry. Indeed, the practical question is not how to develop the energy, but how to utilize it afterward. Of this huge store of "white coal" 250,000 hp. is on the Winnipeg River, comparatively near to Winnipeg itself—and to the border, if our Canadian friends have energy from this source to spare. The great development, however, will have to be on the Nelson River, the great northward-flowing outlet of Lake Winnipeg into Hudson Bay. The utilization of this means long transmission even in the present sense of the term, but, on the other hand, 2,500,000 hp. makes long transmission worth the while, and utilization resolves itself into a question of markets. Most assuredly the Dominion is safe from a shortage of power whether the oil supply turns out ill or well.

Public Education Needed on the Source of Municipal Power

MUNICIPALITIES in most if not all of the states have no powers other than those delegated to them by the respective state legislatures. Ignorance of this fact plays a tremendous part in the public mind in the furtherance of the home rule idea. It is the idea of the average citizen that the powers exercised by the municipality of which he is a part are in some way inherent in the community itself. As a matter of fact, the municipality is organized under laws of procedure passed by the state legislature. For convenience and supposed efficiency in handling municipal affairs certain police and other powers are delegated to the municipal corporations. These powers can be limited or increased at any time the legislature is convinced there is real need for a change. Outside of the powers specifically delegated the municipality may claim nothing. In many cases municipalities have assumed rights that have not been specifically given to them. This has been possible only because no one has questioned these acts. It would not be amiss for the executives of electric light and power companies to inform themselves on the situation in their own states and in turn educate their own public in the matter. To accomplish this might put a different and a more intelligent face on many a home rule controversy.

A Better Contact Between Manufacturers

MOST differences of opinion and purpose between men of kindred interests are the product of misunderstanding. Because they have not habitually worked and talked and thought together on their common problems they have come to look upon these problems as quite individual and their own. And because each travels his own path and follows the association of his own ideas, shaping somewhat divergent aims and methods, each comes to look upon the other as being unconcerned with his affairs, if not competitive and even antagonistic, in matters where really there is the most obvious mutuality of interest.

How and why many such conditions have evolved within the manufacturing branch of the electrical industry is graphically told by Mr. Berresford in this issue. It is a story that should be pondered well by electrical men. We have a most unusual balance of conditions—a few very large manufacturers, a larger group of smaller units and then a lot of little ones. This has produced the same kind of situation within the manufacturing branch that also exists more broadly between the four classes into which the industry as a whole is divided—manufacturers, jobbers, contractor-dealers and central-station men. The result has been a lack of that free interchange of thinking between different kinds of manufacturers, large and small, that is so much needed between the class groups, that the solving of the common problems and the serving of the common ends may have a more harmonious direction and support.

It is hoped and believed that the broader and more centralized organization now embracing the three existing associations of electrical manufacturers may bring greatly increased strength and activity to the progress of both policy and practice. The fact that the heads of our two largest manufacturing systems are now serving personally on an advisory committee in active co-operation with the Electrical Manufacturers' Council promises a new element of co-operation which should mean much in the overcoming of some of the very causes of misunderstanding of which Mr. Berresford speaks.

Conclusions from Questionnaires Must Be Drawn with Caution

OPPORTUNITIES for advance and for new discovery in the field of electric transmission are emphasized by the occasional discussions which arise as to the value of certain types of equipment usually considered to be standard. These discussions also serve as commentaries on the present uncertainty and inadequacy of our knowledge of the natural laws governing the operation of a high-voltage transmission line.

Recent instances of this character were the discussion as to the value of lightning arresters, already commented upon in these columns, and that on the value of the overhead ground wire at the recent midwinter convention of the American Institute of Electrical Engineers. These discussions were occasioned by reports on the returns from questionnaires and other investigation as to the practice and opinions governing in a large number of representative systems.

It was surprising to hear, in connection with the analysis of the investigation as to present practice in the matter of the overhead ground wire, that in some types of transmission line it might be better to omit rather than install an overhead ground wire. There seemed to be no question of the value of the ground wire for a line having steel towers, but omission of the ground wire was stated to be permissible and even conducive to greater reliability in certain types of lines on wooden poles. The ground for this suggestion is apparently the reports from certain operating engineers that the ground wire leads to a lowering of the line insulation to ground and therefore to an increase in the number of insulator failures. This is equivalent to stating that the wood of cross-arms and poles is relied on as a part of the insulation of such a line. It is difficult to understand how a position of this kind can be seriously taken, when such troubles should be avoided, not by eliminating the ground wire, but by the installation of insulators of higher voltage rating.

The value of an overhead ground wire lies principally in the increase of the capacity of the line to ground. This means that any disturbance which may arise at any point is correspondingly reduced in intensity as it advances over the line. A further protection arises in the screening effect of the ground wire against lightning disturbances. While the magnitude of this screening effect has been a matter of discussion, particularly for the case of only one ground wire, it is nevertheless present to some extent. The principles underlying these two types of protection are fundamental and for the most part clearly recognized, as was evidenced by the criticism brought out at the convention of the suggestion that any line might be safer without a properly installed overhead ground wire.

The results of questionnaires and similar investigations of current practice may be of considerable value, particularly when they are directed toward the securing of reports of experience in operation with different classes of equipment. However, it must be recognized that nearly all types of electrical equipment require study in their selection for particular duties as well as care both in installation and in operation. It may happen that these types of skill and care are not applied to their full extent and in such cases that the equipment in question will not give the most favorable report of itself. Consequently it is not to be expected that all of the results from a widespread questionnaire will be indicative of best contemporary engineering practice and opinion.

Probabilities Must Be Weighed in Substation Design

THE object in the construction of any substation is the provision of the best and most reliable service that can be given the consumer. After the equipment, such as transformers, structure and main oil switches, that is absolutely necessary if service is to be given at all is provided, the designer's next thought is the protection essential to insure good service. It is at this point that the biggest errors are made. It is easy to conjure up any number of happenings that are possible. Because they are possible under some conditions there is a tendency to provide protection against every one of them, and many installations in all parts of the country represent just this sort of engineering. The proper course is to classify the possibilities into various degrees of probability and then estimate the cost of protection against each degree of probability. The designer is then in position to know just what protective measures are justified. He must be guided in every decision by the question of cost weighed against the degree of danger and not by a feeling that all the things theoretically desirable must be forced in somehow or other.

Far-Reaching Influence of the Radio Telephone

THE American Telephone & Telegraph Company has announced that it will establish a radio-telephone broadcasting station in New York City that will be leased in much the same way that its wire service is leased. This is only another step in a remarkable development that has aroused intense public interest in the radio telephone during the past year. The manufacturing companies which have established similar stations, as well as the numerous private stations for broadcasting regular programs, have established a demand for the service that is recognized by the daily press, where full programs for the best-known stations are printed each day. The proposed station in New York will be the first commercial station that can be used by any one who is willing to pay the leasing charge. It is significant that the company announces that it will establish a chain of such stations in other important cities if the demand justifies, and that its long-distance facilities will be used to connect these stations together so that programs given in one section of the country can be heard in another section by any one having a receiving set.

The immediate result of the work of the past few months is shown in the creation of a new army of buyers. Radio-supply stores have sprung up by the hundreds all over the United States, and the manufacturers are finding it impossible to keep up with the demand for equipment. At the moment the retail dealer finds himself short of stock owing to the demand on him. To the disgusted buyer this seems to be a chronic condition, though the difficulty will soon be remedied by the further development of manufacturing facilities. More significant is the character of the customers. A large portion of them are youths ranging from ten to twenty-one. They are not technically trained, and yet even the youngest of them can talk inductance, capacity, impedance, resistance and the other technical terms with a pretty thorough grasp on their meaning and a good appreciation of their application in radio work. The observer is forced to speculate upon the far-reaching effect that this condition will have on the future citizens of the country. Fad though the movement may be styled at the present, the education that these young people are getting is of untold value. It may well prove to be one of the most effective aids in dispelling the mystery that has enveloped the electrical industry in the public mind. At the very least it is taking the minds of the younger generation from amusements that may be questionable and giving them something that will be of tremendous use in the future.

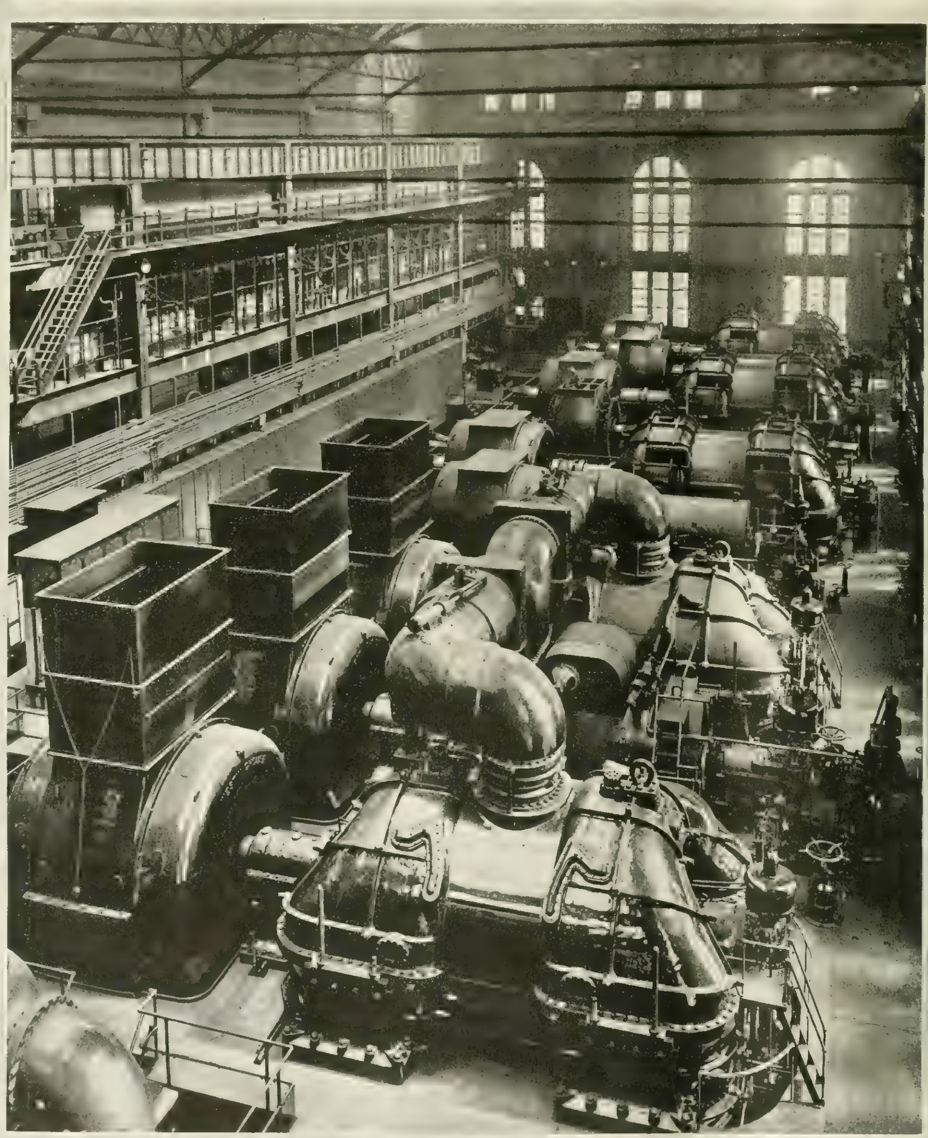
Behavior of Reactors Outdoors Is Encouraging

THE placing of high-voltage terminal and substation equipment out of doors has been generally successful from the start. This has been largely due to the possibility of making the casings of transformers, circuit breakers and lightning arresters completely weatherproof, thus reducing the problem to that of the proper insulation and separation of the connections. A type of equipment which has been somewhat slow in venturing out of doors is the current-limiting reactor. This is probably due to the facts that it is not inclosed and that it relies entirely on the air for insulation between turns. Failures of such reactors have apparently left some doubt as to whether mechanical stresses or abnormal voltages between turns have been the cause. If the latter, obviously the hazard is increased in going out of doors.

To throw light on this question a series of tests have been conducted by the Pennsylvania Water & Power Company. They are reported in this issue by A. F. Bang. Heavy short circuits were thrown on reactors of late type especially designed for out-of-door service, provision being made for severe rain conditions and for the measurement of both current and voltage across the coil. No trouble was encountered, showing that the coils were amply able to withstand the mechanical stresses and that the voltage across the coil was below the normal value for the system and devoid of evidence of high-frequency oscillation. It is concluded that abnormal voltage rises are probably not a danger to installations of this character. However, it is not clear how such a disturbance could be expected under the conditions given, since the electrostatic capacity between the various parts of the coil is undoubtedly extremely small. Obviously the tests do not warrant conclusions as to conditions which may arise in a reactor connected to a long line without intermediate apparatus. All of the conditions for abnormal voltage rises attendant upon an arcing ground or lightning disturbance are present in such a case.

On the other hand, the tests constitute valuable data on the behavior of reactors when used outdoors for limiting current and power under short-circuit conditions. It is also of interest to note that in the case in question, in spite of the increased size and weight of the outdoor type, the saving by the elimination of building space resulted in a net saving of 20 per cent in adopting the out-of-door installation.

Fluctuating Load Carried with Water Rate of Only 11 Lb. per Kw.-Hr. by Three-Cylinder, 60,000-Kw. Turbine



THE three-cylinder cross-compound turbine shown above has carried a fluctuating load with a water rate as low as 11 lb. per kilowatt-hour, according to tests announced last week. It is rated at 60,000 kw. and was installed in the Seventy-fourth Street station of the Interborough Rapid Transit Company, New York, in 1918. With the high-pressure and one low-pressure element in service the lowest water rate was 11.25 lb. per kilowatt-hour. This is better than that for the complete unit when operating at loads below 25,000 kw. The best Rankine and thermal efficiencies obtained were 76 and 25.1 per cent respectively. It is unfortunate that more performance tests are not made public.

European Practices Tend Toward Greater Economy

Standardization of Equipment and Grouping of Related Activities Waste Heat Boilers, Gas Turbines, Large Mercury Rectifiers and Novel Frequency Changer Shunt Motors for Shears—Power-Factor Correction

By A. DYCKERHOFF
Electrical Engineer Illinois Steel Company, South Chicago, Ill.

IN EVERY European practice the tendency is toward greater economy because of the great scarcity and high cost of fuel and raw material. To attain this end large power plants are under construction, either near the coal mines—for example, the Golpa plant, rated at 180,000 kva.—or where water power is obtainable, as in the case of the Walchensee project in Bavaria. As many power plants as feasible have been interconnected, the sizes of units have been increased, and attempts are now being made to establish inter-company standardization of electrical machines so that one manufacturer will make a certain line of machines while the other companies standardize on different lines and types. Various industries have established individual heat bureaus that check any waste of fuel, and exchange of experience is facilitated through a central office. In the foregoing activities the various scientific societies have participated, having recently combined into one national organization to co-ordinate their work.

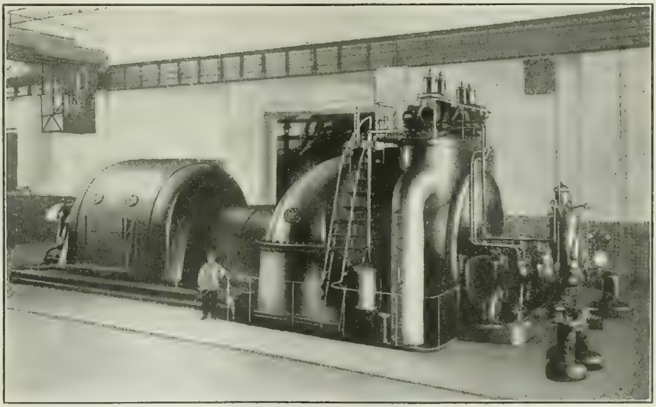


FIG. 1—60,000-KW. SINGLE-SHAFT TURBO-GENERATOR IN GOLDENBURG STATION

A regrouping of the various industries and manufacturers has taken place. Not only have certain steel mills joined hands to enlarge the field of their products with the greatest economy, but companies having different activities have united. For example, one of the largest electrical companies, the Siemens group, has formed a "community of interest" with another group, embracing coal mines, steel mills and machine factories. Another concern, Thyssen, producing steel, coal, mill machinery, gas engines and steam and gas turbines, has taken over an electrical concern. The Allgemeine Electricitäts-Gesellschaft has consolidated with a steel mill in Saxony and a large railroad shop in Silesia. Further, there are certain understandings between concerns making products of different kinds.

This concentration of science and industry has evidently come about through dire necessity and not through governmental fostering.

With the drop in value of the mark the volume of business has so greatly increased that power plants in the industrial districts can, with the prevailing scarcity of coal, scarcely meet the demands upon them. To divide the power available equitably, all large industries are permitted to take power only for a certain period and then only to a specified extent. The result is that the "use factor" of the power plants is very high and a very good thermal economy is being obtained.

Most of the power plants are suffering from a low power factor of about 0.5 to 0.6, owing to the fact that the motors installed during the war were too large for the duty required of them, particularly in mines and steel mills. The detrimental influence is felt more now on account of the linking up of steel mill, mine and public utilities power plants. To ascertain the condition on the lines in the absence of a single suitable meter, two integrating meters are employed, one to measure the active component (wattmeter) and one for the reactive power component. Many power plants are not only limiting or penalizing maximum demands, but are including rate clauses based on the reactive component. For instance, one power plant permits a rebate of 6 per cent to the consumer for reactive-power kilowatt-hours not used and demands from power plants operating in parallel an extra charge of 12 per cent of the kilowatt-hour rate for the reactive power not delivered to the system which joins the plants.

Static condensers have not proved so satisfactory in practice, and synchronous condensers are scarcely ever applied at present on the Continent. The Continent prefers to operate one or two units in the generating station with such an excitation as to offset the reactive power and to equip the main offenders, the large induction motors, with suitable phase advancers. While it is recognized that the crane motors in industrial plants are largely responsible for low power factor, their influence on the line is small compared with that of large induction motors rated at several thousand horsepower each.

With good boiler-plant practice, efficiencies of 80 to 83 per cent have been attained when using coal, while 87.5 per cent has been reached with boilers using blast-furnace gas and suitable burners.

Steam turbines have been further improved as to size and economy. Frequently a water rate of 5 kg. (11 lb.) per kilowatt-hour, including condensation requirements, is guaranteed for 20,000-kw. units at full load. One kilowatt-hour has been developed from an energy input of 4,360 kg. cal. (17,320 B.t.u.) in some cases, including demand of the auxiliaries. The sizes of the turbine-driven units have been increased to 60,000 kva. at 1,000 r.p.m. in a plant near the Rhine which is laid out for a capacity of 248,000 kva. However, the experience gained with such very large units is that units of smaller rating are preferable. For this reason 22,000-kva. or an intermediary rating is more popular on the Continent.

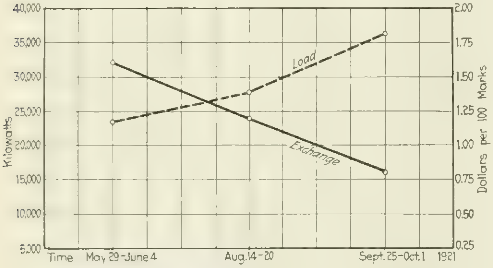


FIG. 2—INFLUENCE OF FOREIGN EXCHANGE ON POWER DEMAND OF A WESTPHALIAN PLANT

PROGRESS MADE IN GAS-ENGINE AND GAS-TURBINE DESIGN

Good progress has been made in the design of the gas engine. The largest unit, as a type, is the 4,000-kw. engine, in the Thyssen Hütte. It is a tandem engine, not a twin tandem, operating at 94 r.p.m., and its dimensions are 1,500 mm. x 1,500 mm. (59.2 in. x 59.2 in.). It is evidently planned to install gas engines of still larger output, since the exhibition in Essen showed a Thyssen gas-engine generator rated at 6,000 kva. and 94 r.p.m. The engine is equipped for scavenging and surcharging to increase the output and the thermal efficiency. It has an efficiency of 27 or 28 per cent at full load, or the equivalent of one net kilowatt-hour per 3,150 kg. cal. (12,500 B.t.u.). Without scavenging and surcharging a good gas engine requires 3,560 kg. cal. (14,100 B.t.u.) per net kilowatt-hour at full load.

Many gas-engine power plants are now equipped with boilers utilizing the exhaust gases to generate steam. Several good waste-heat boilers are on the market. In one instance exhaust gases having an initial temperature of 500 deg. C. (932 deg. Fahr.) leave the boiler at a temperature of 180 deg. C. (356 deg. Fahr.). About 1.2 kg. (2.64 lb.) of steam at 10 atmospheres (142.2 lb. per square inch) is generated per kilowatt-hour from the exhaust gases of the gas engine. To improve the regulation of mixed power plants which have gas-engine-driven and steam-turbine-driven generators, two regulators are sometimes installed, one regulator common to all gas-engine generators and one to the turbine-driven generators. Some Continental gas-engine power plants having turbine-driven generating units to take care of the peak loads and serving considerable roll-motor load have a yearly net average thermal efficiency of about 20 per cent at a load factor of 0.75, constituting an improvement by about 2 per cent in the last eight or nine years.

The research work on the gas and oil turbine which was commenced before the war has been taken up energetically during the last few years. A 1,000-hp. gas turbine has been built and tested thoroughly, and designs are completed for a 10,000-hp. unit to run at 1,500 r.p.m. A model of this was exhibited at Essen. Likewise, a 500-h.p. oil turbine has been completed rated at 3,000 r.p.m. It is said that a thermal efficiency of 25 per cent has been obtained at the circumference of the wheel. This would be equivalent to about 20.5 per cent referred to the generator, so that one kilowatt-hour would require 4,200 kg. cal. (16,700 B.t.u.). Thus at present the gas turbine takes a place between the steam turbine and the gas engine. Evidently many difficulties have been overcome, but still more perseverance and work is needed to make the engine fully reliable.

PROTECTIVE SYSTEM FOR ANTICIPATING FAULTS IN DISTRIBUTION SYSTEMS

Owing to the shorter distances on the Continent, the highest voltage used in the transmission of power has been limited so far to 100,000 volts. Only a few systems operate at this potential at present. One of the latest is the line from the Golpa power station to Berlin. There has been no hesitation to bring the 100,000-volt line into the city proper, over a distance of about 15 km. on towers 26 m. (85 ft.) high, as illustrated on page 120 of the Jan. 21, 1922, issue of the ELECTRICAL WORLD. The highest voltage applied to three-phase cables so far is 35,000. With the growth of the distribution systems, there has arisen the necessity of devices which will indicate defects in a circuit before serious results occur. For this purpose the Pfannkuch protective system is being used to indicate a defect in a cable early enough so that it can be repaired before an actual breakdown occurs.

MERCURY RECTIFIERS OF 2,000-KW. RATING AND NOVEL FREQUENCY CHANGER

The large mercury rectifier has been perfected to a great degree of reliability, and there is great hope that it will be developed to still larger sizes. At least two concerns have placed on the market a line of large rectifiers—their advantages being claimed to be high power factor, high and uniform efficiency, large overload capacity and negligible attendance. The problem of maintaining a high vacuum in the steel containers has evidently been solved satisfactorily, it being possible to maintain the vacuum by operating the vacuum pump about one-half hour a day. The efficiency of the rectifier is about 98 per cent in the 1,200-volt size and about 90 per cent for the 220-volt units. The large standard-size rectifiers in operation are rated at about 500 kw.; however, it is said that sizes of 1,000 kw. and 2,000 kw. have been built with a maximum direct-current voltage of 1,200.

One frequency changer which deserves special mention serves the purpose of changing three-phase, 50-cycle energy to single-phase, 16⅔-cycle energy for railway service. The stator has a special winding similar to that of a three-phase winding, and the rotor field winding is energized by direct current. There are two overlapping fields, one having two poles and the other six poles. The stator winding is common to both frequencies. Currents at 50 cycles and 16⅔ cycles flow in the same winding, but there are separate taps for the two frequencies. The copper losses are considerably reduced by the winding common to the currents of the two frequencies.

The output of the rotary converters has been increased to about 4,500 kw. at 450 volts to 550 volts and 250 r.p.m. To avoid synchronizing, two methods are generally used. One is to connect the stator of an induction motor in series with the alternating-current side of the rotary. The stator of this auxiliary motor is short-circuited when the rotary has reached synchronism. The other method is to apply low voltage to the slip rings of the rotary.

Higher speeds have been employed to reduce the cost of flywheel motor-generator sets, used in conjunction with mine hoists and reversing-mill motors. The speed of most American flywheel sets is 375 r.p.m., while the Continental practice is 428 r.p.m. This has been increased to 500 and 600 r.p.m., the peripheral speed of the flywheel reaching 130 m. per second (25,600 ft. per minute) and more. Since the losses occurring chiefly in the secondary of the alternating-current motor are increased by 3 to 4 per cent on the average owing to the drop in speed of the set, some flywheel sets are being built now to regain a great part of these losses. This has been accomplished in much the same way that economical speed control of alternating-current induction motors has been attained.

Electrically Heated Boilers Developed, Three-Phase Commutator Motors Less Favored

Several firms have developed electrically heated steam boilers which are not only used where hydro-electric power is abundant, but also under general conditions. The points in their favor are: Utilization of surplus power, elimination of coal transportation, possibility of locating them where most desirable, and elimination of long pipe lines, saving of attendance and constant readiness for service. The high resistivity of the water which forms the electrolyte permits voltages as high as 10,000 to be used. The electrodes are made of iron and surrounded by cylindrical tubing of insulated material to enable regulation of the length of the circuit between electrodes. The output of the boiler is determined by the number of groups of electrodes. Units up to 6,000 kw. have been developed in which full steam pressure can be attained in less than one hour. Condensate is best suited for evaporation. Owing to the high frequencies employed formation of an explosive gas mixture is practically impossible. Another type of boiler is regulated by changing the water level.

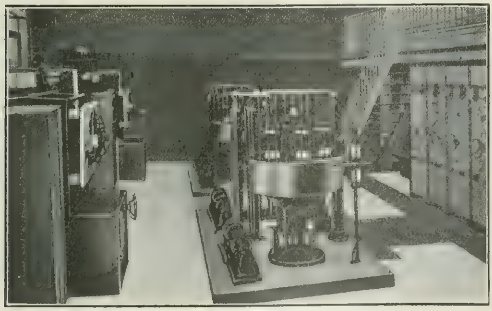


FIG. 3—STATIC RECTIFIER SUBSTATION IS DEVOID OF COMPLEXITIES

The three-phase commutator motor, as an independent unit, has lost its favor lately. Before the war there were great hopes of this apparatus, but these have not been realized owing to the limitations and expensiveness of large applications. The series type has been used on small hoists in mines, etc., in ratings up to 500 hp., the motors being commonly controlled by shifting the brush rigging by means of oil pressure. Commutator motors with shunt characteristics are used in sizes up to several hundred horsepower for pumps, fans and compressors. With these the speed is regulated by impressing different voltages on the rotor from a transformer or from taps of the stator. Alternating-current motors, either small single-phase or three-phase, have been used a great deal for turning lathes and textile machines. As an auxiliary motor in connection with an induction motor, for the purpose of speed regulation, it has been used very moderately in sizes up to a few hundred horsepower.

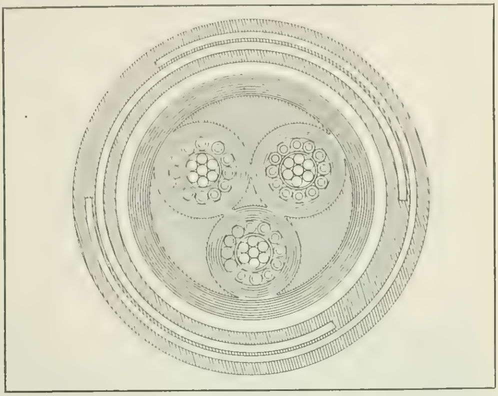


FIG. 4—CROSS-SECTION OF CABLE USED WITH PROTECTIVE SYSTEM SHOWN IN FIG. 5

The core conductor and the layer conductor of each phase are insulated with paper like the individual wires of the outer layer. The odd wires of the outer layer are in parallel, and the even wires likewise, thus forming two wire groups of the outer layer.

Very few installations of electrically driven turbo-blowers and reciprocating blowers for blast and bessemer furnaces have been made in the last eight or nine years. The advantage of the motor-driven units is mainly that they can be placed near the furnaces, that they may be easily controlled and require fewer heat units than an individual engine, which is usually operated anywhere between quarter and full load. While the motor-driven one is also subject to the same load, it is connected electrically to the power station which will scarcely be affected by individual load variations due to the diversity of load. Furthermore, generating capacity equivalent to only one-half of the maximum rating of the motor-driven unit has to be installed. In general, there is some tendency to install motor-driven turbo-blowers and electrically driven piston blowers as standby units under favorable conditions.

One of the most severe intermittent services required of the smaller-sized motors is operation of large shears for cutting steel. The practice is to provide the shear with a flywheel to assist the motor in overcoming the cutting resistance. Since the flywheel and motor are running continuously, the friction load entails high losses. If an alternating-current induction motor is used, the secondary losses for the additional slip must be added. Evidently this does not result in a very economical operation. To improve conditions it is necessary not only to eliminate the flywheel and idle running of the motor, but also to adjust the working speed automatically to the load, so that overload breakdown of the motor is impossible and so that a predetermined maximum of speed is not exceeded. At the same time the motor must be well utilized at the variable load—*i.e.*, the output must remain constant, which means that torque and speed should be inversely proportional. The direct-current motor of the series characteristic does not fill these requirements, owing to the saturation of the iron and the relation of field and armature current; but the shunt-wound motor is adaptable, if its shunt field is regulated automatically. Some of the newer shears have no flywheel and are driven by a reversible direct-current shunt-wound motor which is started just before each shearing operation. In series with the motor are solenoids which have an armature the position of which determines the amount of resistance in the shunt winding and thereby the speed of the motor most suitable for a certain torque. By this arrangement flywheels are dispensed with, high friction losses are obviated, the motor is used to the maximum of its output and an overload is made virtually impossible.

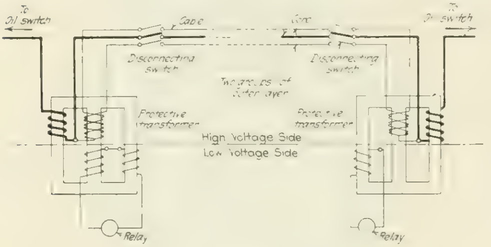


FIG. 5—SIMPLIFIED CONNECTIONS OF PFANNKUCH CABLE PROTECTIVE SYSTEM

The two groups of wires of the outer layer have a small difference of potential impressed by the protective transformer at the beginning of the line, which potential is equalized at the end of the line. Any sufficient change in the insulation due to any cause permits an exchange of the difference of potential. The current thus produced acts on the relays through the protective transformers. The relay is arranged so that, first, it shows the change of the insulation and the phase by a signal (light and indicator) at both ends of the cable and, second, it disconnects the cable for a certain maximum of the leakage current. The system has been tested with a 30,000-volt cable and shown to be so sensitive that small defects were reported by the relays. Sufficient time is given thereby to repair the cable before the breakdown takes place.

REVERSING ROLL-MILL MOTORS AND SPEED REGULATION

Large direct-current reversible motors for main-roll trains have increased in size, one being rated at 16,500 hp. with a maximum torque of 240 meter-tons (1,730,000 lb. at 1-ft. radius) and another which is rated at 18,200 hp.

No new developments have been made in speed-regulation devices of induction motors, but the three-phase commutator motor mounted as auxiliary motor on the main motor shaft and the frequency-changer system as well as the Kramer and Scherbius methods have been tried out thoroughly. The Kramer and Scherbius systems have been applied mostly to large fan and rolling-mill drives. The writer has not heard of any installation where any of these systems are used above synchronism. The attitude is that the complication is too great and reliability insufficient if such sets are operated above synchronism.

POWER-FACTOR CORRECTION BY VIBRATOR AND MAGNETIZER

As mentioned before, particular attention has been directed to power-factor correction of large induction motors because it is believed that they are mainly responsible for the low power factor in many power stations. Two methods have been used, the vibrator and the magnetizer with self-excitation. The vibrator consists of three direct-current armatures oscillating in direct-current fields. In each of the three armatures the current of one phase flows. The power factor of the induction motor becomes a trifle leading over a great range of the load and is about unity at 30 per cent load.

The application of the vibrator-type unit is limited by the output of the induction motor and by the fact that it is not suitable for induction motors which operate with a slip increased by the insertion of resistance in the secondary motor circuit. The other machine, the magnetizer with self-excitation, consists of an armature with commutator and direct-current winding in a rotary field which is energized by the rotor current of the induction motor. The armature is rotated by a small auxiliary motor. While the machine is energized by the main rotor current, it is capable, with proper dimensions, of securing phase advancement independent of the load of the induction motor and also at light load. This magnetizer can also be used with induction motors which operate with a slip regulator in the motor circuit, in conjunction with flywheels, as, for instance, for roll trains. The mechanism of the slip regulator is so set that it will act only when a certain average load is exceeded. The magnetizer is so arranged that it will overcompensate the induction motor from friction load to this average load, above which the power factor will shift from leading to slightly lagging, depending on the slip of the induction motor.

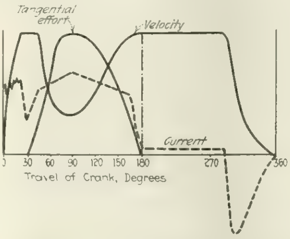


FIG. 6—CHARACTERISTIC CURVE OF MOTOR-DRIVEN SHEAR WITHOUT FLYWHEEL

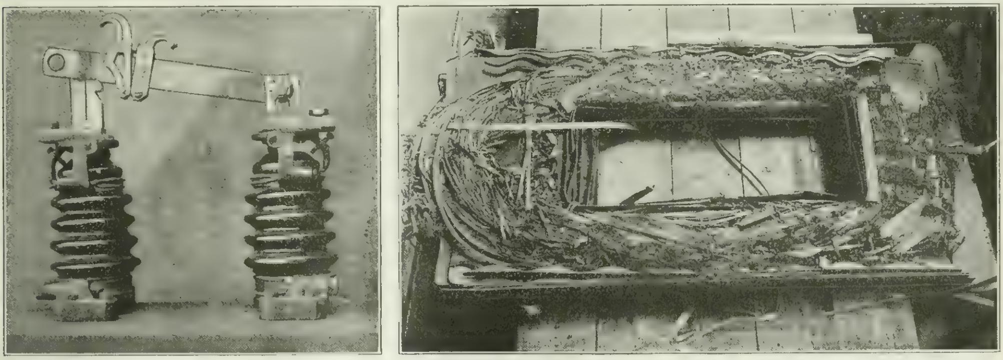
Another application of electric power is the use of the electric arc to remove "piping" from very large steel ingots. The electrodes are supported by a frame placed on the ingot while it is in the ingot mold. The distance of the electrodes from the steel ingot can be regulated. For a 60-ton ingot a transformer of 300-kva. rating is used and the electrodes are about 4.75 in. (12 cm.) in diameter. The electric arc between the electrodes and the steel ingot is sustained for a period of several hours, thereby permitting the cooling of the steel to be regulated and reducing the amount of piping ordinarily formed.

Result of Short-Circuit Tests on Outdoor Type Reactance Coils

Tests Conducted Under Artificial Rainfall Did Not Cause Any Flashovers or Deformation Even Under Severe Short-Circuit Conditions Saving Effected in Building Structure by Using Outdoor Type

By A. F. BANG
Testing Engineer Pennsylvania Water & Power Company

WITH the ever-increasing growth of electrical power plants and the interconnection of systems formerly separate accidental short circuits have become a matter of very serious concern to all large systems. Experience from the operation of such systems has proved that if too large a short-circuit current is permitted to flow into an accidental fault, it is liable to twist the windings of generators and transformers out of shape, snap off insulators, blow open disconnectors, destroy current transformers, cause the explosion of oil switches which try to clear the short, and work other mischief of a similar sort. In some cases even generator shafts have been broken or the bolts holding the stator to the bedplate sheared off.



FIGS. 1 AND 2—SOME RESULTS OF EXCESSIVE SHORT CIRCUITS THAT MIGHT BE PREVENTED BY REACTORS
Left—Disconnecting switch accidentally forced open during a surge. Right—One coil of a transformer that was badly damaged by a short circuit.

To obviate such difficulties and still maintain the great benefit of the economy resulting from a unified system with only one or a few large generating stations, it has become the policy of all large systems during the last twelve years or so to install reactance coils in series with generators, buses, feeders, etc. Their purpose is essentially a double one—first, to relieve the above-mentioned mechanical and thermal stresses by a reduction of the short-circuit current, and, second, to help to maintain a substantial voltage on the part of the system that is not damaged and thus localize the trouble by preventing the synchronous equipment on this part from falling out of step during the period of the short. Reactance coils of this kind, mainly designed for indoor installation, have long been in service. With the growing tendency to install as much electrical equipment as possible out of doors, reactance coils for outdoor use have also been designed. Inasmuch as installations of this kind are not yet very common, perhaps it may be of interest to describe briefly certain short-circuit tests which recently were made on such coils by the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company on their system in Baltimore, Md.

The reactance coils which were tested were designed by the General Electric Company as feeder reactance coils for a 13,200-volt system. Each coil contains about $2\frac{1}{2}$ per cent reactance in a 4,600-kva., three-phase, 13,200-volt circuit; that is, it has a reactance of 0.955 ohms at 25 cycles. It is rated at 200 amp., 191 volts, 38 kva. The construction is the well-known concrete type in which the windings are held rigidly in position by means of concrete columns cast around the turns after they have been wound in a form. The turns are wound in radial layers which are slightly conical, adjacent layers being inclined in opposite directions. The windings consist of one continuous cable and progress from turn to turn from the outside through to the inside turn in the first layer, then from the inside turn to the outside turn in the second layer, and so on. The minimum clearance between turns and layers is $\frac{13}{16}$ in. (20 mm.) and the concrete has been thoroughly impregnated under vacuum with a waterproof compound which prevents absorption of moisture. Both concrete and winding are coated with lacquer, producing a smooth, hard finish which sheds water readily. The reactors are braced to withstand the magnetic forces between the different phases of the circuit by means of large petticoat-type insulators having a dry flashover of 90,000 volts. They are also supported from the ground by means of similar large insulators. The net weight of one of the reactance coils, including sixteen concrete supports, is 3,600 lb. (1,680 kg.).

It has been reported from time to time that a few reactance coils of different manufacture have failed in actual service at the time of heavy short circuits, and there has been considerable discussion as to whether this was due to mechanical stresses set up between turns which caused them to swing together and start a flashover or whether these failures have been due to high surge voltages set up between turns or layers which initiated flashovers and quickly caused a complete failure of the coil. It is now generally held that the chief cause at least of these reported failures has been the extremely heavy mechanical stress set up momentarily at the very peak of the initial short-circuit current when this happens to be greatly displaced. For this reason all modern coils have been much strengthened mechanically by increasing the number of supports for the turns. The present coils, for instance, have sixteen concrete supports where formerly about ten would have been used. The possibility that such a coil might fail owing to flashovers caused by high voltage between turns or layers nevertheless remains. Therefore it would seem natural that the danger of failure in this way is especially to be feared in reactance coils of the outdoor type if they happen to be subjected to a severe short circuit at a time when they are "soaking wet" from a heavy rainfall. Before adopting this type of coil the Pennsylvania Water & Power Company decided therefore that it would be well to subject such coils to the highest short-circuit current which could be produced on the company's system, while the coils at the same time were exposed to a heavy spray of water.

When installed in the usual way, one in each phase, the highest effective symmetrical current obtainable through these reactors on a 13,200-volt system with unlimited generator capacity behind it would be 13,200 ÷ ($\sqrt{3} \times 0.955$) = 8,000 amp. (r.m.s. value). Owing

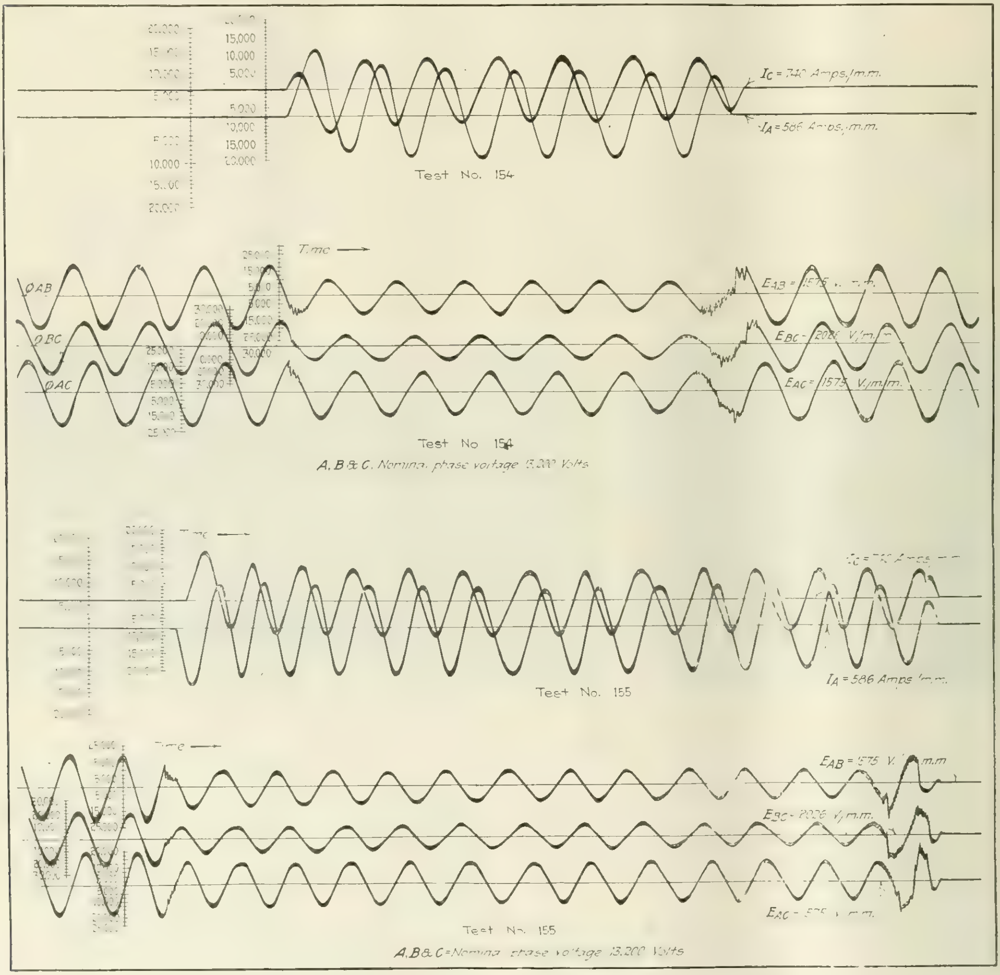


FIG. 3—OSCILLOGRAMS SHOWING CONDITIONS THAT EXISTED DURING SHORT-CIRCUIT TEST

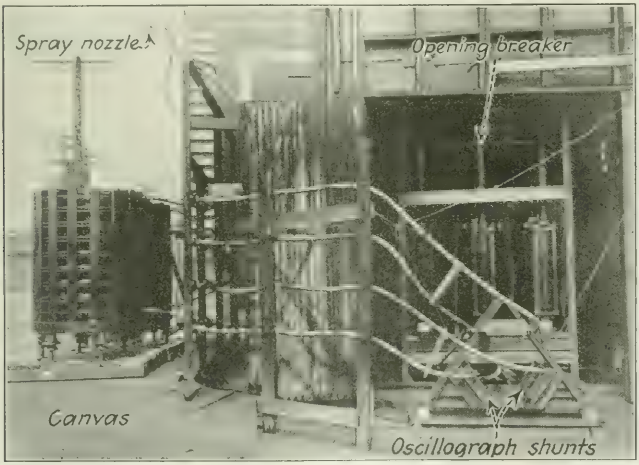
to the reactance in generators and tie lines, etc., however, the present Baltimore system cannot produce more than about 6,300 amp. through one of these coils. In order to obtain approximately this current with the generating capacity of about 120,000 kw. available for the test, only two coils were used for the test and these were connected in open delta across the 13,200-volt phases. It was calculated that this would produce an effective symmetrical current of 7,200 amp. in each of the coils and about 10,600 amp. in the common leg.

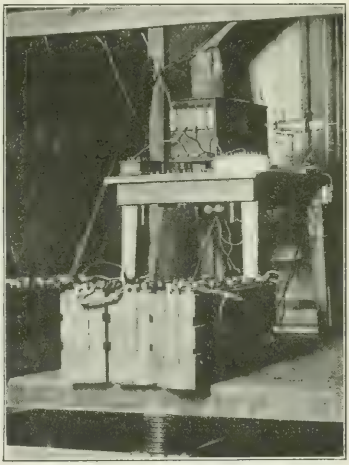
The layout of the breakers used for closing and opening the short circuit and also the arrangement of shunts and potential transformers for measuring by oscillographs the current and voltage obtained are shown in the accompanying diagram. As will be seen, the short circuit was a dead metallic three-phase short circuit with the reactance coils next to the short. One oil circuit breaker was used for closing the short circuit, while another opened the circuit immediately after by means of instantaneous relays, thus leaving the short circuit on only for the time necessary for the switch itself to clear, that is, about 6 cycles. The two other breakers were merely intended as protective breakers to clear the short in case of failure of any of the other equipment. The oscillograph which recorded the current waves was mounted on an insulated platform with its own battery for excitation so as to withstand the high potential to which it would be exposed through the drop leads attached to the ungrounded shunts. Current transformers were not used as they were not considered reliable enough to record the transient phenomenon under investigation. Another oscillograph recorded the potential between phases from the low-tension side of standard potential transformers.

The test specification called for a water spray of 1 in. (2.5 cm.) in ten minutes, which is approximately equal to the maximum rate of rainfall recorded in Baltimore. To produce this spray an ordinary lawn-sprinkler nozzle was used mounted about 6 ft. (1.8 m.) above the coils. The rate of spray was measured by continually moving a pan under the spray immediately over the top of the coils and then measuring the depth of water precipitated in the pan at certain intervals. The water used was Baltimore city water, and a sample of this was tested for conductivity and was found to measure about 9,000 ohms per cubic centimeter at 15 deg. C., which is a far greater conductivity than that obtained in ordinary rain water. The water was turned on for from five to ten minutes previous to the short and remained on during the short.

Altogether four tests were made, three with immediate opening of the short and one with a slight delay, leaving the coils subjected to the short a little over half a second. In none of these short circuits did any flashovers whatever take place nor was any deformation of any of the windings noticed. In fact the only evidence that the short was being applied was the slight vibration of the leads connecting the coils with the system. The oscillograms show the current and voltages obtained in the third and fourth tests. It will be noticed that even during the short the voltage across a coil is approximately 7,500 (r.m.s. value). As no more than about 7,620 volts across a coil (r.m.s.-25-cycle value) can be obtained with the normal installation of these coils even from a system with unlimited generator capacity, it is clear that the test proved that these coils, even under heavy rainfall, are sufficiently well insulated to withstand the normal voltage strain between turns and layers obtained during short circuit. As the tests were made virtually under system conditions and as the oscillograms do not show any excess voltage due to surge conditions, it would seem that high-voltage surges between turns and layers do not need to be feared on this installation. The only high frequency in the voltage waves, it will be observed, occurs during the last cycle, when the oil switch clears the short circuit, and is evidently caused by the arc in this switch.

As no very great displacement of the initial current wave took place in any of the tests on which oscillograms were obtained, it is not certain that these coils were exposed to the heaviest mechanical stress which they may be subjected to even on the system where they are being installed. However, it is known from former tests made at the same place on reactance coils of the same type and the same number of supports (except





FIGS. 4 AND 5—ARRANGEMENTS FOR SUBJECTING REACTORS TO SEVERE SHORT CIRCUIT UNDER ARTIFICIAL RAINFALL; BOOTH IN WHICH OSCILLOGRAMS WERE MADE DURING REACTOR TEST

that they were designed for indoor use) that these have withstood absolutely the highest current to which they could be exposed even on a system with unlimited capacity, and it is therefore considered certain that these coils also would have sufficient mechanical strength.

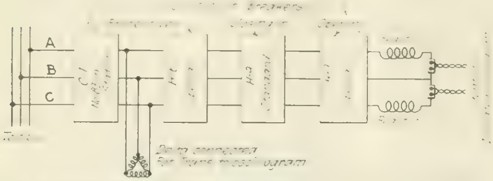


FIG. 6 LAYOUT OF CIRCUIT BREAKERS AND TEST INSTRUMENTS

The outdoor design of reactance coils is necessarily larger and heavier than the indoor type, and the coils of the former type are therefore distinctly more expensive. However, the saving in the building cost is generally so great that it will pay to install the outdoor type of coil. In an installation of three sets of coils on the Pennsylvania Water & Power Company's system it was thus figured that the total cost would be reduced from approximately $46,000 to $37,000. In other words, a saving of approximately 20 per cent would be obtained by using the outdoor type of reactance coils, as it otherwise would have been necessary to build an expensive brick structure around the coils of the ordinary indoor type.

While this is probably the first time that such severe tests have been made on this type of coils, they have actually been in service in several places for a number of years. Thus it is reported that they have given entirely satisfactory service on the Syracuse Lighting Company's system and on the Montreal Light, Heat & Power Company's system for six and four years respectively, notwithstanding the extremely severe winter temperature to which the coils have been exposed. With these facts in mind it may well seem advisable for engineers to consider whether reactance coils of the outdoor design may not be more suitable and less expensive than the indoor type, especially in places which were originally not laid out for the installation of any reactance coils but where later on expansion of the system has made them necessary.

The Electrical Manufacturing Industry*

A Study of Its Organization, the Influence of Its Grouping, the Need and Opportunity for Closer Contact and Association

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THE industry founded upon the generation and employment of electricity is probably more complex than any of the other pursuits of mankind and comes into contact to a greater degree than any other with those other pursuits. It is based on pure science and holds little of the empiric. Its content of engineering and research is more important than in any other industry. Its mechanisms call for the maximum of manufacturing knowledge and skill and are complicated by considerations not present in other structures. Their applications call for an intimate knowledge of practically all other arts. In addition, through its supply as a public utility, there comes a governmental contact—municipal, state and federal—present in no other calling. Only through organization and the resultant co-operative effort can the problems incident to so complicated a relation be solved satisfactorily and with adequate dispatch.

On the other hand and considering only that portion of the industry engaged in manufacture, the conditions are the direct reverse of those under which association work ordinarily has its inception and successful growth. It is not natural for the strong to ally themselves with the weak nor for the large to perceive the necessity for association with the small. Ordinarily association takes place between a number of units of similar magnitude, and under such conditions the tendency to promote the relation is at a maximum. Each unit possesses men of substantially the same caliber and of substantially the same acquirement. They speak the same business language and their viewpoint is substantially the same. They understand the conditions which determine a given action on the part of one of their associates, and while criticism may result, distrust due to misunderstanding does not—and distrust is the prime element militating against effective associate effort.

The electrical manufacturing industry is not so constituted. It is made up first of three organizations, two of general and one of special character; next of a comparatively small number of second-line companies, no one of which possesses facilities exceeding one-tenth of any of those listed in the first line, and then of a large number of concerns definitely smaller than the second-line companies and covering in the total a wide line of interests, but each of comparatively narrow horizon. No condition could be more accurately calculated to breed that misunderstanding and distrust fatal to co-operative effort.

It is obvious that association results from need made evident by daily business conditions and must be founded on the confidence that the other man will play fairly and that immediate self-seeking will be subordinated to that enlightened self-interest which indicates the adoption over an extended period of a policy fundamentally right. In the light of the foregoing consider the relation of the large and the small man under the conditions which actually obtain.

With its wide market contact and its statistical accumulation, the large corporation, more accurately than the small, perceives the business trend and shapes its policies accordingly. In the absence of such knowledge and with only his limited facilities as a guide, a minor manufacturer establishes a conflicting policy. The inevitable collision follows, and its inevitable result is interpreted as a selfish and unfair use of an unwarranted power. Hence a distrust is born which, even if it does not involve an immediate undesirable result, produces distorted viewpoints and hinders progress.

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*An address delivered before a recent meeting of the Electrical Manufacturers' Council.

On the other hand, the man at the head of the large company hesitates to assume the lead, in the practical certainty that such leadership will be constructed as an effort to influence the trend of affairs for his own ends. He is practically forced into the position of guiding as he may from the background through the instructed action of less conspicuous members of his organization, and this loses to the industry the constructive effort of which he alone is capable and which would be exerted were he in direct contact and certain that he would not be misunderstood.

I do not assert that there have never been grounds for the suspicion of ulterior motives. Until human nature radically changes men will seek individual advantage. I do assert, however, that such grounds are more frequently given by the subordinate than by the superior, and, moreover, that the suspicion is more frequently based on misunderstanding than on fact.

All of us, large and small, are vitally interested in the prevention of such conditions. Irrespective of magnitude, we progress only as our industry progresses, and I am certain that if these distrusts and misunderstandings could be removed our gain would be enormous.

Education Through Contact

If they are to be removed, it can be only by a process of education, and this can come only through the contact made possible by association. There is no way first to remove them and thereafter to associate. We have established the Electrical Manufacturers' Council, and it is now our task to make the best use of it. We must so arrange our affairs that everything relevant in knowledge and experience shall become available and effective in determining what our underlying policies shall be. To accomplish this with certainty and promptitude we must employ the wisdom, far-sightedness and constructive ability of our best minds. These will be found in the important positions in our large institutions. We must create an atmosphere in which the work of these men will be welcomed and in which they will be encouraged to exert their efforts for the common good. That they will do this with wisdom and fairness if such opportunity is given I am convinced.

On the other hand, this contact with the smaller man and his operations and motives will bring to them as a matter of daily realization the fact that he cannot be ignored if satisfactory progress is to be made; that, no matter how dominating, the major corporation cannot be self-sufficing, and that the health of the industry is predicated on the health of each constituent member.

My plea, therefore, is that in this undertaking which has assumed definite form there be a constant effort to maintain an atmosphere of trust and toleration; that the conditions be such that any man, whatever his relation, may confidently assume office or speak his opinion without suspicion of ulterior motive, and that to such end there be present in our relations a frankness hitherto not always present and which will result in specific expression concerning any condition not deemed satisfactory.

There is no doubt of success if we can do this, and success, I believe, in larger measure than any of us realize. Without it we may not altogether fail for a time, but we cannot hope to endure.

Improving Customer Relationship

An Argument for a Company "Consumers' Department" Which Will Take the Side of the Consumer in Every Complaint or Difference of Opinion

By Emmet N. Britton
Assistant to the General Manager San Joaquin Light & Power Corporation

Back in the days of pinafores and petticoats, when we had consistently misbehaved and had disregarded all promises of punishment, the nurse would always use as a final threat, "The bogie man will get you if you don't look out," and it generally had the desired result. Today the public utilities of this country are being threatened with the "bogie man" of public ownership, but whether this phantom will remain in the gaseous state or turn into live flesh and blood and become a real menace depends largely upon the attitude of the utilities toward their customers.

In order to assure the consumer of courteous treatment it is necessary first of all that the employees, from the mail boy to the president, be filled with a belief in the company. Sometimes a company is a pretty large unit and the personal touch is hard to keep up, but it can be obtained by building up esprit de corps in the departments of the head office and districts.

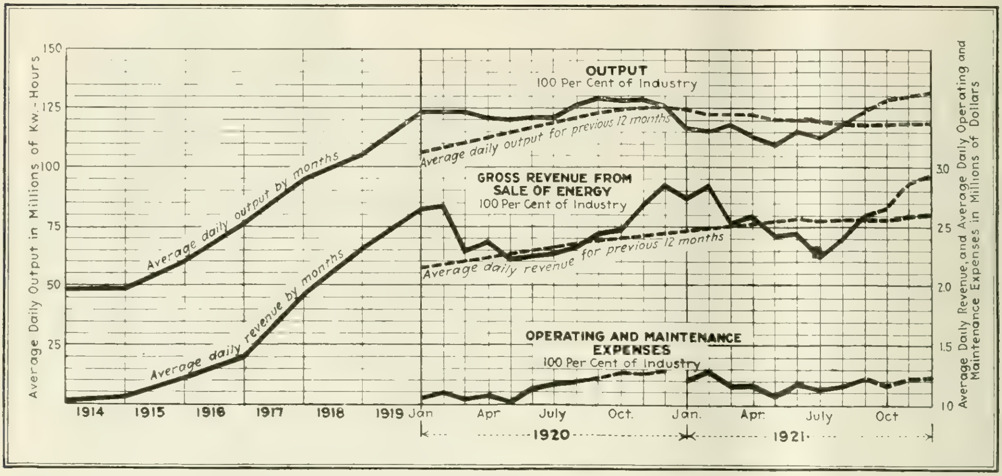
The meter readers, bill collectors, counter clerks and service men are the power company to more than 90 per cent of the consumers, and if they are unshaven and slovenly these consumers with whom they come in contact think of the power company as unkempt and slovenly. These men have a wonderful opportunity to make good will for the company.

The consumer, like all of us, appreciates attention, and a representative of the management should make frequent calls upon the different classes of consumers to find out if they are receiving all of the service to which they are entitled. Complaints received should be followed up with almost religious care, and especially those which are uncovered by questioning the consumer.

A Consumer's Department

The establishment of a department directly responsible to the general manager whose duty will be to represent the consumer will offset the overzealousness of many of the departments whose one idea is to give the company all of the cake and frosting. The head of this department should take the consumer's side of all arguments and fight for him and his interests, forgetting the fact that he is on the payroll of the company. He should make the acquaintance of as many of the consumers as possible and not only help them in increasing the efficiency of their plants but be a real friend at court and their direct representative. He will have access to all of the departments and will be able to give the consumer advice on all matters pertaining to the use of electricity, whether it be engineering or commercial advice. When the consumers come to realize that they have some one working for their interests in the company, he will become their friend and will eliminate little dissatisfactions which might grow to serious proportions. He will be able to show the consumers, individually, the wastefulness of political ownership and so allow the development of our natural resources in the most efficient manner.

December Energy Output Exceeds 4,000,000,000 Kw.-Hr.



CENTRAL-STATION OUTPUT AND GROSS REVENUE MAKE NEW RECORDS

DECEMBER marked an epoch in the history of the electric light and power industry. For the first time the amount of electrical energy sold in any one month exceeded four billion kilowatt-hours and the gross revenue from sale of energy topped the ninety-million-dollar mark. Reports received by the ELECTRICAL WORLD for the month of December from central generating and distributing companies representing 77 per cent of the installed rating of the country indicate that the output of 4,041,000,000 kw.-hr. exceeded that of December, 1920, by 120,600,000 kw.-hr., showing an increase of 3.1 per cent in output for the twelve-month period. The December gross revenue of $90,070,000 indicated an increase of 5.2 per cent over the year previous. In addition, the operating and maintenance expenses during December were 6.1 per cent below those of December, 1920. From an economic viewpoint, therefore, the December returns are most encouraging to the electric light and power industry, especially when the industry is compared with many other primary industries of the country which were still unable to report favorable operations.

The favorable figures must be attributed almost entirely to the large increase in the domestic lighting load during the twelve-month period. An investigation recently completed by the ELECTRICAL WORLD indicated that 1,001,700 new residential customers were added to the lines of the distributing companies during 1921. This new load would be most apparent in December, and the added income received from these new high-revenue customers undoubtedly accounts in large part for the 5 per cent increase in gross revenue. While definite figures are not available, it is probable that the energy sold to industrial customers during December, 1921, was about on a par with that sold to that class of customers during December, 1920.

The energy sold during December was only slightly more than that sold during November. A general slowing down of industry after the spurt in October was reported throughout the country during November and December. Hence, while the lighting load increased materially during December, the industrial load in the

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
Jan.	77	2,765,632	2,943,349	−6.0	69	$58,855	$50,861	15.8
Feb.	76	2,453,671	2,711,800	−9.4	69	55,540	48,633	14.3
Mar.	76	2,806,609	2,989,581	−6.1	70	55,513	49,071	13.3
April	77	2,675,949	2,895,067	−7.0	72	55,326	49,064	12.8
May	77	2,668,457	2,889,174	−7.6	72	53,901	47,932	12.6
June	77	2,686,479	2,872,900	−6.4	70	52,385	47,977	9 3
July	77	2,706,016	2,949,132	−8.2	70	50,747	49,195	3.4
Aug	77	2,839,498	3,041,927	−6.7	70	51,931	50,848	2.1
Sept.	77	2,848,212	2,937,339	−3.0	70	54,501	52,955	2.9
Oct.	76	2,997,133	3,045,696	−1.5	71	57,340	55,599	3 1
Nov.	77	3,006,020	2,970,174	1.2	71	61,055	58,381	4.6
Dec.	77	3,112,012	3,018,681	3.1	71	63,951	60,761	4.6

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Jan.	40	14,562	13,085	11.3	56.1	55.3	26.8	27.0	38.1	45.6
Feb.	42	15,085	13,640	10.5	55.6	54.5	22 9	26 0	44.1	47.3
Mar.	52	18,757	17,248	8 7	56 1	57.7	23.4	19.6	40.2	44.8
April	52	17,815	16,641	7.1	53.0	56.5	23.9	19 8	41.4	43.3
May	52	17,274	16,727	3.1	55.4	56 8	24 2	22.9	40.6	44.8
June	53	18,836	19,089	−1.3	56.2	62.5	20.4	21.6	45.0	50 9
July	52	18,633	20,964	−11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	53	19,301	20,900	−7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	53	19,765	21,359	−7 5	54.1	60.3	20.8	22.1	47.3	54 7
Oct.	54	19,828	22,231	−10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov.	55	19,694	21,780	−9.6	49.9	58.9	23.1	23.3	43.4	50.5
Dec.	55	20,830	22,194	−6.1	47 8	55.9	26.9	29.3	46.1	49.2

aggregate was undoubtedly considerably under that of October and November. The result of these two opposing tendencies in the aggregate was a slight increase in the output over that which was reported for the month of November.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives further evidence of the tendency toward financial prosperity in the electric light and power industry. During December, 1921, the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 47.8 per cent, as against 55.9 per cent in December, 1920. The average operating ratio for this type of plant during the year 1921 was 54.2 per cent, as against 59.3 per cent during 1920. The average operating ratio for this type of generating plant during the normal year 1912 was 46.8 per cent, which would indicate that the average operating ratio for 1921 was still about 8 per cent above the normal ratio which existed in pre-war times.

Government figures indicate that production during December was less in the majority of industries than in either November or October. To a certain extent this was a seasonal decline. On the other hand, a number of important industries, such as the iron and steel, lumber and paper industries, increased their activities, the result being an increase in industrial energy consumption by utilities serving such industries to a major degree.

For the first time in several months the textile industry of New England reported slight curtailments in operation during December, and the boot and shoe and paper industries also were operating under November. The seasonal increase in the lighting load for this section and the requirements of new lighting customers were undoubtedly counterbalanced by these decreased industrial requirements, resulting in an output about on a par with that of November.

The seasonal dullness in manufacturing due to the holidays and the taking of annual inventories was evidenced in the manufacturing states of the Middle Atlantic and the North Central States. In the Middle Atlantic States, however, industries such as the textile trades, shoe and leather industries and the iron and steel mills showed increased operations during December over those reported for November. The net result in this section was that the central-station industrial load was probably about the same as during the month of November.

In the South Atlantic States some of the large industrial consumers of electrical energy, such as the lumber mills and the coal-mining industry, curtailed their activities materially during December. Textile mills and other primary industries of this section were operating about on a par with November.

The returns indicate, therefore, that during December the industrial energy requirements of the Atlantic section in the aggregate were about the same as during November. The seasonal increase in lighting load plus new lighting customers added during the month was sufficient, however, to result in a total average daily central-station output of about 1,000,000 kw.-hr. in excess of that reported for November. The Atlantic

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
KW.-HR. OUTPUT																				
Jan	81	200,269	247,800	-19.2	80	1,003,223	1,043,650	-3 9	73	860,643	956,078	-10.0	59	144,936	145,336	-0 3	82	556,561	550,685	1 1
Feb	81	178,694	216,890	-17.6	80	902,030	970,539	-7 0	72	789,539	882,873	-10.6	59	131,654	132,537	-0.7	83	451,754	508,961	-11.2
Mar	80	205,348	230,309	-10.8	81	1,029,120	1,119,428	-8 1	72	894,500	941,893	-5 0	59	139,381	136,017	2 4	83	538,260	561,934	-4.2
April	80	196,680	227,008	-13.3	79	963,659	1,052,716	-8 4	71	828,457	894,028	7.3	59	132,075	135,421	2 5	89	555,048	586,894	-5.4
May	81	191,141	219,298	-12.8	78	934,973	989,408	5 5	71	819,506	899,657	8 9	59	136,573	138,416	1 3	91	586,264	642,495	-8 7
June	80	192,007	219,476	-12.5	78	940,443	1,003,727	-6 3	71	806,270	880,934	-8.5	60	136,011	129,120	5 3	92	611,128	639,637	-4 5
July	80	187,622	218,995	-14.3	77	934,822	1,026,390	-8 9	71	804,009	884,572	-9 1	60	140,795	141,450	-0 6	92	639,768	678,725	-5.7
Aug	79	205,351	224,324	-8 5	78	992,681	1,054,124	-5 8	71	848,803	923,210	-8 1	60	147,967	154,353	-4 1	93	644,696	685,916	6 1
Sept	79	221,364	223,269	0.8	78	1,004,252	1,051,268	4 5	71	851,671	886,370	-3.9	60	149,758	151,680	-1.2	93	621,167	624,752	-0 5
Oct	79	249,202	221,929	12.1	78	1,103,525	1,121,676	1.6	71	919,514	930,236	-1 1	60	154,266	156,713	-1 5	94	570,626	615,142	7.2
Nov	79	247,119	215,565	14.6	77	1,128,063	1,112,346	1.4	71	913,124	907,955	0 5	60	154,125	150,976	2 0	94	563,589	581,857	-3 1
Dec	79	255,247	216,756	17.8	78	1,193,251	1,151,355	3 6	71	939,140	920,655	2 0	61	154,407	150,303	2 7	93	569,967	579,612	-1.6
REVENUE		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan	81	$6,379	$6,170	3 5	73	$22,180	$19,225	15.3	58	$16,818	$14,436	17.3	58	$4,155	$3,484	19 3	82	$9,323	$7,546	23 6
Feb	81	5,925	5,728	3 4	73	21,492	18,327	17.4	58	15,971	14,070	13 6	58	3,915	3,329	17.6	83	8,237	7,179	14 7
Mar	80	5,784	5,566	3 8	72	21,822	18,934	15.3	58	15,853	14,103	12 4	59	3,747	3,246	15 5	83	8,307	7,222	15 0
April	80	5,665	5,554	2 0	72	21,504	18,609	15.8	58	15,506	13,822	12 2	58	3,744	3,312	13 2	89	8,817	7,767	13 6
May	81	5,362	5,342	0 4	72	20,795	17,613	18.0	58	14,866	13,558	9 8	59	3,516	3,179	10 7	91	9,362	8,240	13 7
June	80	5,285	5,397	-2 4	72	20,058	17,438	15.0	58	14,485	13,519	7 1	59	3,536	3,152	12 2	92	9,021	8,439	6 9
July	80	5,180	5,121	1 1	72	18,798	17,155	9.2	58	14,158	14,689	3 6	60	3,509	3,145	11 3	92	9,101	8,733	4 3
Aug	79	5,297	5,483	-3 3	72	19,050	17,926	6.2	58	14,465	14,594	0 8	60	3,612	3,536	2 2	93	9,507	9,309	2 1
Sept	79	5,694	5,857	-2 7	72	19,992	18,750	6.6	58	15,324	15,192	0 8	59	3,811	3,673	3 7	93	9,680	9,482	2 0
Oct	79	6,332	6,072	4 2	71	21,520	20,115	6.9	58	16,098	16,175	0.4	60	3,920	3,903	0 4	94	9,470	9,334	1 4
Nov	79	6,806	6,238	9 1	71	23,277	21,540	8 0	58	17,122	16,952	1 0	60	4,139	4,158	-0 4	94	9,747	9,493	2 6
Dec	79	7,029	6,563	7 1	72	25,021	22,974	8 9	58	17,705	17,444	1 4	61	4,259	4,189	1 6	93	9,937	9,591	3 6
OPERATING EXPENSES:		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Jan	34	$1,098	$1,288	-14.7	49	$6,373	$5,411	17 8	28	$3,941	$3,451	14 2	37	$1,015	$905	12 2	54	$2,135	$2,030	5 2
Feb	35	1,069	1,242	-13.9	52	6,799	5,937	14 5	28	3,958	3,445	14 8	41	1,217	1,053	15 5	55	2,042	1,963	3 9
Mar	45	1,576	1,651	4 5	58	7,969	7,241	10 0	34	4,570	4,228	8 2	47	1,776	1,514	17 2	80	2,866	2,614	9.7
April	44	1,418	1,479	4 1	56	7,590	7,168	5 9	34	4,347	4,112	5 7	48	1,567	1,403	11 6	80	2,893	2,479	16 8
May	48	1,548	1,577	1 8	53	6,921	6,660	4 0	36	4,274	4,292	0 4	49	1,563	1,486	5 2	83	2,969	2,713	9 5
June	45	1,737	1,862	-6.7	53	6,916	6,878	-0.5	38	4,843	5,152	5 9	56	1,835	1,678	9 4	86	3,565	3,519	1 3
July	46	1,712	2,077	-17.6	50	6,772	7,111	4 8	37	4,940	5,800	-14.8	58	1,870	2,039	8 2	86	3,339	3,937	-15.1
Aug	47	1,861	2,088	-10 8	50	6,871	7,131	-3.6	37	5,028	5,793	-13.2	58	1,892	2,003	5 5	92	3,648	3,884	6 0
Sept	47	2,049	2,262	-9.4	51	6,851	7,294	-6.0	38	5,353	5,687	5 8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
Oct	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18 2	59	1,990	2,192	9.2	93	3,511	3,891	9 7
Nov	49	2,040	1,964	3 8	54	7,103	7,790	-8.8	38	4,994	5,980	-16.4	59	1,931	2,262	-14.6	92	3,626	3,784	4.1
Dec	50	2,102	1,892	11.0	54	7,800	8,243	-5.3	37	5,072	6,094	-16.7	59	2,005	2,259	-11.2	92	3,852	3,708	3.8

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.2	61.8	61.2	61.8	53.1	53.7	53.1	53.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.6
Hydro Plants.																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	27.5	27.3	27.5	27.3
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	43.5	45.8	43.5	45.8	39.5	38.6	39.5	38.6	38.6	46.6	38.6	46.6	35.2	45.6	35.2	45.5
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8

section was the only one reporting an increased output over November.

During December industrial plants in the North Central States were operating at between 65 and 70 per cent in the aggregate. Some large users of central-station energy were operating at greater capacity, but with the possible exception of aluminum plants, few if any plants were operating at full capacity. The output of the central generating and distributing companies of this section was slightly below that of the month of November in spite of the increased lighting requirements during the first portion of the month and new lighting customers that were added to the lines during the month.

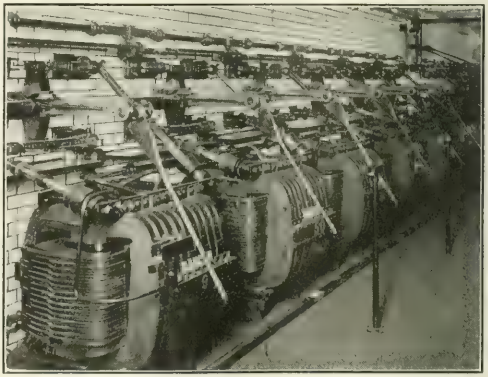
Industrial Slump in South Central Section

Industrial activity in the South Central States experienced considerable curtailment during December. Textile mills decreased production, steel-plant operation showed recession, and the lumber industry was operating at only about 35 per cent capacity. In spite of the seasonal increase in lighting requirements and new customers, the central-station output of this section was about 5 per cent under that reported for the month of November.

A further decline in activity was also reported by virtually every industry of the Mountain States during December. Several of the large consumers of industrial energy in this section, such as the canning and sugar industries, had practically ceased operations owing to the close of the season. With the exception of the lumber industry, a decline was also experienced throughout the Pacific Coast. As a result of these adverse conditions, and notwithstanding a substantial increase in lighting requirements and new customers, the Mountain-Pacific section as a whole reported an average daily electrical output almost 200,000 kw.-hr. below that of November.

Thirty-Year-Old Transformers Still in Service

PART of a group of 10-kw., 2,500/10,000-volt, single-phase transformers installed in April, 1891, and still in operation are shown in the accompanying illustration, which was recently sent to us by Ferranti, Ltd., Hollinwood, Lancashire, England. It is particularly interesting in showing the type of transformer construction, switch mechanism and bus arrangement installed more than thirty years ago. As may be seen, the transformers are of the shell-type, air-cooled, and without any cases. The buses are connected with the transformers through mechanically operated disconnecting switches. The levers projecting over the tops of the transformers operate the disconnecting switches simultaneously. Even in those early days buses were equipped with sectionalizing switches.



THIS EQUIPMENT HAS BEEN OPERATING SINCE 1891

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Pulverizing Anthracite Coal Is Practical and Economical

To the Editors of the Electrical World:

The article by E. B. Powell appearing in the Feb. 11 issue of the Electrical World upon the subject of "Pulverized Coal as a Power-Plant Fuel Past Experimental Stage" has undoubtedly been received with more than ordinary interest, coming as it does from an engineer of Mr. Powell's standing. Mr. Powell states at the beginning that there have been no new installations or developments of a radical nature or of particular striking importance this year. As far as published or general information is concerned, he is right, although there are two installations which are of "striking importance" in that they are actually pulverizing anthracite coal with efficiencies that compare favorably with those pulverizing the much softer bituminous coals. We must therefore take exception to that part of Mr. Powell's article in which he states that no commercial pulverizer has yet been able to handle the harder grades of anthracite economically.

That pulverized anthracite coal has not been used to any extent has been due primarily to the pulverizer. While most bituminous coal pulverizers are economical, when they are used for pulverizing anthracite their principle of operation is such, and the abrasion of anthracite coal is so severe, that the parts are worn out in a very few weeks, and the cost for repairs alone ranges anywhere from 30 cents to $1 per ton of anthracite coal ground. On the face of it this eliminated the use of high-speed pulverizers on the harder grades of anthracite.

About two years ago we were approached on the problem of pulverizing anthracite coal, with the warning that the particular coal to be ground was so hard that almost any piece would cut glass. Having our successful experience with harder materials such as silica, carborundum, slag and other abrasives in mind, we undertook the problem. The only difficulty which arose was in choosing a satisfactory separator to obtain the fineness desired, for in our previous operations the mills were never required to produce the tonnage of fine dry product that is now required. Several methods of obtaining a uniformly fine product were tried, two of which have proved eminently satisfactory and show without question that the mill recommended can accomplish this work at a total operating cost far below that orginally expected either by the user or ourselves.

The action of the mill is such as to prevent excessive abrasion of the apparatus. As a matter of fact, one mill which has been in operation more than one year showed, upon inspection, that only one side of the lifter bars was worn. It was estimated that the lining would last at least two years longer. This mill had been pulverizing anthracite culm having an ash content of 25 per cent to 30 per cent, which is considered to be the hardest anthracite in the East.

When grinding this coal so as to allow 90 per cent to pass a 200-mesh screen, the foregoing mill required 30 hp.-hr. per ton of coal ground. This included the energy required to run the air separator and other minor apparatus operated in conjunction with the mill. Hence the figure may be taken as the total energy required to pulverize the hardest-grade coal in this country.

In another case, where anthracite river coal is being ground, the mill works in conjunction with an electrically vibrated screen. The coal contains about 18 per cent ash, and although not so hard as the culm just mentioned, it is much harder than bituminous. In this case the energy consumption, including all auxiliary apparatus, does not exceed 20 hp.-hr. per ton of coal ground to allow 90 per cent to pass a 200-mesh screen. These figures compare very favorably with grinding bituminous coal. In fact, they are even better than many results obtained in the latter field.

With the millions of tons of anthracite culm and river coal available and a satisfactory method of pulverizing and burning assured, it is only a matter of time before this fuel will be pulverized and burned with efficiencies as high as those obtained for the highest grades, either by shipping the coal to the central station for pulverizing or by locating a station near the source of supply.

The Hardinge Company, Harlowe Hardinge,
New York. Vice-president.

Eliminating Hum on Telephone Lines

To the Editors of the Electrical World:

Replying to E. P. Peck's query in the Electrical World of Feb. 11, I may state that I have found, after several years of experimenting, that the most satisfactory way of getting rid of the hum on wired telephone lines due to transmitting harmonics in nearby transmission lines is by using the "Wonder-phone" equipment, manufactured by the Universal High Powered Telephone Company, Inc., Seattle, Wash. At the present time I am using a number of this company's transmitters, which transmit a current of 2½ amp. as against 0.25 amp. in the standard commercial telephone transmitter.

A special transmitter permits the use of this high current and makes it possible to talk over any length of line up to a distance that would require the circuits to be balanced and repeating coils used; that is to say, a distance of from 300 miles to 400 miles. The person receiving the conversation can hear what is being said without placing the receiver to his ear, and sometimes it can be heard distinctly 24 ft. from the receiver. Of course, this is too loud and is disagreeable to the person listening; therefore a small shunt rheostat is used across the incoming telephone line and convenient to the operator which shunts out enough of the incoming message to reduce it to a pleasant amplitude. When this is done properly all of the hum is lost or shunted out, as the voice is so many times greater in volume than the hum. Both voice and hum are reduced equally with the shunt rheostat, and the hum is virtually lost.

Owing to the simplicity of this arrangement, it is easily adjusted, and the absence of delicate electrical apparatus makes it satisfactory. G. A. Iler,

Superintendent Operation, Tests and Repairs.
Georgia Railway & Power Company,
Atlanta, Ga.

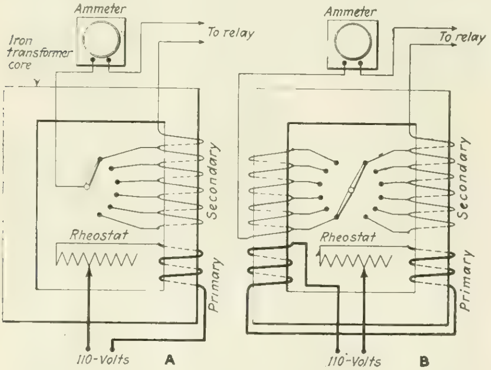
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Relays Affected by Wave Form

ALTHOUGH most instruction books on induction relays contain only an inconspicuous note saying that the relays are "slightly affected by variations in wave form and frequency," this variation may produce an error as much as 100 per cent under certain conditions. A striking example of this was recently encountered by the writer while testing some relays on a 25-cycle and 60-cycle radial system.

The testing practice followed was to disconnect the relays from the transformers and supply a phantom current from a small step-down transformer. This transformer had a 110-volt primary and a secondary with taps so arranged that they would give 6, 8, 12, 20, 40 and 80 amp. on the relays with but slight adjustment of the rheostat, as shown in *A*.



EXTRA TURNS ADDED TO 60-CYCLE PHANTOM LOAD BOX TO MAKE IT GIVE TRUE WAVE SHAPE ON 25 CYCLES

The relays were tested in the regular manner, put back on the lines, and set for a definite minimum time of two seconds. Soon after this a fault occurred and it was found that the relays on the 25-cycle portion tripped entirely too quickly. The 60-cycle relays, however, gave the correct time delay. They were again retested and again put back, but the next disturbance again tripped too quickly on 25 cycles.

A different tester then tested the relays, using a load drawn directly from the circuit instead of a phantom load. He found that the actual time on the 25-cycle relays was less than one second. This naturally caused an investigation into the phantom load, although it was pointed out that the 60-cycle relays were tested with exactly the same equipment and gave the correct time. The investigation disclosed the fact that while the primary of the transformer took only about 0.3 amp. from a 60-cycle circuit, yet it drew a magnetizing current of 17 amp. from a 25-cycle circuit. This resulted in a very flat-topped wave in the relays, a decreased torque and increased time.

After the transformer had been equipped with another coil, as shown in *B*, the magnetizing current was reduced to its proper value and the phantom current produced exactly the same time element as the regular load current.

The ammeter used was also of the induction type, but it did not contain any saturation transformer as in the relay. This indicated that this type of ammeter is not affected by variations in wave form. V. H. TODD.

Summit, N. J.

Suggestions on Rebabbitting Bearings

IN CHOOSING metal for rebabbitting bearings careful consideration should be given to the work that is expected of it, because a metal which might give good service on a low or medium-speed shaft, or where the work is steady, would soon go to pieces on a crank or wrist pin, or any place where it would be subjected to a constant shock. On such a bearing a tough babbitt should be used, one having tin for a base. A good proportion is 89 per cent tin, 7 per cent antimony and 4 per cent copper. A bar of babbitt metal that can be bent back on itself, cold, without cracking, shows toughness, will not dent easily and will ring when struck with other metal should be about right. In general the engineer is safe in buying metal of a reliable make, if the purpose for which it is intended is stated.

Where there is much rebabbitting to be done, it is well to have several mandrels of different sizes on hand, as they will save time. Before pouring bearings care should be taken to clean the shells thoroughly of all grease, dirt and particles of old babbitt and prepare them for pouring. After placing the necessary liners, the two halves of the shell are clamped or wired together, set on the board and centered on the wooden form. A wooden plug is fitted in the oil hole, if there is one; fireclay is banked around the end of the bearing resting on the board, and a dam of clay is made around the top end. In a clean melting pot, or a ladle large enough to hold sufficient metal to pour the bearing, put the babbitt, and while it is melting heat the shell with a blowtorch. The old rule (which I think is as good as any) says that when the metal is hot enough to blacken a pine stick it is hot enough to pour. Remove the dross from the top of the metal and pour quickly. In a few minutes the wooden form can be easily driven out, and if the job has been well done, it will show a smooth, even surface, ready to be bored or scraped to size. It sometimes happens in the manufacture of babbitt that particles of copper and antimony amalgamate into what are called hard points. These are no larger than pinheads and are as hard as steel. If they come to the surface, as the babbitt wears down, they are sure to score the shaft or pin. If the crank pin and wrist pin are round and in line, and if the boxes are fitted "brass and brass" and keyed up rigid in the strap, they will give better service and eliminate "sidelash." However, space is usually left between the brasses to facilitate keying up lost motion as the babbitt metal wears away.

Camden, Me. M. M. BROWN.

Automatic Station with "Supervisory Control" System

AN ADAPTATION of printing telegraph apparatus is to be employed by the Malden (Mass.) Electric Company to control its automatic feeder stations from the load dispatcher's office in Malden. This system of remote control with a return signal is known as the distributor system of supervisory control. It is reported that this is the first time that equipment of this kind has been used in this country in connection with standard automatic station control and switching equipment.

The purpose of the distributor system of supervisory control is to give at all times an indication to the load dispatcher of the position of all oil circuit breakers on the system while allowing him at any time by means of control keys to make such changes in the switching set up as may be necessary. There will be only four pilot wires between the dispatcher's office and the feeder station at Everett to control and indicate an ultimate number of fifty oil circuit breakers. It is also planned to use only four more pilot wires to control and indicate an ultimate number of twenty-five oil circuit breakers each in the Medford station and a future one.

The supervisory system is an adaptation of the motor-driven distributor which has been in use for a long time in connection with the printing telegraph. In the dispatcher's office by pressing a self-locking key corresponding to the oil circuit breaker to be closed a current impulse is sent by the distributor over one wire to the feeder station and there collected by a similar distributor and given to a polarized relay also corresponding to the oil circuit breaker to be operated. The polarized relay acts to close the circuits of the regular closing relays. To open the breaker the same key, thrown to the off position, causes a reverse impulse to act on the same polarized relay in the feeder station which acts in the reverse direction to open the switch.

In the feeder station an auxiliary switch on the oil circuit breaker selects the direct or reverse impulse and through the distributors acts on a similar polarized relay in the dispatcher's office, which in turn acts to light a red or green indicating lamp. A timing wire keeps both distributors in synchronism. The fourth wire is the common return. All wires will be standard telephone cable size.

In the Everett station there will be an initial equipment for 22,000-volt incoming lines, one bank of 22,000/4,000/2,300-volt transformers, three three-phase, 4,000-volt power circuits, one three-phase, four-wire arc-light feeder and four arc-light circuits. The high-tension lines will operate in parallel and will be protected by balanced reverse power relays which operate to trip the oil circuit breaker of the line in trouble regardless of the supervisory control. Differential relays protect the transformer bank and act to open and lock out the high-tension breakers. The three-phase power and the single-phase lighting-feeder circuits are protected by a standard reclosing relay scheme which allows only three operations in succession in case of trouble and then locks out. The arc-light circuits are protected by hand-operated oil circuit breakers which can be opened by the supervisory control. The ultimate equipment contemplates two 33,000-volt lines, two transformer banks and feeders to make up a total of approximately fifty oil circuit breakers.

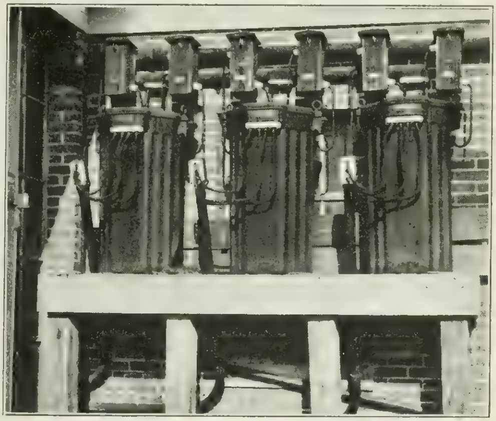
The unusually reliable service rendered by the Medford station automatic reclosing feeder equipment during the severe sleet storm in Massachusetts last November was, it was said, one of the factors governing the Malden Electric Company's decision to make its Everett station automatic and include in its plans automatic control for the projected station.

The distributor system of supervisory control with return signal is a development of the Western Electric Company, and the equipment installed was supplied by the General Electric Company.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Space Saved by Mounting Lighting Transformers in a Corner

THREE 25-kva. lighting transformers are mounted on a platform at the side of a shop doorway to save space at the factory of the Northway Motors Corporation, Natick, Mass. The transformers are supported close to the building wall by a wooden flooring carried on 6-in. x 6-in. upright timbers, the platform being of 2-in. x 9-in. stock, as is shown in the illustration. Cross-timbers of 6-in. x 6-in. section are run under the flooring and are fastened to the wall by 4-in. angles and to a window sill below the flooring by a 6-in. x 6-in. short post invisible in the photograph. All wiring is in rigid conduit, the 550-volt primary leads being brought out at the top from a service panel within the building through a horizontal conduit line from which short connections are made to sets of expulsion-type primary cut-outs hung from the conduit by strap-iron and angle braces, and thence to the primary windings. Each set of 110-220 volt secondary leads is run in a separate 2-in. conduit into the building as shown. The installation occupies no otherwise useful space and, although so near the doorway, is far enough above and at one side to present no inconvenience or hazard.

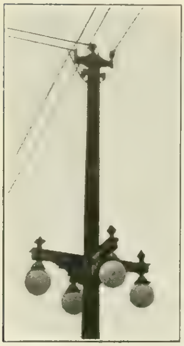


PRIMARY AND SECONDARY LEADS TO TRANSFORMERS MADE THROUGH CONDUITS

Above the transformers are expulsion-type primary cut-outs hung from conduit by strap-iron and angle braces.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Ornamental Lamp Standard Fed from Overhead Service



To SAVE the expense of underground conduit to serve the ornamental street lamps in Trinidad, Col., the line wires have been run on short arms fixed to the tops of standards. From this the two series circuits enter the top of the standard through conduits. Thus two wires enter each conduit on either side of the standards. Inside the standards the wires run down to the brackets supporting the lamps, without the use of additional conduit, the pole itself serving as the conduit for the lighting circuit.

Cables for Mining-Locomotive Gathering Reels and Cutting Machines

THE life of electric cables used with gathering reel mine locomotives is so short and the troubles experienced with them have been reflected so seriously in the output of coal mines that an investigation was made not long ago to determine the causes of these troubles and what remedies could be applied to mitigate them. Not so much trouble is experienced with the cables used for cutting machines, but advantage was taken of the investigation to look into this service in order to find out just what the conditions were.

In order to accomplish this a number of coal mines were visited in West Virginia and Pennsylvania, where actual operations were observed and the question was discussed with mine superintendents, foremen and others.

In the first place, it was found that single-conductor gathering-reel cable is used almost exclusively in the Logan fields, apparently on account of its cheapness, while two-conductor flat and two-conductor concentric cable is used in Pennsylvania. The choice of the type to use in a given district seemed to be governed mainly by custom or tradition. However, the causes of trouble and the corrective measures are the same with all three types.

The principal cause of the deterioration—or perhaps, more accurately, the destruction of gathering-reel cables—is from their being run over. Very often the cable catches on something or becomes tangled up in some way, with the result that it does not wind up properly on the gathering reel and is run over by the locomotive. Then, of course, a splice is necessary, and this makes a thick spot which is quite likely to catch in the guide on the spooling device of the reel and cause it to be run over again.

One of the most frequent causes of catching in the guides is slipping of either the rubber insulation or the braid, or both, from under the tape applied at splices. This slipping of the rubber and braid, even if it does not interfere with the action of the reel, sometimes leaves a spot of bare copper which is quite likely to cause a short circuit to the side of the reel, not only damaging the latter, but often burning the reeled-up portion of the cable so badly that it has to be replaced. Other causes of trouble are cracking of braids and insulation from kinks, or the constant winding and unwinding on the reels and occasionally breaking of the strands due to the same causes, resulting in pierced insulation with consequent short circuits or grounds. Grounds or short circuits also occur if poorly spliced cables or cable with cracked insulation lie on moist ground or in water.

Cables are usually discarded when the splices become too numerous. Examination of junk piles near the mines disclosed many cables with very frequent splices.

Another interesting fact shown by the junk piles was that the outside braided coverings were rarely damaged enough by abrasion to cause the cable to be replaced for that reason. One might quite naturally expect that the wear and tear on the braids would be one of the most serious causes of trouble, but as a matter of fact the cables are not actually drawn along the ground to any great extent.

The life of gathering-reel cables varies from two weeks to one year, the average being only about four to six months under full production.

While it is obviously impracticable to make a cable which can withstand being run over by a locomotive, it is nevertheless possible to design it in such a way as to reduce to a minimum many of the causes contributing to such mishaps. The following suggestions for the construction of gathering-reel cable are therefore made with this in view.

PROPER CONSTRUCTION

Stranding. — In order to secure the proper degree of flexibility, it is necessary to strand the copper conductors, but it must be borne in mind that if the cable is too flexible, there is danger of tangling. Experience indicates that with two-conductor flat cable each conductor should consist of forty-nine wires; with concentric cable, sixty-one wires (inside conductor), and with single-conductor cable, 127 or 133 wires, the former figure being for concentric stranding and the latter for rope stranding.

Insulation.—The standard rubber insulating compound specified by the Fire Underwriters in the National Electrical Code is fully adequate as regards life and flexibility. The compound should, however, be applied to the conductor in such a way as to adhere very tightly to prevent slipping. Ordinary code wire such as is used in buildings and for other purposes is often not sufficiently adhesive. Tightly adhering insulation also reduces the liability of cracking.

Braids.—Two ordinary weatherproof braids are required which should also adhere very tightly. The braids on ordinary wire do not sufficiently meet this requirement. Very heavy braids are generally called for because, as has already been pointed out, the conditions of service do not, except under special circumstances, entail very serious abrasive action on the cables.

Braids should be saturated with the usual weatherproofing compounds to strengthen them mechanically and prevent rotting.

The smooth, waxy finishing compound which is ordinarily applied to the braid of house wires after weatherproofing to facilitate drawing them into conduit, while attractive in appearance when new, is hardly worth while for gathering-reel cables.

With two-conductor flat cables it is desirable from the standpoint of safety and convenience to provide a raised thread in the braid of one conductor so that the two conductors can be distinguished from each other in the dark by touch and thus indicate which conductor is connected to the live and which to the grounded (track) side of the source of power.

Concentric cable is usually made with rubber insulation over the outer conductor, but this is sometimes omitted and the cable merely covered with weatherproof braids, because it is customary to connect the outer conductor to the grounded side of the circuit. The omission of this insulation is a dangerous practice as the outer conductor may be inadvertently connected to the "live" side of the circuit, and as had happened at one of the mines visited, a man might be killed by taking hold of a cable under such conditions.

In the Logan district, where single-conductor cables are used on the locomotives, two-conductor flat cables are used for the cutting machines. In other districts the same cable is generally used for both cutting machines and locomotives.

The service conditions for cutting-machine cables are much less severe than with locomotives as these cables are not nearly so likely to be run over. The principal source of damage to them is from being stepped on and from tools and lumps of coal being dropped on them, which is mainly injurious to the rubber insulating compound.

Although the life of mining-machine cables is longer than that of gathering-reel cables, being about two to three years, there is nothing about the service requirements which would indicate the necessity of a better or more expensive specification than that already given for locomotive cables. In fact, it is regarded by many mine superintendents as extremely undesirable to have two grades of cable in a storeroom, especially where the same general type is used for both cutting machines and locomotives.

F. A. WESTBROOK,
Field Engineer.

Habirshaw Electric Cable Company,
New York, N. Y.

Installing Engine-Type Generators with Limited Equipment

SOME erecting engineers who read the instructions for installing engine-type generators published in ELECTRICAL WORLD Jan. 28, page 187, have pointed out that an A-frame or gin pole is not always available and that a single-screw jack is the only lifting device that can be readily obtained. While the extra time and expense required to install heavy apparatus under such conditions will usually justify the hiring or buying of the necessary handling equipment, instructions for installing a generator with limited handling accessories will be given for the benefit of engineers who find themselves in this predicament.

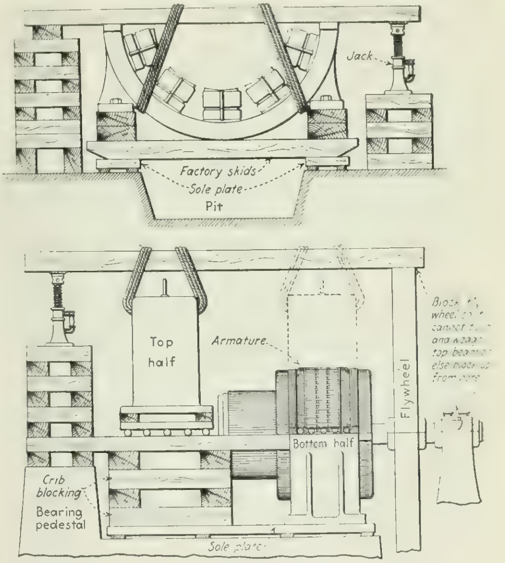
It is assumed that the foundations and space for the generator have been checked, that the center line of the shaft has been established, and that the sole plates have been laid on the foundations with a 1-in. board under each corner ready to receive the lower field frame.

Lay a timber across the field frame and lash it tight with rope. By using the jack first on one end and then the other, as shown by the sketch, it can be lowered slowly but safely. Leave the field setting against the side of the pit furthest from the flywheel so that when the armature is rolled out of its crate (on two timbers) it will not be necessary to raise it higher than just enough to let the commutator clear the field frame.

The engine man generally looks out for the bearings. Fill the bearings with small, clean blocking; then lay two timbers, one for each end, on top of bearing housing. The other end of the timber should be placed under the armature shaft, which must be jacked clear of the crate. Before doing this clean off carefully all paint and grease and look sharply for marks and dents in the parts of shaft that rest in the bearings. Then take out one side of the crate and roll the armature, now resting on the timbers, out of the crate over the bearings.

With the one-screw jack raise the end of shaft enough to pull out one of the timbers, then the other, and lower one end at a time, but always keep the blocking underneath so that it cannot drop more than a couple of inches should anything happen. While the engine man is leveling the shaft, slide the bottom of the field over the bolt holes, start all four bolts and center them in the holes by shifting the sole plate. Raise the field frames enough to insert ¼ in. of liners, let it down with the sole plates as one piece, set on wedges with the proper air gap, and center so that very little adjusting will be necessary after the top half is on. Tighten up the foundation bolts and have a wedge close to each bolt so as not to spring the sole plates.

To place the top half of the field build a crib high enough to permit the field to be rolled over the shaft close to the commutator. With the screw jack rigged as shown in sketch, make a lift to allow the removal of the skid, and then lower by degrees until there is just space under the frame for three or four small pipe rollers. Roll the frame over the lower half, make another lift, take out the rollers and lower again, but notice first if the joint bolts will enter the holes or if the field coils are in the way. If so, the bolts must be put through the holes before lowering.



INSTALLING GENERATORS WITH BLOCKS AND JACK

In erecting an alternating-current machine proceed about the same way as for a direct-current machine, but do not attempt to line or level the stator until after the joint coils are in place, to save handling them more than once. While the engine man is leveling the shaft with the rotor on it, the coils can be installed. Never attempt to slide the stator or field frame while it is resting on the lifting screws or jack bolts as the screws will either bend or cut a heavy groove in the sole plates.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Maintaining Day-Service Standards in the Small Community

A Suggestion from Charles McGee Adams on a Vital Factor Affecting Appliance Popularity and Good Will for the Central Station

WITH the steadily increasing interest in appliances being displayed by the central-station company and the growing appreciation of their value as load, there is a point of nearly fundamental importance which deserves serious consideration, particularly by companies serving the smaller towns, and that is that the foundation of any profitable load of this sort is adequate and reliable service during daylight hours.

In the cities and larger towns service in the daytime has been maintained at even a higher standard, if there is any difference, than at night, because of the increasing volume and importance of the industrial load. But in the smaller towns the industrial load is insignificant. The bulk of consumption comes from the lighting load, and as a result daylight service, when available, is often subject to interruptions and voltage fluctuations. Yet it should not be difficult to see that the quickest and surest way to discourage the use and sale of appliances is to have service fail when they are to be used.

A certain town in southwestern Ohio permits a severe pumping load that could easily be shifted to late evening to come on during the day. A man in this town has the most complete electric home in the county, but his equipment is useless much of the time, and dealers find themselves seriously handicapped in selling electrical devices because of the character of the service.

In another town linemen refuse to work on hot primaries, with the result that whenever a transformer is to be cut in, a pole set, or any other routine work done, service is cut off and remains off till the work is finished, while flatirons grow cold, vacuum cleaners stop and refrigerators heat up. Still another town, a rural hamlet, is served by a single 5-kw. transformer fed from a high-tension line, and two-wire services from the transformer are run a half mile in No. 10 wire. This answers tolerably for lighting load, but it is scarcely necessary to say that housewives find that their irons will not heat.

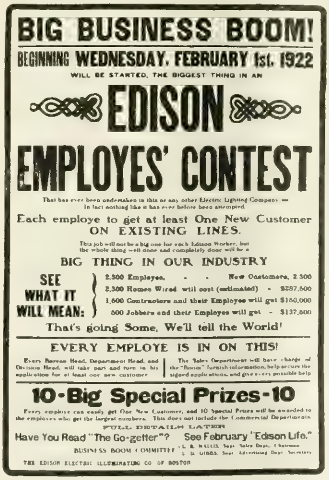
Of course, there are many small towns whose service is maintained at the same standards as in the large cities, but at the same time there are too many small towns like those just cited where daylight service is admittedly inferior to that supplied at night simply because the local company tolerates this condition.

At present the appliance load on the lines of these utilities may not be large enough to be profitable. In all probability it is not, with service conditions as they too often are. But if experience is any guide, there is every reason to expect that it will grow into something even larger than the lighting load, provided it has the foundation of proper and reliable daylight service.

The very best appliances are useless without an adequate energy supply. In the small towns and outlying villages these conveniences are doubly valuable to the user. But because he happens to live in a small town it does not seem reasonable that he should have to put up with an indifferent energy supply. Although the blame cannot rightly be placed upon companies whose service is up to standard, such service reflects upon the central stations as a whole. Many of these small towns are supplied by a private individual or a small local company which takes its energy from a nearby transmission line. In such cases the larger power company should make an extra effort to see that the distribution lines and other equipment are ample to maintain a high standard of service. Public good will and pleasant customer relations are based upon the quality of service rendered, and without this prime requisite no company can expect to grow and prosper.

A Business Boom for the Boston Electrical Family

ON FEB. 1 the Edison Electric Illuminating Company of Boston launched a campaign for new customers in which all employees are to be participants. Contractors and jobbers have also been asked to aid in the campaign which will be mutually helpful. It is expected that before the end of the year at least one new customer per employee will be added to the existing lines. The campaign is to be under the supervision of the sales department, of which L. R. Wallis is the head. It is estimated that if each of the company's 2,300 employees secures a new customer, the house-wiring business resulting will amount to $287,500, and that of this sum 1,500 persons, representing contractors and their employees, will get $150,000, and 500 persons, representing jobbers and their employees, will receive $137,500.



BIG BUSINESS BOOM!

BEGINNING WEDNESDAY, FEBRUARY 1st, 1922

WILL BE STARTED, THE BIGGEST THING IN AN

EDISON

EMPLOYES' CONTEST

That has ever been undertaken in this or any other Electric Lighting Company —
In fact nothing like it has ever before been attempted.

Each employe to get at least One New Customer
ON EXISTING LINES.

This job will not be a big one for each Edison Worker, but
the whole thing well done and completely done will be a

BIG THING IN OUR INDUSTRY

SEE WHAT IT WILL MEAN:
2,300 Employes, - - New Customers, 2,300
2,300 Homes Wired will cost (estimated) - $287,500
1,500 Contractors and their Employes will get $150,000
500 Jobbers and their Employes will get - $137,500

That's going Some, We'll tell the World!

EVERY EMPLOYE IS IN ON THIS!

Every Bureau Head, Department Head, and Division Head, will take part and turn in his application for at least one new customer

The Sales Department will have charge of the "Boom" furnish information, help secure the signed applications, and give every possible help

10-Big Special Prizes-10

Every employe can easily get One New Customer, and 10 Special Prizes will be awarded to the employes who get the largest numbers. This does not include the Commercial Departments.

FULL DETAILS LATER

Have You Read "The Go-getter"? See February "Edison Life."

BUSINESS BOOM COMMITTEE
L. R. WALLIS, Supt. Sales Dept., Chairman
L. D. GIBBS, Supt. Advertising Dept., Secretary

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

POSTER ANNOUNCING EMPLOYEES' CONTEST

In announcing the campaign L. D. Gibbs, superintendent of the company's advertising department and secretary of the newly formed "business boom" committee, stated that no such campaign has ever before been attempted by a central-station company. Every bureau head, department and division head is "in on" the campaign, as well as the rank and file of employees. Ten special prizes will be awarded employees outside the commercial departments who obtain the largest numbers of new customers.

Showing What's Back of the Company's Service

THIS picture of the members of the Lions' Club of Dayton, Ohio, guests of the Dayton Power & Light Company at a luncheon, was taken in the turbine room of the company's Miller's Ford station. The club members were taken to the plant at noon by automobile and conducted through the station in groups of ten under the guidance of an employee of the company who explained the principal features of the various pieces of apparatus. The luncheon was presided over by O. H. Hutchings, vice-president and associate general manager of the company.

LIONS' CLUB LUNCHEON IN DAYTON COMPANY'S MILLER'S FORD STATION

The Dayton company for years has consistently endeavored to maintain the public interest in its property and its affairs by telling the people both its sorrows and its joys and by taking advantage of every opportunity to exhibit and explain the system to the business men of the community. Contact with civic organizations has been the source of many helpful friendships and visits of inspection to the plant have been made a feature of get-together meetings with different local bodies that have aided materially in the upbuilding of a high degree of public confidence and appreciation.

Selling $11,300 of Stock Daily for 2,300 Days

IN A LITTLE less than 2,300 working days the Pacific Gas & Electric Company of San Francisco has sold $26,068,000 of its first preferred stock. It was almost eight years ago when this company first offered its preferred stock directly to its customers and employees. Since the initiation of the plan on June 3, 1914, sales for every working day have averaged over $11,000. These results are the more noteworthy when it is considered that during the war period the company discontinued its efforts to sell stock and that it did no advertising from the time the United States entered the war, in April, 1917, until the latter part of October, 1920, or for a period of more than three and a half years.

In the accompanying table the number of sales and the par value of the stock sold are given, and it is an interesting fact that in this period the company's list of stockholders has increased from 3,000 to 18,000, of whom more than 15,000 are residents of California. One of the features of the company's stock-selling campaign is the remarkably low sales expense. In a period from June, 1914, to November, 1921, inclusive, the average selling cost per share for direct sales aggregating $25,662,600 was only 89.1 cents, and during the last active campaign in the interval from July, 1920, to Nov. 20, 1921, inclusive, $10,871,200 par value of stock was sold at an average cost of only 70.7 cents per share.

SALES TO CONSUMERS OF FIRST PREFERRED STOCK.

Year	No. of Sales	Par Value of Stock Sold
1914	3,739	$8,801,300
1915	1,712	3,785,100
1916	617	1,123,100
1917	650	890,000
1918	192	156,000
1919..	52	35,900
1920	3,669	3,634,650
1921...	6,399	7,491,550
1922 (to Jan. 13)	163	150,400
Total...	17,193	$26,068,000

What Other Companies Are Doing

Wichita Falls, Tex.—Thirteen electric ranges were sold recently in two weeks' time by the commercial department of the Texas Power & Light Company in this district. These range sales were made in the face of cheap natural gas and adverse financial conditions.

Charlotte, N. C.—A significant index to the increased understanding by the public of the value of electric service is shown in the 3,285 new customers added to the lines of the Southern Public Utilities Company during 1921. Of this number 2,400 were residential customers and the remainder, 885, were commercial and industrial users.

Central Maine. — During the first three weeks of 1922 eleven of the branch offices of the Central Maine Power Company sold a total of $6,214 worth of electric appliances. The list of sales includes curling irons, flatirons, grills, heating pads, portable lamps, radiators, toasters, vacuum cleaners and washing machines. A bogie for 1922 sales has been set for each district office of the company, but some of the branch offices exceeded their year's quota in the first three weeks and it is expected that the present bogie will undergo a revision upward.

Vancouver, B. C.—During the year 1921 the British Columbia Electric Railway Company added 510 lighting installations to its Island system, increasing the connected load by 850 kw. The total number of lighting customers is now 15,400 with a connected load of 9,985 kw. Substantial gain has also been made in commercial power, an increase of 2,170 hp. in connected motor load being the result of the year's operations. The total horsepower now connected is 25,570. The company expects that still better results will be obtained during 1922.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Cost, Slow Turnover and Excessive Stock Duplication

By George A. Hughes
President Edison Electric Appliance Company, Inc., Chicago

IN THE processes of distribution throughout the electrical industry, volume of business and the varying cost of selling different articles are two vital factors whose relation to ultimate profit appears not always to be clearly understood. No doubt, during this readjustment period, electrical merchants, both wholesale and retail, may be finding the cost of doing business burdensome, as indeed has the manufacturer. But the answer is certainly not longer discounts, which would involve higher prices. The need is rather for setting the business house in order, facing the issues of reduced public buying interest and keener competition and keeping in mind the law of survival of the fittest, which will be found operating in the electrical trade as well as in other spheres.

G. A. HUGHES

It is highly important for the wholesale and retail branches of the electrical business to study and know their costs of doing business. But it is equally important that the proper interpretation be put on any figures or statistics which are obtained. Questions of distribution of overhead on varied lines, annual volume and rate of turnover, for example, are practical factors which seriously affect the result. Then, again, electrical appliances must be considered according to their proper classifications. For example, shelf merchandise, such as flatirons, should be distinguished from articles like washing machines and vacuum cleaners, as the latter require a different form of merchandising.

It so happens that in the distribution of electrical heating appliances our experience is not confined to the electrical trade, strictly speaking. For years these goods have also been sold through hardware stores, housefurnishing goods stores and department stores—old-established lines of business which know merchandising costs and merchandising methods and have survived in keen competition. These retail stores have been well satisfied to promote the heating-device business at discounts which have been in force without substantial change since the beginning of the business, and which are comparable to discounts of analogous lines and even better than many. In one of the most successful retail trades, I am advised that the average discount is 30 per cent.

The important factor of turnover is overlooked by many retailers. In an analysis of a retail dealer's stock recently made, with an inventory of $75,000, it was found that 80 per cent of the total turnover was done on $25,000 of the inventory. In other words, of his investment of $75,000 in merchandise he had $50,000 in slow-moving or frozen investment. From a merchandising standpoint there is no fundamental difference between electrical merchandise and other commodities. A grocer has a better profit on some articles than on others, but he finds it necessary and profitable to carry a complete line of goods.

It would be a serious matter to involve such investigations of cost with the matter of trade discounts and prices, because the latter involve such practical considerations as trade practice, competition, skill in merchandising, efficiency in operation, rate of turnover, volume of business, relation of the electrical appliance sections to other departments, business conditions and so on.

If a campaign for ascertaining selling cost is taken up in times like these, it should be associated with a campaign for lower costs and better merchandising if the average electrical dealer is to stay in the race. At the same time, one thing in particular which calls for better merchandising, and which has impressed me, is the unnecessary duplication of investment on account of the tendency to multiply various makes of the same kind of appliances, instead of confining the investment to and concentrating on one or two standard lines of appliances which have consumer demand and faster turnover.

A great work has been done in getting the electrical contractor to study and know his costs. This has led to a fairer basis of competition and has therefore had a stabilizing effect. But the matter of cost of merchandising is far more complicated, because the practical and varying elements affecting the figures, which I have indicated, and the electrical merchant's cost of doing business, must enable him to meet the competition of other merchants in established business.

Who Should Carry Through to the Consumer?

By J. P. Provost
Vice-president Union Electric Company, Pittsburgh, Pa.

MANUFACTURERS and jobbers of the larger household appliances—that is, electric clothes washers and ironers, vacuum cleaners, dishwashers and ranges—sooner or later will be obliged to work out in definite shape a distribution process that will carry through to the consumer with the burden balanced to the opportunity and to the profit. But this business as yet has not been put clearly on such a basis. Some manufacturers are selling to the jobber and leaving the job from there on in his hands. Some are giving active and direct aid to the jobber in the further distribution of their product. Some are selling directly to the dealer and assisting him. Some are carrying right across the usual channel and selling to the consumer only. Each, however, has the right to choose the method he prefers and work out his own experiment from which he would be enabled to establish a definite policy. But be the process what it may, some one must be clearly delegated to carry through to the consumer with educational advertising, personal selling and supporting service.

The majority of manufacturers have chosen the natural organized channel of the electrical trade, and I believe will continue to do so. There is need for warehousing these goods, for the development of retail outlets in many large and small communities, and for carrying the credit and education of the retailer, the pioneering of the appliance to the people and the financing of installment payments. It is a big job that somebody must do, but the work must be better scheduled and regulated so that the compensation will be proportionate to responsibility. Either the manufacturer must carry the entire burden and retain the entire profit, or he must rely upon the jobber for warehousing, allowing him a warehouse margin and carrying on the burden of dealer education and pioneering to the customer himself, or he must put the follow-through work flatly up to the jobber and give him a discount commensurate with the function he is to perform. Some jobbers went very heavily into this large-appliance business, building up a large trade outlet and developing a big installment sales business through their dealers. These jobbers believed that this was a very profitable business. After a time, however, an accurate analysis of the facts and figures proved that they had found it necessary to assume such a large part in the work of carrying through to the consumer that the business was in the end not profitable but expensive. They had not known it, just as jobbers today do not know it, because little by little they have taken on more and more of the marketing responsibility without proportionate increase in compensation.

It May Hurt, but It's Got to Be Done

O-O-o o o o O-O
NEW BUSINESS WOODPILE
SELLING
WELL, STANDING THERE YELLING WON'T HELP A WEAK BACK! AND REMEMBER — IF YOU DON'T KEEP THIS KITCHEN FIRE GOING YOU'LL NEVER GET YOUR DINNER
COLUMBIA
He's been so used to just gathering up an armful and carrying it in that, naturally, it does come a bit hard at first having to swing the axe.

A BIT of homely logic that suggests the underlying need of the present business situation. Only hard work, earnest selling effort and persistent advertising will create markets and increase sales in times like these. From *Sales Management.*

This business is young and these facts have not yet come to light in many cases. Experience will gradually demonstrate the situation and the readjustment that is needed will be made. But how much better it would be if we could balance up these functions and the participation at once, avoid the handicap of uncertainty that is now hobbling the appliance business, and enjoy the full advantage now of the added impulse that will come to the sale of these devices when the distributers' responsibilities and profit stand out clear and sure.

There is a tremendous market for these large appliances, and it can be easily controlled and developed by the electrical trade if we get our machinery running smoothly and keep it so. Because they cannot compete with the electrical man's ability to service such appliances, the department stores will not be able to carry off this business unless we sacrifice it to them by bad management, and there is no reason why we should do this. But there is much bad management mixed with the business now, and it is none to soon to work it out.

Two Letters on the Small-Order Problem

AN INTERESTING sidelight on the small-order question which confronts manufacturers today is shown in this exchange of letters, names omitted, between a manufacturer and a jobber. The manufacturer's letter clearly states his problems, while the jobber's reply suggests the only practical solution. The manufacturer's letter reads:

(Your order S-10 and S-15)

GENTLEMEN—We note with regret that the small miscellaneous items that we have been receiving during the past year from you work a financial hardship, so far as we are concerned, though undoubtedly unintentional on your part. We appreciate that war conditions upset all of us, and we have stood in the breach even at an absolute loss. We, however, think that you would not expect us to continue to do so, as we must exist.

The above two orders, each calling for one bell-hanger's bit, are fair samples of what we have been getting. We have to be very careful in making shipments to follow your minute instructions, answer your "follow-ups," etc., which is very costly (we have the figures). Presume that the same conditions exist at your end of the line.

We, of course, are going to ship these two orders as directed and are writing to you frankly, as good old friends, to ask you to send us a little sweet along with the bitter. This retail business is a loser for us.

An expression from you as to what we may expect will be appreciated. Perhaps these little one-item propositions can be purchased in your own city to your advantage. We have sold the .... Company for thirty-odd years and understand the situation exactly, and we believe that in sending us these small items you have not given the matter any thought, so we will forgive you.

With personal regards, we are very truly yours,

———— — ——.

The jobber's letter reads:

GENTLEMEN—I received your letter of Dec. 1, also your letter of Dec. 8, regarding the small-order question, and quite agree with you that our pick-up privilege has been abused. We certainly should carry an assortment of the items in question, and I am pleased to inclose herewith a small order, which should eliminate so many pick-up-items.

This is a saving to ourselves as well as yourselves, and I want to thank you for bringing the matter to my attention. Yours truly,

———— ————.

This practice of buying at wholesale prices in retail quantities has grown to a point where it cuts into the profits at both ends. It is largely a matter of habit. But the habit will only be broken when the manufacturer, jobber and dealer, each in turn, performs his part in ending it.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Prevention of Transient Voltage in Windings.—J. MURRAY WEED.—Article relating to windings such as are used in transformers, reactors and the like, with particular reference to the characteristics which determine internal distribution of suddenly impressed voltages or sudden voltage changes and the resulting internal oscillations. After describing the production of these transient voltages in ordinary windings, the paper explains this phenomenon as due to faulty arrangement of inherent capacitance with the inductance of the winding. Methods of prevention are described for the ordinary windings, by supplementing the faulty arrangements of inherent capacitance with auxiliary capacitances or condensers. Methods are given for the construction of windings with the ideal distribution of inherent capacitance called for by this principle.—*Journal of the American Institute of Electrical Engineers*, January, 1922.

Possibilities of the Turbine.—P. F. COFFIN.—The efficiency limitations reached in the present-day steam turbines may be overcome by using two vapors in series, such as mercury and steam. Experiments carried out on a 1,000-kw. unit producing 1 kw.-hr. on about 11,300 B.t.u. are described in the article.—*Power*, Jan. 24, 1922.

Lamps and Lighting

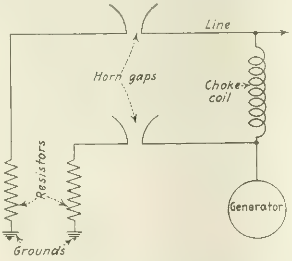
The Lighting of Public Buildings.—A. L. POWELL and EDGAR PARKER.—A thoroughly satisfactory building depends upon the preliminary planning of the lighting, simultaneously with the structural elements, and as public buildings in general are elaborate structures with special lighting requirements, the best results are obtained only when these features are carefully considered beforehand. A description is given of the lighting requirements of art galleries, museums, libraries, municipal, county and state buildings and banks.—*Transactions of the I. E. S.*, Dec. 30, 1921.

Generation, Transmission and Distribution

Power Factor Meeting of the V. D. E. in Essen.—MATTHIAS.—A number of valuable suggestions to overcome or at least to subdue phase displacement in large networks. For example, no oversized synchronous motors should be used. The air gap of these motors should be kept as small as possible, preferably by using ball or roller bearings for the shaft. Squirrel-cage armatures are recommended for all motors as high as 30 hp., and to avoid excessive magnetic leakage flux there should be a speed as high as possible, if necessary with the use of a reduction gear. If a motor operates for an appreciable length of time on low load, it should be changed from delta to star connection, which can be done with a simple switch. Synchronous motors may be used for as little as 30 hp. They have a commutator and may therefore also be used as converters. A combination asynchronous-synchronous motor was developed with a high starting torque. With the use of synchronous condensers care must be exercised to determine their most effective location on the network.—*Elektrotechnische Zeitschrift*, Dec. 29, 1921.

An Example of Transmission-Line Calculations.—R. D. EVANS and H. K. SELS.—This is the last of a group of four articles by these authors dealing with transmission-line problems. This article solves a general problem, which is to determine the most economical voltage and balance of transmission equipment necessary to deliver at a distance of 125 miles a load of 50,000 kw. per circuit whose power factor will average 85 per cent.—*Electric Journal*, February, 1922.

Protection Against Lightning.—E. POIRSON.—An interesting theoretical paper wherein, to aid in the proper design of arresters, the author tries to calculate the approximate energy in a lightning discharge. A cloud with a radius of 500 m., situated 400 m. above the ground, represents a capacity of 0.055 mfd. The earth capacity is assumed to be 700 mfd. A bolt from this cloud to ground may have a potential of 50,000,000 volts. Assuming an air resistance of 10 ohms and the self-inductance of the rectilinear distance of 400 m. to be about 0.00075 henry, the frequency of such a discharge would be 24,700 cycles per second. A total of about 69,000,000 joules would be liberated in such a bolt, and, assuming a thousandth of a second as the time of discharge, this would equal 69,000,000 kw. The author discusses simple arresters, consisting of arcing horns, choke coils or resistors, and their best combinations. He proves mathematically that the use of a single choke coil with a few turns is of little protective value and suggests a combination of two horns and one choke coil.—*Revue Générale de l'Electricité*, Dec. 31, 1921.



TWO HORN GAPS USED FOR LIGHTNING PROTECTION

Traction

Why Modern Motors Should Supersede Older Types.—J. M. HIPPLE.— The author tells how self-ventilation, together with the use of commutating poles, box-type frames, bronze bearings and improvements in mechanical and electrical design, has produced a motor for present-day service for electric railways.—*Electric Railway Journal*, Jan. 21, 1922.

Electrification of Chilean Railroads.—A seven-million-dollar contract provides for complete electrification of the first zone, which includes 144 miles of track between Valparaiso and Santiago. Thirty-nine electric locomotives are required for the initial step, comprising six express passenger, eleven local passenger, fifteen road freight and seven switching locomotives. The express passenger and road freight locomotives will be equipped with the Westinghouse system of regenerative braking. Hydro-electric power will be used. When the proposed stations are complete they will have a rating of 120,000 kw.—*Electric Traction*, January, 1922.

Installations, Systems and Appliances

Increasing Welding Speed.—H. R. PENNINGTON.—The possibilities of increasing the speed of arc welding are pointed out in this paper, which was read before the American Welding Society in Chicago. Electric welding speed on a given section is dependent upon the rate of metal deposition and the amount of metal required to effect the jointure. Three tests on welding wire to determine the advantages of coated wire, using $\frac{5}{32}$-in. and $\frac{1}{4}$-in. wires, are given.—*Welding Engineer*, January, 1922.

New 7-Ton Heroult Furnace.—Description of a tilting furnace made by the American Bridge Company and different from its other standard type in that arrangements are made for the use of a mechanical charger. The lift of the electrode is extremely high, which allows the use of a mechanical charger without danger of breaking electrodes.—*Iron Age*, Feb. 2, 1922.

Electric Winding Engines and Mine Hoists.— H. H. BROUGHTON.—The author has collected a series of notes on the strength of helical gearing, with the idea of providing the user of such gears with data by which he can check the designs of the gearing manufacturers. The article is in two parts, the first dealing with typical calculations of the working load, with a chart for determining the horsepower rating of gearing in units. In the second article the properties of the various types of gears are described and compared.—*Electrician, (London)*, Jan. 6 and 13, 1922.

Electrochemistry and Batteries

Formation of Fume Ions in Electrical Precipitation.—YASUJIRO NIWA.—Assuming that the fume particle and the ion are conductive spheres, the author derives the theory of formation of fume ions. He discusses the relation between the precipitation efficiency, the gas condition and the properties of particles and finally concludes that the high temperature of gas and the low conductivity of particles hinder the formation of fume ions and lower the precipitation efficiency. The author shows that the conclusions drawn coincide with the working data of the 180,000-cu.ft.-per-minute precipitation treater for gas at the Ashio smelter of Japan.—*Institute of Electrical Engineers of Japan*, January, 1922.

Units, Measurements and Instruments

Electrolytic Meter.—J. SCHALKHAMMER.—Much difficulty was experienced in Austria during and shortly after the war in obtaining a sufficient number of electric meters for new customers. A very simple and accurate meter was developed on the principle of the electrolytic meter. An iodine-mercury electrolyte is used between a mercury anode and a carbon cathode, both sealed into a glass vessel with an accurately calibrated measuring tube. The volume of this tube is so chosen as to be sufficient for one to two years, after which period the tube is reversed and emptied. The voltage drop of the meter is about one volt. Of course, the instrument is only an ampere-hour meter, but experience has shown that variations of the voltage settle quickly to the normal value and that, therefore, the absence of a voltage coil is not a serious drawback. The meters are very rugged and are unaffected by short circuits or by magnetic fields. The latter fact is of great importance for the electrochemical industries, where stray fields of 20,000 amp. to 30,000 amp. make the proper installation of a motor meter very costly.—*Zeitschrift für Elektrotechnik und Maschinenbau*, Jan. 15, 1922.

Telegraphy, Telephony and Signals

The Insulation of a Communication Line.—J. G. HILL.—A study of the important points of the resistance of insulators on communication lines.—*Post Office Electrical Engineers' Journal (London)*, January, 1922.

Printing Telegraph Systems Applied to Message Traffic Handling.—A. H. REIBER.—This paper discusses some of the economic principles which determine the applicability of the automatic printing telegraph to present-day communication problems. Examples are given of the application of this type of apparatus to modern business conditions, and the fundamental fact is demonstrated that whenever speed is essential in communication consideration should be given to the automatic printing telegraph. The study is limited to those forms of light-traffic-load printing-telegraph systems which have been developed particularly for linking together factory departments, railroad terminals, branches of banks, or of other large corporations. A description is then given of the principle of operation of three systems, namely, the Morkrum "green code" system, the Western Electric "start-stop" system and the Kleinschmidt system.—*Journal of the A.I.E.E.*, February, 1922.

Miscellaneous

Proposed Regulation of Lake Ontario.—Studies by Canadian and United States government engineers for the International Joint Commission to determine the effect of the St. Lawrence River power development on the regulation of Lake Ontario.—*Canadian Engineer*, Dec. 29, 1921.

Federal Water Power Projects up to December, 1921.—The annual report of the Federal Power Commission (1921) shows that in the previous sixteen months there were issued 260 applications for licenses to develop water power under the federal water-power act, covering a total of 16,826,000 hp. of estimated installation. A table is given showing the hydro-electric power plants under way in the United States. This table gives the name of the company, name and location of the plant, dam and reservoir construction, pipe, canal and tunnel systems, maker, type and size of prime movers, static head, present stage of development and ultimate capacity of the plant in kilowatts. Among the companies are the Niagara Falls Power Company, Henry Ford & Son, Inc. (plant at Green Island), Alabama Power Company, Manitoba Power Company, Dearborn Plant of the Southern Power Company, Ruby Creek plant of the city of Seattle, Drum plant (unit No. 3), Hat Creek plants Nos. 1 and 2 and Pit River plant No. 1 of the Pacific Gas & Electric Company, Caribou plant of the Great Western Power Company, Kern River No. 3, Big Creek No. 8 and Big Creek No. 3 of the Southern California Edison Company. — *Engineering News-Record*, Jan. 5, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Municipal Plants Seek Advantage of Interconnection

ACTIVITY in the construction of transmission lines is evidenced in Oklahoma, particularly lines to serve communities that have hitherto maintained their own municipal generating plants. A line from Skiatook to Pawhuska, it is stated, will take the place of improvements to the municipal plant at Pawhuska for which bonds had been voted. The improvements have been abandoned and franchises granted for the construction of the transmission line from which the power supply will be drawn. A new line has recently been placed in service which furnishes three municipalities with service from the Enid plant of the Oklahoma Gas & Electric Company. Three other municipalities have voted bonds for the construction of transmission lines to connect with the system of the same company, and some eight or ten other communities have opened negotiations with the same object in view.

The agricultural states, of which Oklahoma is one, are largely represented in the municipal service field by small plants that cannot hope for large growth. The happenings in Oklahoma are typical of the reports that are coming from these states and indicate that municipalities are awakening to the advantage of interconnection and the abandonment of old and inefficient plants.

Utilities Oppose Bills that Facilitate Municipal Ownership

VIGOROUS and comprehensive condemnation of measures now before the Massachusetts Legislature to make it easier for cities and towns to embark upon municipal ownership was expressed last week before the legislative committee on power and light at Boston by E. W. Burdett, counsel for the Massachusetts Gas and Electric Association. Following the recent failure of certain members of the Boston City Council to railroad a public-ownership scheme to success in connection with the Boston Edison company rate inquiry, several bills were introduced with the object of relaxing the legislative procedure necessary before public lighting plants can be established in the Bay State.

Pointing out how the present laws safeguard the community against intolerable duplication of overhead and underground systems, conserve regulated investment in plant and give time for sober second thought by the electorate after a municipal ownership agitation has got under way, Mr. Burdett emphasized the economic waste of competition in public utility service and showed how the present statutes have been evolved after long and serious study of the public-ownership problem.

A. E. Pillbury, for the Association of Massachusetts Gas Companies, also opposed the bills and stated that the purpose of setting up the original Gas and Electric Light Commission about a third of a century ago was to prevent competition in public service by substituting public regulation for ruinous rivalry of local utilities.

The committee has reported against proposed bills.

To Have Grouped Educational Exhibits at N.E.L.A. Convention

ONE of the features of the Atlantic City convention of the National Electric Light Association, to be held May 15 to 19, will be an educational electrical exhibition. The exhibition committee has issued its circulars and application blanks to the manufacturer members of the association, many of whom already have applied for space. All space will be assigned on March 15.

A new plan for using the Million-Dollar Pier at Atlantic City has been devised for this year's convention. As usual, the registration and convention committee rooms will be at the entrance to the pier. The ballroom will be devoted entirely to recreation purposes, and the exhibits all will be shown beyond the ballroom on the pier. At the end of the pier, beyond the exhibits, will be two rooms for the sectional meetings, while the theater will be used for the main convention sessions. Another meeting room has been built under the theater. Thus, for the first time, all convention facilities will be together on the pier.

In planning the exhibition the committee has arranged to have exhibits of similar products made in adjoining spaces. Among the important sections of the industry invited to co-operate in this way are those related to industrial heating, electric vehicles, incandescent lighting and wireless.

California Power Act Menace to Industry, Says Banker

THE proposed initiative amendment to the California constitution which will be voted upon in November and which would create a five-hundred-million-dollar state power bureau, is having a depressing effect on all California securities in the view of B. H. Dibblee, vice-president of E. H. Rollis & Sons and chairman of the California group of the Investment Bankers' Association of America.

"Generally speaking, the East has undoubted confidence in the future of California and in California securities, hundreds of millions of dollars of which have been distributed there. Unfortunately, however, a cloud has appeared on the California horizon, namely, the proposed water and power act," Mr. Dibblee said to a representative of the ELECTRICAL WORLD. "A few Eastern bankers have heard of the act, and I have been asked if California was going to emulate North Dakota, which now is shunned by all wise investors.

My reply was that the people of California are too sane to adopt any such radical measure.

"The fact that California has considered this measure will, when generally known, have a depressing effect on California securities. Its adoption would unquestionably result in the dumping on this market of millions of dollars' worth of California public utility and municipal bonds now held by Eastern and local investors. The proponents of the measure have apparently overlooked the fact that its passage would create such a mistrust of California as a conservative investment field that California securities would be looked upon as questionable investments, and that this mistrust would eventually cost the industries, utilities and municipalities of this state an incalculable amount, owing to the higher interest rates which they would have to pay for money in order to attract the capital necessary for the tremendous development which we all anticipate and desire. It is most unfortunate that this act should have been proposed, particularly at this time when the development of our state requires such large amounts of capital, a considerable portion of which must come from the East. The ultimate result of the policy upon which the proponents of the water and power act wish the State of California to embark may be seen in North Dakota, which has found it almost impossible to market its state bonds."

Severe Sleet Storm Visits Wisconsin and Michigan

DAMAGE that may run into several million dollars was done on Wednesday and Thursday night of last week to utility properties in southern Wisconsin and Michigan by a freak winter storm that ended with a sleet storm comparable to that in New England early this winter. The storm swept from the southwestern corner of Wisconsin toward the northeast and down the Fox River valley, the center line of the disturbance.

Wisconsin, Berlin, Appleton, Fond du Lac, Sheboygan, Green Bay and Manitowoc were among the communities suffering most severely. The transmission lines in the section suffered interruptions due to wire breakages. Important telephone toll leads were wrecked for miles and power and lighting distribution systems and telephone plants were badly damaged by ice, which is reported to have formed to diameters as large as 3½ in.

Communication had not been restored over some important lines early this week, and weeks will be required to restore even a semblance of service in some of the smaller properties. Reports at Madison on Wednesday of this week indicate that some of the smaller telephone and power companies may not be financially able to make the needed repairs. One or two cases of intention to discontinue service have been reported already.

Trees have been badly damaged and in many cases entirely stripped by the accumulation of ice. The difficulties of making repairs were increased by heavy snow following the sleet and by the preceding floods. Many cases have been reported where line conductors either had to be cut out and abandoned or chopped from under ice formed on the ground and ranging up to 8 in. in thickness.

The storm reached Michigan during the night of Feb. 22 and in the amount of destruction is reported to have been the worst in the history of the state. The storm, which lasted about twelve hours, accompanied by a 15-mile wind, covered the entire peninsula north of Bay City and Muskegon. The freezing rain formed ice on the wire 2½ in. in diameter with depending icicles 7 in. long and averaging in number five to every foot.

All telephone and telegraph service was disrupted. Stretches of telephone toll lines 50 miles long, constructed only last year, were flattened to the ground. Some poles were broken in two or three places. There was, however, no uniformity in this regard.

In some cities 40 per cent of the poles of distribution systems went down. A report from the Consumers' Power Company, which operates throughout the storm territory, states that more than 90 per cent of its service was maintained with no interruptions exceeding fifty-seven minutes.

House Hearing on Muscle Shoals Projects Coming to an End

HEARINGS before the House military affairs committee in Washington on the question of what shall be done by Congress in regard to the future of Muscle Shoals are coming to an end as this is written. By the first of the week it is expected that the committee will have all necessary data before it and be able to go into executive session to frame its report. What this report will contain there is no one in Washington with sufficient prophetic ability to forecast, not even a member of the committee. It is expected that at least a week's time, perhaps longer, will be required for the committee to make up its mind as to what sort of a report shall be brought in.

One thing seems certain as this is written. There are not enough votes to be had in the committee to provide for a majority report in favor of accepting the Ford offer. Many members of the committee are for different reasons against accepting the Ford proposition. One of the principal reasons is that that offer requires an appropriation of from $45,000,000 to $50,000,000 of new money from taxes with which to complete the project.

Campaign of N. E. L. A. for Business Development Taking Shape

DETAILS of further progress in the National Electric Light Association's program for a broad, nation-wide campaign of business stimulation and commercial development show that the movement is now taking on definite shape. A plan is being worked out which will have national direction and guidance but be applied locally in community campaigns, the inspiration and ammunition for which will be provided from the general headquarters.

The joint committee for business development, which was appointed as the result of a meeting of some fifty executives representing the several branches of the industry, has decided to function through four sub-committees, each representing a branch of the industry and responsible for the direction of the particular activity under their charge, as follows:

Lighting Committee.—P. B. Zimmerman (chairman), National Lamp Works, General Electric Company; Rex J. Cole, Duplex Lighting Works, General Electric Company; L. R. Wallis, Edison Electric Illuminating Company, Boston; S. E. Doane, National Lamp Works, General Electric Company; F. R. Farmer, Beardslee Chandelier Manufacturing Company; E. J. Callahan, Westinghouse Lamp Company; F. W. Smith, United Electric Light & Power Company, New York; G. W. Osborne, Edison Lamp Works, Harrison.

This committee has in preparation a prospectus which will describe in detail more than twenty lighting activities for the consideration of the local organizations. It will give definite suggestions based upon the actual experiences of the many cities, such as Cleveland, Milwaukee, Los Angeles and Denver, in connection with each of the many activities suggested.

Appliance Committee.—C. E. Greenwood (chairman), Edison Electric Illuminating Company, Boston; A. K. Baylor, General Electric Company, New York; A. J. Hixon, National Association of Electrical Contractors and Dealers, Boston; W. E. Robertson, Robertson-Cataract Company, Buffalo; F. A. Ketcham, Western Electric Company, New York; A. A. Brown, Westinghouse Electric & Manufacturing Company, New York; W. R. Putnam, Idaho Power Company, Boise.

This committee will make available a brochure giving complete plans for educational demonstrations of appliances, together with suggestions for special sales campaigns and equitable methods of handling the appliance and of electrical homes.

Industrial Power Committee.—C. K. Nichols (chairman), New York Edison Company; R. S. Ballard, Southern California Edison Company, Los Angeles; A. A. Brown, Westinghouse Electric & Manufacturing Company, New York; E. W. Lloyd, Commonwealth Edison Company, Chicago; F. W. Smith, United Electric Light & Power Company, New York; W. E. Robertson, Robertson-Cataract Company, Buffalo; C. L. Collins, Reliance Electric Manufacturing Company, Cleveland.

The activities of this committee will be divided into several parts, which will include the better use of industrial power, the elimination of isolated plants, a better understanding of electric vehicle service, etc.

Wiring Committee.—A. K. Baylor (chairman), General Electric Company, New York; A. J. Hixon, National Association of Electrical Contractors and Dealers, Boston; L. R. Wallis, Edison Electric illuminating Company, Boston; LeRoy Clark, Safety Insulated Wire & Cable Company, New York; R. E. Fisher, Pacific Gas & Electric Company, San Francisco.

This committee will be equipped to give the latest suggestions on wiring information to the building industries and to the local organizations. It will be constantly working with the wiring committee of the National Electric Light Association and with all other committees on better wiring in the industry.

Following the naming of these committees and the outlining of their duties, Chairman R. H. Tillman also appointed a special committee, under the chairmanship of E. W. Lloyd, to study present central-station methods of merchandising and to outline plans for revivifying dormant or underdeveloped commercial departments.

While the direction of this broad movement will be under the direct control of those sub-committees of the joint committee for business development, the program evolved will be administered by a N.E.L.A. headquarters staff organization. This headquarters staff is to include a campaign director, who will devote all of his time to this work, and an adequate staff of complete co-operation with local organizations and with other national organizations as well as individuals in the electrical industry.

Purchase of the Los Angeles Distribution System by City Completed

THE purchase by the city of Los Angeles of the distribution system of the Southern California Edison Company within the city limits has finally been completed. This purchase has been hanging fire for several years and has been the subject of numerous legal battles. The purchase price was $11,000,000 plus additions and betterments valued at about $1,250,000. It is expected that considerable rebuilding and co-ordination of the distribution system will be effected within the next year.

Utah Manufacturers Oppose Adoption of Lighting Code at Present Time

OPPOSITION to the adoption at the present time by the Industrial Commission of Utah of a proposed industrial lighting code has developed to a considerable extent among a number of the members of the Utah Manufacturers' Association. At a recent meeting at the State Capitol, which was presided over by G. R. Yearsley, chief factory inspector for the industrial commission, and which was attended by a committee from the Utah Manufacturers' Association, it was decided that no agreement could be reached as to terms of the proposed measure. The arguments presented by the manufacturers were based largely on the claim that considerable expense would be incurred to them at a time when expense is hard to bear.

It is expected that no definite action in regard to the matter will be taken at the present time.

Radio Regulation Conference Opens in Washington

SECRETARY HOOVER opened in Washington on Monday the conference called to recommend rules to be embodied in legislation regulating the use of wireless. The open hearings, which were presided over by Mr. Hoover, conducted during the first three days of the week, while producing little in the way of constructive suggestions, did condense into one record a vast amount of information with regard to this development. This was said to be the first time that anything approaching this quantity of information has been assembled in a single volume. It was brought out very clearly that there are property rights in space and that the government is fully convinced that it is in the public interest that these rights shall be controlled. It was predicted that the time is not distant when every household will have its receiving set. One of the predictions growing out of the conference is that the day will come when the President of the United States can address every household in the land.

Committees were appointed to look into the legal and technical phases of radio-telephone communication and control, with these chairmen: Legal, Representative W. H. White; technical, Dr. S. W. Stratton, director Bureau of Standards; amateurs, Hiram P. Maxim.

In opening the conference Secretary Hoover said:

> I think that it will be agreed at the outset that the use of the radio telephone for communication between single individuals as is done with the ordinary telephone is a perfectly hopeless notion. Obviously if ten million telephone subscribers are crying through the air for their mates, they will never make a junction; the ether will be filled with

frantic chaos, with no communication of any kind possible. In other words, the wireless telephone has one definite field, and that is for spread of certain predetermined material of public interest from central stations. This material must be limited to news, to education, to entertainment, and the communication of such commercial matters as are of importance to large groups of the community at the same time.

It is therefore primarily a question of broadcasting, and it becomes of primary public interest to say who is to do the broadcasting, under what circumstances and with what type of material. It is inconceivable that we should allow so great a possibility for service, for news, for entertainment, for education and for vital commercial purposes to be drowned in advertising chatter or used for commercial purposes that can be quite well served by our other means of communication.

The problem is one of most intensely technical character, but is not one without hope of fairly complete solution. Fortunately, the sending of radio-telephone messages can be arranged in wave lengths sufficiently far apart not to interfere with each other, and receivers can at their option tune their receiving instruments to the different wave bands. With the improvement in the art and in the delicacy of instruments the distance between wave lengths may eventually decrease and thus the number of layers of messages increase. Furthermore, it is possible to increase the number of sending stations and thus the variety of material, if the power applied to certain wave lengths is limited so as to circumscribe the area of distribution from a given station. Beyond this again certain times a day may be set aside within certain wave lengths for certain types of information.

Debate on Water-Power Possibilities of the St. Lawrence

IN A DEBATE between Gov. Henry J. Allen of Kansas and Gov. Nathan L. Miller of New York on the proposed St. Lawrence River ship canal, held before the seventeenth convention of the National Rivers and Harbors Congress, the water-power possibilities of the St. Lawrence River came in for discussion. The convention was in Washington, and the debate took place on Wednesday afternoon of this week.

Governor Miller objected most emphatically to any development of the St. Lawrence River at the expense of the people of New York, who would be users of the power. He also criticised most severely the report of the engineers on the project, calling it superficial. The supposition is, he said, that the electrical energy would be used in larger part in New York, but no investigation was made of the possible market or of the cost of transmission. The constitution of the State of New York forbade the erection of an electric high-tension transmission line across the Adirondack Park reservation, and in order to reach a market the transmission lines would have to go around the mountain reservations. His contention was that no money should be expended on the proposed St. Lawrence River waterway until Congress shall have made an expert and exhaustive investigation of every phase of the work. If, after such an investigation had been finished, a favorable report was made, the Governor said the State of New York would gladly support the project. He characterized the Boston-to-Washington superpower scheme as far in advance of the times and said its consummation would be a great way off. Citations were made from the report of Hugh Cooper in opposition to the proposed scheme of hydro-electric development.

The meeting was very well attended, more than 800 being present, and the debate was spirited and well received.

Supply Manufacturers to Adjourn Annual Meeting to June

APPROVAL has been given by the members of the Associated Manufacturers of Electrical Supplies to the plan of adjourning the regular annual meeting when called on March 16 to some time during the last week in June.

The annual meeting is now fixed by the constitution for the third Tuesday in March of each year, but because the summer meetings of the sections, which for the last four years have been held at New London in June, have become so popular and so largely attended, the suggestion was made that it would be better if the annual meeting could be held in the week of the summer meetings. This, it was pointed out, would avoid the expense of two important meetings coming so close together.

Under the new plan the governors whose terms of office would expire on April 1 will hold over until July 1. At the June meeting the members will consider not only an amendment of the constitution necessitated by the change of date for the annual meeting, but also necessary amendments to the bylaws, making the fiscal year of the association begin on the first day of June in each year and the terms of office of the governors begin on the first day of July in each year.

The schedule for the spring meetings of the sections follows:

Monday, March 13

Association Rooms. — General standards committee, 2 o'clock.

Tuesday, March 14

Association Rooms.—Snap Switch Section and Molded or Formed Insulation Section, 10 a. m.; Lamp Receptacle and Socket Section and Line Material Section, 2 p. m.; Attachment Plug Section, 4 p. m.

Old Colony Club.—Signaling Apparatus Section, 10 a. m.; Industrial and Street Lighting Section, 2 p. m.

Wednesday, March 15

Association Rooms.—Fuse Section and Panelboard and Switchboard Section, 10 a. m.; Knife and Inclosed Switch Section and Electrical Porcelain Section, 2 p. m.; Carbon Section, 3 p. m.

Old Colony Club.—Fan Motor Section and Rigid Conduit Section, 10 a. m.; Non-Metallic Conduit Section, 2 p. m.; Armored Cable Section, 4 p. m.

Thursday, March 16

Association Rooms.—Radio Apparatus Section and Air Circuit-Breaker Section, 10 a. m.; annual meeting, 2 p. m.

Old Colony Club.—Outlet Box Section, 9:30 a. m.; Outlet Box Fittings Section, 11:30 a. m.; Switch Box Section, 2 p. m.; Cast Box Section, 4 p. m.

Friday, March 17

Open for adjourned meetings.

Next Convention of Illuminating Engineers to Be at Boston

BOSTON will be the scene of the next annual convention of the Illuminating Engineering Society, which is scheduled for Sept. 25 to 28 inclusive. This will be the sixteenth annual gathering of the society, and the convention arrangements are in the hands of a committee of which C. L. Edgar, president Edison Electric Illuminating Company of Boston, is chairman; H. F. Wallace, New England manager Edison Lamp Works of the General Electric Company, is vice-chairman, and J. Daniels, illuminating engineer, Boston Edison company, is secretary.

Idaho Power Applies for License for Transmission Lines

ONLY one application was received by the Federal Power Commission during the week ended Feb. 25. The Idaho Power Company applied for a license to cover four transmission lines as follows: Thousand Springs to Caldwell, 115 miles; Boise to Malad, 90 miles; Lower Salmon Falls to Swan Falls, 85 miles; Mountain Home to Featherville, 44 miles.

Power and Irrigation Interests Clash

SHARP differences of opinion were voiced by the promoters of power and of irrigation projects as to which comes first in public importance at the first joint hearing on water rights conducted in California by federal and state officials. At the meeting, which was held Feb. 21, plans for the expenditure of more than $50,000,000 for hydro-electric and irrigation developments in Nevada and Sierra Counties were explained in detail: The Yuba Development Company is planning the expenditure of $27,000,000 in irrigation projects in those counties, and the Excelsior Water & Power Company proposes to spend $25,000,000 for power projects on the south and middle forks of the Yuba River and on Deer Creek.

Oklahoma Utilities Plan Full Program

AN UNUSUALLY full program has been arranged for the annual convention of the Oklahoma Utilities Association to be held at the Huckins Hotel, Oklahoma City, March 14 to 16. The afternoon of the first day will be given over to a joint meeting of the electric light, telephone and electric railway men to discuss the Corporation Commission's order pertaining to overhead-line construction and crossings. The application of the order will be discussed from the standpoint of the commission and each of the classes of wire-using utilities. Representatives of the manufacturers and supply men will meet to discuss the results of the national co-operative advertising program and to talk on a co-operative program for 1922. At other sessions public relations, regulation and the proposed standards of service for electric utilities order of the state commission will be discussed.

American Engineering Standards Committee Elects Officers

AT THE adjourned annual meeting of the American Engineering Standards Committee, held in New York recently, Albert W. Whitney, a representative of the National Safety Council, was elected chairman, and George C. Stone, a representative of the American Institute of Mining and Metallurgical Engineers, was re-elected vice-chairman. Mr. Whitney is associate general manager of the National Bureau of Casualty and Surety Underwriters. A. A. Stevenson, the retiring chairman, is a representative of the American Society for Testing Materials. C. E. Skinner of the American Institute of Electrical Engineers, Martin Schreiber of the American Electric Railway Association, Eugene C. Peck of the American Society of Mechanical Engineers, John A. Capp of the American Society for Testing Materials, A. H. Moore of the Electrical Manufacturers' Council, N. A. Carle of the electric light and power group and Dana Pierce of the fire protection group were among those elected to represent member bodies on the executive committee.

Illinois Utilities to Discuss Greater Energy Consumption

THE program of the electric, railway and gas associations of Illinois for the joint convention at the Hotel Sherman in Chicago on March 15 and 16 will include an investigation of the per capita consumption of central-station energy, methods of getting new business, the inductive-interference problem and the rural-lines problem.

Economics of Generation and Distribution from Operators' Viewpoint

PERFORMANCE tests of a 60,000-kw. turbo-generator, methods of securing the highest boiler-room economy, comparisons of energy-supply systems for auxiliaries, and benefits to be derived from four-wire, three-phase distribution were the subjects of a most interesting meeting held jointly in New York on Feb. 24 by the metropolitan section of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. More than 400 persons attended.

The turbine test data, which were presented by H. B. Reynolds, referred to the three-cylinder, 60,000-kw. unit of the Interborough Rapid Transit Company, New York. Operating under normal railway load fluctuations, the complete unit developed an economy of 11 lb. per kilowatt-hour. With the high-pressure element and one low-pressure unit in service, the lowest water rate was 11.25 lb. per kilowatt-hour.

Factors that have to be taken into consideration to operate a boiler room most economically and methods of applying them were discussed by I. E. Moultrop, Edison Electric Illuminating Company of Boston. With an irregular load, he pointed out, the most desirable rating at which to operate a boiler depends on amount of labor required, duration of peak, effect of forcing on maintenance, fuel consumption when forcing or banking and similar considerations.

Three methods of energy supply for station auxiliaries and their relative merits were discussed by H. C. Albrecht, Philadelphia Electric Company, namely (1) the main generating unit or main bus, (2) the house turbo-generator, and (3) a combination of the foregoing. Attention was also called to the increasing use of 2,300-volt motors where ratings of 50 hp. and more are required, the precautions necessary in protecting operators from electrical equipment, and methods of securing satisfactory speed control of alternating-current auxiliary drives.

In large plants the auxiliary service substation may be as large as or larger than any substation on the system and hence must be made just as reliable, if not more so, declared R. H. Tapscott, New York Edison Company. Francis Hodgkinson, Westinghouse Electric & Manufacturing Company, expressed the belief that selection of auxiliary drives offers the greatest opportunities for economy. Reliability is no longer an advantage peculiar to steam-operated equipment, he declared, and necessity of exhaust steam for feed-water heating is not so important with economizers. Even if feed-water must be heated, that is no reason why uneconomical auxiliary drives should be used, he contended. Mr. Hodgkinson expressed a preference for house-turbo-generator supply to auxiliaries, citing the advantages of the method used by the Duquesne Light Company for obtaining a heat balance.

Advantages of the three-phase, four-wire distribution system were outlined by Thomas Sproule, Public Service Electric Company, who announced that the entire New Jersey system is going to be converted from two-phase, four-wire to three-phase, four-wire. Among the advantages cited were increased carrying capacity, better voltage regulation, less line loss, and ability to serve a greater area economically.

Indiana Cities Take Merger Case to Courts

A SUIT to have declared null and void the order of the Indiana Public Service Commission approving the merger of seven Indiana light and power utilities into the Indiana Electric Corporation, authorizing the issuance of securities to finance the merger and denying a rehearing of its orders in the case was filed in the Marion Superior Court on Feb. 23 by attorneys for the cities of Indianapolis and Kokomo. A permanent injunction against the carrying out of any of the provisions of the various orders of the commission in this connection is asked.

The suit throws the entire merger case, which has been fought before the commission for nearly six months, into the courts for determination.

The suit asserts that the corporation is not a public utility, that the two corporations actually proposing to buy and consolidate the seven companies are the American Public Utilities Company and the Merchants' Public Utilities Company, neither being a party to the petitions before the commission. It is asserted that the capitalization of the corporation, as provided in the order of the commission, exceeds the sum of the capitalization of the corporations to be consolidated, which is contrary to law.

Many Utilities Engaged in Financing in February

STOCKS and bonds totaling $30,635,900 were offered investors by the electric light and power public utilities during the month of February. This figure, the smallest total recorded since October of last year, represents a decrease of more than $20,000,000 under that of January. February, 1921, also showed a decided drop from the total of the preceding month. The number of separate issues, however, was large. The average yield, 6.90, is slightly higher than that for January. The most prominent characteristic of the month's flotation is the decline in the interest rate. Four of the issues, for instance, paid only 5 per cent interest. Another interesting feature was the ten-point premium on the $1,800,000 8-per cent preferred-stock issue of the Consolidated Gas, Electric Light & Power Company of Baltimore. Long-term issues again predominate. The $5,760,000 issue of the Pennsylvania Power & Light Company constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Philadelphia Electric Co..	$4,000,000	.....	Cumulative preferred stock..		8	....	Par (25)
California-Oregon Power Co...	1,000,000	Twenty-year	First and refunding mortgage sinking-fund gold bonds, series B.	Extensions................	6	6.60	93½
Central Illinois Light Co..	2,750,000	Twenty-one year	First and refunding mortgage gold bonds.............	To retire bonds falling due and to reimburse company for expenditures made in improvements to property.	6	6.50	94½
Central Massachusetts Light & Power Co.	300,000	Five-year	Convertible bonds series C	To purchase notes issued and to be issued of the companies whose shares are owned	6	7.20	95
Consolidated Gas, Electric Light & Power Co. of Baltimore	1,800,000		Cumulative preferred stock, series A....		8	7.27	110
Defiance Gas & Electric Co	525,900	Twenty-year	First lien and refunding mortgage sinking-fund gold bonds, series A		7	7.25	97½
Ozark Power & Water Co. (Branson, Mo.)	2,000,000	Thirty-year	First mortgage sinking-fund gold bonds	....	5	7.20	73
Pennsylvania Power & Light Co..	5,760,000		Cumulative preferred stock	To reduce floating debt and for other corporate purposes...................	$7.00	7.29	(no 96 par)
Sierra & San Francisco Power Co	1,000,000	Twenty-seven year	First mortgage bonds	....	5	6.05	86
Southern Cities Utilities Co	200,000	Ten-year	Gold coupon notes	To purchase additional property and equipment......	8	8	108
Tri-City Railway & Light Co. (Davenport, Ia.	$[illegible],000,000	Eight-year	First and refunding mortgage gold bonds of 1910.	To retire underlying bonds and reimburse company for construction expenditures ..	5	6.25	92
American Public Service Co	1,000,000	Twenty-year	First lien gold bonds of 1912	Partially to reimburse company for expenditures made for improvements, betterments and extensions to property	6	7	8[illegible]
Denver Gas & Electric Light Co	[illegible],000,000	Twenty-nine year	First and refunding mortgage sinking fund gold bonds of 1911...	Refunding and other corporate purposes	5	6.10	8[illegible]
Eastern Shore Gas & Electric Co	450,000	Thirty-three year	Consolidated mortgage sinking-fund gold bonds, series A	Refunding, retiring debentures falling due and other corporate purposes	7	7.25	[illegible]
Ohio Public Service Co	4,000,000	Twenty-five year	First mortgage and refunding gold bonds, series B	Refunding and other corporate purposes	7	7	[illegible]
Virginia Western Power Co	850,000	Twenty-year	First and refunding mortgage gold bonds, series A	To retire notes and for extensions. .	7	7.25	[illegible]
Total...	$30,635,900						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Indiana Company Promises Reduced Rates if Allowed to Buy Its Energy.—The Interstate Public Service Company, which owns and operates an electric plant and a distribution system in Lebanon, Ind., has applied to the Public Service Commission for permission to discontinue this plant and to buy energy from the Terre Haute & Eastern Traction Company, which has a line running through Lebanon. The present primary rate of 12 cents a kilowatt-hour to Lebanon customers will be reduced to 10 cents, the company says, if the commission approves the agreement.

N. F. P. A. Men Ready for Suggestions.—In anticipation of next fall's meeting of the electrical committee of the National Fire Protection Association, comments or suggestions from interested individuals, firms or organizations concerning proposed changes in the so-called 660-watt rule, which limits the current load on the ultimate branch circuit, will be welcomed by either A. Penn Denton, chairman sub-committee on wiring systems and standards, Seventeenth and Oak Streets, Kansas City, Mo., or A. R. Small, chairman subcommittee on devices and materials, 207 East Ohio Street, Chicago.

Oklahoma Utility Improves Plant.—Improvements and additions to the Oklahoma City power plant of the Oklahoma Gas & Electric Company have increased the plant capacity 25 per cent. One new 850-hp. boiler with a superheater and auxiliaries has been installed, giving the plant a battery of ten boilers, which use in excess of 200,000 gal. of water per day. Superheaters have also been added to three boilers formerly in service. A new stack, 156 ft. high and 6 ft. 3 in. in diameter, is now complete. Twenty-seven circuits for the lighting of Oklahoma City now radiate from the Noble Street plant.

Beavers Cause Interruption to Service in Hood River District.—A colony of beavers on the east fork of the Hood River, recently felled a tree 18 in. in diameter that came down across a power line of the Pacific Power & Light Company and plunged the upper Hood River valley in darkness for hours. Repair crews have no little trouble repairing damage wrought by these persistent animals in this part of Oregon. A year ago they felled a tree in the same way, interrupting light and power service, and last summer one of their dams constructed below a county bridge across the east fork of Hood River backed water over approaches to the structure and had to be removed.

Pennsylvania Power & Light Company Takes Over Wilkes-Barre Company.—With the approval of the Pennsylvania Public Service Commission, all the property of the Wilkes-Barre Company has been leased by the Pennsylvania Power & Light Company and will be operated by the latter. It is understood that there will be no present change in the local management. A new transmission line from the Pennsylvania company's Hauto plant to Wilkes-Barre is being built and will be ready about June 1.

Growth of Electrical Engineering.—The rapid growth of electrical engineering in the United States is indicated by a few fragmentary items from the 1920 census which have been given out by the bureau. These show that Texas had 4,359 electrical engineers and electricians at the time the census was taken, as compared with 2,232 in 1910. Buffalo in 1920 had 2,420 electrical engineers and electricians. This compares with 1,347 in 1910. Oakland, Cal., had 1,257, an increase from 784. Pittsburgh had 2,186, comparing with 1,543 in 1910. Omaha had 719, as against 443. Providence had 590, which compares with 440. Delaware had 701. In 1910 the state had only 318.

Co-operative Agreement in Southern California.—In order to avoid further duplication of facilities the Pacific Gas & Electric Company and the Western States Gas & Electric Company have, subject to the approval of the commission, entered into an agreement for a division of territory in San Joaquin County, and each company has agreed to sell its transmission and distribution lines in the territory assigned to the other. The Western States Gas & Electric Company serves the city of Stockton, while both companies have been operating in the county outside of the city. The proposed division of territory is in the neighborhood of Lodi and Lathrop. The reproduction value of the properties for the Pacific company involved in the transaction is given as $170,504 and that of the Western company at $64,492.

Electrically Driven Ferryboats Are Planned for New York City.—Three new ferryboats are soon to be built by the municipal authorities of New York for use on the city's line to Staten Island. The boats will be coal burners with electric drive. In order to secure greater economy in operation than is possible with reciprocating engines, it has been decided to install a steam-turbine-driven generator supplying high-tension alternating current to a motor at each end of the boat, the latter being directly connected to the propeller shaft. It will thus be feasible, the city's Commissioner of Plant and Structures explains, to run the two propellers at different speeds, which, it is expected, will result in increased propulsive efficiency as compared with the present method of attaching both propellers to one through shaft and revolving them at the same speed.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

North Central Electric Association.—The annual convention of this geographic division of the N.E.L.A. has been set for June 13-15 at the St. Paul Hotel, St. Paul, Minn.

Southwestern Electrical and Gas Association. — The eighteenth annual meeting of this association will be held in San Antonio, Tex., on May 3-6, in connection with the meeting of the Southwestern Geographic Division of the N.E.L.A. Texas, Oklahoma, Arkansas and Mississippi will be represented.

Section Meetings of A. I. and S. E. E.—March meetings of the Association of Iron and Steel Electrical Engineers are scheduled as follows: Philadelphia, March 4, "Automatic and Remote-Controlled Substations," by R. Tencher, district manager Dwight P. Robinson & Company, Chicago; Cleveland, March 13, "Protective Relays for Generators and Transmission Lines," by L. N. Crichton, engineer supply engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Chicago, March 15, "Description of Plant of Acme Steel Goods Company," by J. H. Wagner, and "Description of New Merchant Mill of Interstate Iron & Steel Company," by H. E. Davis; Pittsburgh, March 18, "Synchronous Motors in Mines and Steel Mills"; Birmingham, March 25, "Lubrication of Mill Motors," by H. E. Harrell, assistant chief electrician Tennessee Coal, Iron & Railroad Company; Youngstown, March 25, "Bent-Tube Versus Straight-Tube Boilers."

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia, March 4; Cleveland, March 13, Chicago, March 15; Pittsburgh, March 18, Youngstown, March 25; Birmingham, March 25.

A. I. E. E. Section Meetings—New York, March 15; Pittsburgh, March 15; Schenectady, March 17.

American Physical Society—Washington, April 22.

Associated Manufacturers of Electrical Supplies—New York, March 13-17.

Oklahoma Utilities Association—Oklahoma City, March 14-16

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

A. S. M. E. Spring Meeting—Atlanta, April 8-11.

American Electrochemical Society—Baltimore, April 27-29.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Findings of Fact Made by Commission Not Conclusive Under Indiana Law.—The Supreme Court of Indiana, in Public Service Commission vs. Lake Erie & Western Railroad Company, has declared that, under the statutes of Indiana, findings of fact made by the commission are not conclusive in a superior court when an action is brought to set aside a commission order, since in that case the court tries the case de novo. (133 N. E. 492.)*

Assumption of Risk.—An experienced miner who had worked six months in a drift containing an unprotected electric trolley wire 5 ft. above the floor level and who knew of the existence and danger of the wire was held by the United States Circuit Court of Appeals in Utah (Bianco vs. Bingham Mines Company) to have assumed the risk, and a verdict awarding damages to the widow of a man killed under the circumstances indicated was reversed. (276 Fed. 513.)

Commission's Rates Are Prima Facie Lawful.—Sustaining the Public Service Commission of Montana in a suit brought against it by the Billings Utility Company, the Supreme Court of Montana declared that rates fixed by the commission in accordance with the law are prima facie lawful, can be attacked in court on the sole ground that they are unlawful or unreasonable, shall be deemed reasonable and just until final determination by the courts, and the burden of proof rests on the party antagonizing the order fixing the rates. (203 Pac. 366.)

Contributory Negligence for the Jury—The Supreme Court of North Carolina has held, in Snyder vs. Town of Ashboro, that there was no error in refusing to permit a witness to express his view of the necessity of the action of a head operative in a rolling mill who placed his hands underneath and upon rolls operated by electricity to discover why they were not working properly. The electrical energy to run this mill was furnished by the municipal plant, and the plaintiff recovered damages from the town on the ground that, after a suspension of service, the connections had been wrongly made by the town's workmen and that the machine therefore operated backward instead of forward and caused his injury. The question of contributory negligence was, the Supreme Court held, rightly left to the jury. (110 S. E. 84.)

What Constitutes a Public Utility?—Holding, in Celina vs. Union-Center Mutual Telephone Association, that a group of persons denominating themselves a partnership association but organized to conduct a local telephone exchange were carrying on a public utility, the Supreme Court of Ohio found that there was neither denial of property rights nor abridgment of privileges and immunities nor denial of the equal protection of the law in requiring such an association to obtain a certificate of convenience as a prerequisite to doing business. (133 N. E. 540.)

Electricity Personal Property.—Asserting that electricity is a product of manufacture and therefore personal property, the Supreme Court of Colorado, in Hetherington vs. Camp Bird Mining, Leasing & Power Company, sustained the lower court in finding that the plaintiff could not recover the price paid by the defendant for electricity generated on the plaintiff's property and sold to the defendant by the original owner of the property while said original owner was temporarily repossessed in the course of an unsuccessful attempt, supported by the defendant, to redeem the property, which had been sold to the plaintiff, as trustee, under foreclosure proceedings. (202 Pac. 1087.)

Commission May Compel Utility to Make Extensions.—Petitioned by the Bluefields Waterworks & Improvement Company to suspend a rate-making decision of the West Virginia Public Service Commission, the Supreme Court of Appeals of that state declared that the commission could lawfully require a public utility to make extensions and additions to its plant when they are necessary to enable it to serve the public as required by law or the provisions of its contract or franchise, and, further, that a public utility has no right to a rate sufficient to cover the cost of expenditures for extensions or additions to its plant in advance of the actual installation of such extensions or additions and their employment in the public service. (110 S. E. 205.)

Federal Income Tax Must Not Be Included in Operating Expenses.—The Georgia Railway & Power Company brought suit in the United States District Court at New Orleans against the Georgia Railroad Commission because of a reduction in gas rates ordered by the commission, and among the company's contentions was one for the right to include federal income taxes as part of operating expenses. The court not only ruled against the company, but censured it for bringing an action based in part on the claim that the income tax could properly be passed on to the consumer. In this case the Georgia Railroad Commission ordered a reduction in the gas rates charged by the company on the ground that readjustment conditions following the war were no longer prevailing. The company sought to retrieve an alleged loss of $1,000,000 sustained from 1917 to 1920.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Commission's Duty to Utilities.—In giving a rehearing to the Sault Ste. Marie Gas & Electric Company in the matter of its gas rates the Michigan Public Utilities Commission observed: "So far as the commission is concerned, it has a plain duty, under the law, to perform, of allowing rates which will produce sufficient revenue to pay all legitimate operating expenses, create a reserve to take care of depreciation, and allow a fair return upon a fair value of the property. . . . It is just as much the duty of this commission to see that a utility gets sufficient revenue to properly function and give service as it is to see that the utility does not get too high a rate of return."

Company-Wide Electric Rates.—The Commerce Commission of Illinois recently arrived at a decision on the reasonableness of an electric rate proposed for the village of Winslow by comparing it with the rates charged for the same class of service by the same company in other communities. "So far as possible," the commission asserted, "the rates of an electric utility furnishing service in a number of municipalities by transmission lines should be uniform throughout the territory served. Inasmuch as the village of Winslow is receiving service as a part of a relatively large electric system, a separate investigation of the results of service in Winslow, a comparatively small community, would serve no purpose."

Heating and Cooking Rates.—Dealing with an application from the village of Eagle River for an increase in the rates for energy for grills and radiators, the Wisconsin Railroad Commission said recently: "Flat rates in general are unsatisfactory and wasteful but are especially ill adapted to appliances of high wattages, such as electric grills and radiators, where the use will vary to a great extent among different consumers. The rates proposed by the applicant will result in an unusually high rate if the average use of the appliances is less than two hours per day and in an unusually low rate if they are used much over four hours a day. As the average use will probably be over three hours a day, we cannot hold that the proposed rate will be excessive for the average consumer. We shall therefore authorize the proposed rate, but would strongly recommend that the applicant file a schedule of meter rates and proceed to install meters for all customers where it is difficult to determine the amount of electrical energy that is being consumed."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Edward B. Meyer, formerly assistant chief engineer of the engineering department of the Public Service Electric Company, has been appointed chief engineer of the Public Service Production Company to engage in general engineering and construction work. Mr. Meyer is most widely known for the excellent contributions which he has made to the literature on transmission and distribution engineering as chairman of the A. I. E. E. transmission and distribution committee and of the N. E. L. A. underground systems committee. He is author of "Underground Transmission and Distribution," a book dealing with every phase of underground construction. In addition to his work in the field of transmission and distribution, Mr. Meyer has had extensive experience in every branch of central-station construction since he first became connected with the industry in 1903. He was responsible for the construction and in complete charge of the field forces during the erection of the Essex power station of the Public Service Electric Company, a job which set a speed record in power-plant building.

E. B. MEYER

During the war Mr. Meyer was a member of the committee formed to advise the government on the standardization of electrical equipment and supplies, particularly cable. He is at present vice-chairman of the American Engineering Standards sectional committee on insulated wires and cables and is a member of several of the sub-committees. Mr. Meyer was born in Newark, N. J., in 1882 and was graduated from Pratt Institute, Brooklyn, in 1903. Immediately upon graduation he entered the employ of the Public Service Electric Company and continued with that company until 1922. In 1906 he was made field engineer in charge of the installation of underground transmission and distribution systems, continuing in that capacity until 1909, when he was made assistant engineer in charge of the entire street department. In 1912 he was appointed assistant to the chief engineer in general charge of all construction work involving the installation of power plant, substation and outside plant facilities. Mr. Meyer retained that position until 1919, when he was appointed assistant chief engineer, a position which he occupied until Feb. 1, 1922, on which date he became chief engineer of the Public Service Production Company.

E. C. Headrick has been appointed chairman of the Denver Electrical Co-operative League, from which position T. O. Kennedy recently resigned. Mr. Headrick started his career in the electrical industry under the direct supervision of George Westinghouse. He was born at Johnstown, Pa., Feb. 22, 1869, and after being graduated from high school in that city went to Pittsburgh, where he entered the private laboratory carried on by Mr. Westinghouse for the conduct of his personal experiments. In 1900 Mr. Headrick was sent to France as a special representative of the Westinghouse company and after two years abroad returned to this country to accept a position as assistant shops superintendent in the power apparatus department of the Western Electric Company in Chicago. Later he returned to France to redesign the engines made by the Rateau Turbine Company in order to standardize production in this country. In 1909 he went to Denver and started a contractor-dealer business of his own, specializing in the handling of motors and heavy machine equipment. Mr. Headrick served as president of the Denver Association of Electrical Contractors and Dealers during the years 1919, 1920 and 1921. In that capacity he used every effort to bring about co-operation within the industry. He became vice-chairman of the Electrical Co-operative League when it was organized in June, 1921.

E. C. HEADRICK

Charles W. Spooner, a Grand Rapids consulting engineer, has organized with Robert H. Merrill the firm of Spooner & Merrill, consulting engineers. After graduation from the University of Michigan's course in civil engineering Mr. Spooner's preliminary practical training was obtained in surveying, drafting and computing work throughout the Western States. In 1906 he became associated with Gardner S. Williams at Ann Arbor, Mich., in the design of water-power developments and hydro-electric power plants and in general hydraulic investigations. As a result of this work Mr. Spooner became associated at Ann Arbor with a new branch of engineering, the appraisal and valuation of public utilities, begun by Dean M. E. Cooley and Professors Riggs and Anderson. From 1911 to 1916 he assisted in the valuation of the Edison Sault Electric Company of Duluth, the Grand Rapids Railway Company, the Toledo & Indiana Railway Company and many other companies. In 1916 Mr. Spooner began independent practice, and his valuation work has included the La Crosse Gas & Electric Company, the Arkansas Valley Railway, Light & Power Company, the 1919 rate cases for the Wisconsin-Minnesota Light & Power Company and the rate cases of 1920 affecting the Eastern Wisconsin Electric Company gas and electric properties.

C. W. SPOONER

J. C. Thompson, formerly division manager of the California-Oregon Power Company at Klamath Falls, Ore., has been made assistant treasurer.

Judds J. Brooks, Jr., formerly general manager of sales, Harbison-Walker Refractories Company, Pittsburgh, has been appointed assistant to the president.

H. A. Kimber, formerly of the Quigley Furnace Specialties Company, is now in charge of the Quigley pulverized-fuel department of the Hardinge Company, 120 Broadway, New York, the latter organization having absorbed the Quigley company's pulverized-fuel department recently.

Frank Venable, assistant manager of the Montana Electric Company, Butte, has been appointed to a special committee of the Associated Industries of Montana, which has been charged with the work of extending the scope of the association until it fulfills the duties of a state-wide chamber of commerce.

Leonard Kebler, president of the Ward Leonard Electric Company, Mount Vernon, N. Y., sailed from New York Feb. 18 for a three months' combined business and pleasure trip through the Riviera, Egypt, Italy, France, Switzerland and England. He will be accompanied by Mrs. Kebler.

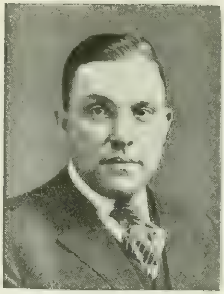
C. E. Ingalls has resigned as San Francisco district manager for the Crocker-Wheeler Company and will shortly enter the field as a manufacturer's representative with offices in the Rialto Building, San Francisco. Arthur Purdon has been appointed to the district managership to fill the vacancy caused by Mr. Ingalls' resignation.

Burton Y. Gibson, a pioneer in the electric cooking and heating industry on the Pacific Coast, has been appointed factory representative on that coast and in the Hawaiian Islands for the Walker & Pratt Manufacturing Company, Boston. Mr. Gibson has spent the past fifteen years in the electrical business, during ten of which he has specialized on electrical heating and cooking problems. He was with the Edison Electric Appliance Company for six years. He will have his headquarters in San Francisco.

B. Y. GIBSON

F. O. Hoyt, formerly on the staff of the New York sales department of the Standard Underground Cable Company, has been appointed manager of the Philadelphia sales department, having charge of the eastern Pennsylvania, southern New Jersey and Delaware territories.

A. E. Hitchner, assistant to the manager of the industrial department of the Westinghouse Electric & Manufacturing Company, until further notice will have general charge of those sections of the company organization formerly handled by W. H. Patterson, who recently resigned as assistant to the manager of the industrial department to accept the position of vice-president of the Kaestner & Hecht Company, Chicago.



A. E. HITCHNER

G. I. Kinney, San Francisco manager for the International General Electric Company, has been elected to the directorship of the Foreign Trade Club of San Francisco, as the result of his activities in the promulgation of foreign trade out of San Francisco.

Edward H. Eardley, who was recently elected president of the Contractor-Dealers' Association of Salt Lake City, is one of the pioneers in the electrical industry in that city, his first connection with the business world having been as an office boy with the Holding Electric Company. He established a contractor-dealer business of his own in 1906, and this has grown until at the present time the Eardley Electric Company is one of the most active and progressive firms of its kind in Salt Lake City. He has been actively connected with the Contractor-Dealers' Association for the past twelve years and has served as secretary of that organization for five years. He was one of the first to lend his influence to the co-operative idea in that territory and was one of the founders of the Rocky Mountain Electrical Co-operative League. He has recently been elected to the executive committee of the National Association of Contractor-Dealers.

W. M. Vernor, formerly with the Westinghouse Electric & Manufacturing Company at New York, has resigned to take up work as an electrical engineer and salesman with the Catton-Neill Engineering & Machinery Company, Manila, P. I.

Obituary

Albert G. Whitney, president of the St. Cloud (Minn.) Public Service Company, died on Feb. 2. Mr. Whitney was one of the pioneers in the building of high-voltage lines in Minnesota. He came to St. Cloud in 1887 and took over the central station of that city and by hard work built it up to a large company serving about fifty cities.

Sir Francis Barker, a director of Vickers, Ltd., London, Eng., died the first week in February at his home in London, at the age of fifty-six. Sir Francis was an important factor in the organization of the foreign development of the Parsons turbine and was instrumental in establishing works for this business in the principal countries of Europe. He was chairman of the executive council of the Russo-British Chamber of Commerce.

William J. Canning, assistant secretary of the Edison Electric Appliance Company, Chicago, Ill., died at his home in Brooklyn, N. Y., on Feb. 13. Mr. Canning had been with the General Electric Company and the Edison Electric Appliance Company for many years, having started in as an office boy with the former company in 1888. Later he entered sales work and in 1895 was transferred to the Philadelphia office in that capacity. Three years later he was appointed to a position of special service to the sales executives of the company. From 1904 to 1912 he served as a district heating salesman in the New York territory. Since 1913 he had been engaged as assistant to A. K. Baylor.

W. J. CANNING

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Strenuous Efforts to Liquidate Old Accounts

A CAMPAIGN has been opened by various industries, it has been learned, among them particularly those selling to the smaller retailer, to clean up past-due accounts. To some extent this policy is being applied to the electrical industry, though so far it has not been as noticeable as in several others. The plan being followed is to send out collection men, whose road expenses are paid and who receive 5 per cent of all collections. Oftentimes, according to an authority on collections, this method brings good results in the case of the small dealer, who pays little attention to a letter, but will settle up a bill if approached personally.

February saw a considerable increase in the number of accounts posted with an electrical credit organization, while on the other hand settlements decreased fully as much. Many of the accounts posted were for small sums, but in the aggregate totaled enough to present a serious problem to the smaller manufacturers and jobbers. It was pointed out that in these days of keen price competition both classes are doing business on a small margin of profit, and losses through bad accounts cannot be charged off as easily as they could formerly.

During the past four or five months credit managers of electrical houses have been more chary than ever before in extending credits, and for that reason losses on recent accounts have been kept down to a fairly satisfactory minimum. Still, it is difficult to refuse to sell to a contractor who has a contract to fill, though in many cases the contractor is kept waiting for his money and so the jobber in turn must wait. These latter accounts are not classed as bad, but the method creates a situation of strained credit throughout the whole industry.

Detailed Figures for Electrical Exports During 1921

EXPORTS of electrical goods from the United States during 1921 are shown in detail in the table presented on the opposite page. The table was compiled by the ELECTRICAL WORLD from data obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. The total amount of electrical goods purchased from American manufacturers by each country purchasing more than $50,000 worth is shown, with a further subdivision into kinds of product. The table also gives the total amount of each item sold to all countries. Forty countries are grouped under the heading "all others," having taken individually less than $50,000 worth.

Two items, arc lamps and electric locomotives, have been omitted from the table on account of the comparatively small number of individual sales. The most important purchasers of arc lamps were Canada, which bought $7,922 worth; Mexico, $2,329; Bolivia, $1,402, and Japan, $1,228. Sales of electric locomotives included the following large ones: Brazil, $1,664,181; British India, $151,418; Japan, $69,960; Chile, $55,376; British South Africa, $49,202; Panama, $46,708; England, $25,334; Canada, $22,219. These figures have been included in the totals.

Canada proved the best customer of the United States, taking a total of $11,812,901 worth of all kinds of apparatus and appliances. As a whole, England and the British possessions took approximately 30 per cent of all electrical goods exported during 1921. The amounts were: England, $4,258,216; Scotland, $182,085; Ireland, $30,450; Newfoundland, $257,887; Jamaica, $238,920; other British West Indies, $192,088; British Guiana, $70,888; British India, $3,394,616; Australia, $7,433,441; New Zealand, $1,928,339; British South Africa, $2,349,047. The South American countries proved good buyers also, the largest being Brazil, with a total of $6,739,622, while Argentina imported $3,903,905 worth. Cuba took $5,751,846 worth. Japan, with a total of $9,631,086, was topped only by Canada. The total for China was $4,085,566, and Mexico bought $5,776,972 worth.

Electrical Manufacturers' 1919 Taxes Amount to $19,306,429

COMPANIES engaged in the manufacture of general electric machinery, stationary and marine engines and refrigerating machinery paid taxes totaling $19,306,429 in 1919, according to a compilation just completed by the Bureau of Internal Revenue. The number of companies making returns was 343. Of these 333 companies had net incomes aggregating $66,930,812. Ten of the companies reported no net incomes. Their deficits totaled $316,514.

In connection with the taxes on electrical goods, Treasury Department Regulations 47, recently revised and relating to excise taxes on sales by manufacturers, has just been issued. Article 34 of the regulations defines what is meant by portable lighting fixtures. All lighting devices adapted for interior illumination and not designed to be fixed permanently in one location and all articles commonly known as such, irrespective of the principle of illumination used, are included in this classification.

Metal Market Situation

AT LEAST one large selling agency was reported earlier this week as offering copper at 12¾ cents per pound for March and April deliveries, but some consumers have stated that they are unable to secure any of the metal under 12¾ cents. Nominal quotations at the time were maintained at 13 cents, with no orders and very few inquiries reported. Exports for the month have been slightly over 40,000,000 lb. A sale of 2,000 tons to a French consumer at the beginning of the week was reported, but confirmation could not be obtained. In spite of the continued lack of buying an improved undertone is apparent. There is less copper in possession of second-hands, and standard copper at London has been more active the past few days.

Current output of Lake copper is averaging about 8,500,000 lb. a month, and upon the resumption of the Calumet & Hecla properties this will run about 11,500,000 lb.

NEW YORK METAL MARKET PRICES

	Feb. 21, 1922	Feb. 28, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	58 0 0	58 15 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00
Electrolytic	12.75	12.75
Casting	12.50	12.50
Wire, base	14.25–14.50	14.00–14.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.35	4.25
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.87½	4.90
Tin, straits	29.25	30.00
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	Feb. 21, 1922	Feb. 28, 1922
Heavy copper and wire	10.00–11.00	10.50–11.25
Brass, heavy	4.75–5.00	4.75–5.00
Brass, light	4.25–4.50	4.25–4.50
Lead, heavy	3.50–3.75	3.50–3.75
Zinc, old scrap	2.00–2.12½	2.25–2.50

Exports of Electrical Goods from the United States During 1921 by Countries and Items

	Batteries	Carbons	Dynamos and Generators	Fans	Heating and Cooking Apparatus	Insulated Wire and Cables	Interior Wiring and Supplies	Lamps		Magnetos and Spark Plugs	Meters and Measuring Instruments	Motors	Rheostats and Controllers	Switches	Telegraph Apparatus	Telephones	Transformers	All Others	Total per Country
								Carbon-Filament	Metal-Filament										
Belgium	24,921	272	103,627	572	1,695	41,482	7,551	531	58,589	6,515	45,977	444,271	46,634	427,791	108	179,435	53,583	684,945	2,128,[illegible]
Denmark	45,199	. .	11,053	80	210	23,036	1,220	.	2,219	17,293	9,750	9,899	76	1,864	1,351	7,548	812	42,527	174,137
Finland	8,274	.	13,984		.	2,630	490	.	1,033	2,548	1,384	13,572	......	218		1,465		25,688	71,286
France	26,042	390	215,096	240	4,507	134,416	12,124	2,562	41,459	61,288	13,608	525,361	3,165	69,407	9,723	95,118	642,888	1,159,579	3,016,973
Germany	. .	3,000	634	27	1,737	1,326	139	......	741	225	682	7,683	....	53	.....	85	4,445	28,607	49,514
Greece	1,887	. . .	13,919	30	1,930	4,336	4,892	......	3,605	414	638	2,251	2,305	14,412	....	138	300	43,099	94,1[illegible]
Italy	243	138	133,772	374	3,721	107,670	2,898	......	4,772	2,108	16,239	83,885	20,325	68,180	......	15,682	346,836	887,5[illegible]	1,691,[illegible]
Holland	47,490	.	12,030	177	13,817	154,969	5,360	.....	600	13,431	25,652	52,015	3,583	39,722	19,401	159,773	2,071	190,890	740,[illegible]
Norway	20,935	122	17,236	1,492	15,899	27,913	2,978	15	3,927	5,632	5,540	13,377	972	5,095	95	78,732	151,529	323,911	[illegible]
Poland	. . .		76,500	......	....	267,603	....	....	13,750	2,020	. . . .	5,411	. ....		....			12,384	377,4[illegible]
Portugal	7,159		350	....	42	9,574	1,765	.....	2,801	736	50	904	.....	6,106	.....	8,556	16,564	41,005	95,612
Rumania	117		450	....	419	984	2,598	. . .	3,630	489	2,215	44,736	1,765	2,176	. . .	2,755	1,229	9,2[illegible]	72,[illegible]
Spain	76,180	782	337,257	48,182	28,771	75,463	7,004	1,068	49,210	31,972	70,440	391,115	59,240	75,731	4,149	45,662	449,561	1,034,1[illegible]	2,7[illegible]
Sweden	8,389	4,216	1,113	. . .	1,369	2,342,710	1,361	.	5,976	9,156	6,670	40,763	440	817	440,687	248,610	38,214	512,5[illegible]	3,66[illegible]
Switzerland	2,848		1,726	676	4,731	37,956	5,881	.	. .	658	1,091	33,989	26	33,689		113,495	189	200,698	43[illegible]
England	283,628	57,490	113,897	24,499	149,377	233,598	76,376	32,734	27,802	68,001	242,606	600,594	17,851	267,850	62,587	356,287	64,284	1,853,431	4,258,216
Scotland	1,185	511	5,503	303	22,437	40,412	2,391		29	1,786	9,512	54,728	3,217	39	5,580	1,584		32,[illegible]	[illegible]
Bermuda	2,939		. .	713	1,798	6,125	10,207	159	4,021	507	4,100	8,739		1,342	916	4,080	5,471	21,584	70,[illegible]
Canada	1,202,558	234,008	671,671	121,639	254,746	196,795	348,377	10,880	171,124	366,619	310,430	1,443,197	100,325	629,958	71,209	639,627	265,205	4,744,392	11,812,[illegible]
Costa Rica	4,539	1,711	4,108	88	7,435	17,045	5,848	330	6,975	6,975	234	17,178	456	3,254	1,621	6,606	7,196	39,832	135,324
Guatemala	10,444	9,635	9,342	201	4,603	16,053	16,895	693	44,518	951	1,859	15,504	236	5,951	484	5,638	20,183	33,560	192,750
Honduras	15,945	162	13,078	1,314	2,088	17,624	10,939	42	13,884	3,482	4,430	14,331	316	5,671	45	7,804	16,664	54,723	182,542
Nicaragua	6,293	216	5,730	270	247	6,638	8,023	194	6,794	905	775	4,343	770	3,405	1,532	2,668	6,296	32,248	87,5[illegible]
Panama	40,692	1,446	8,993	11,576	28,305	78,541	24,418	8,976	176,435	11,812	10,588	108,706	3,926	14,594	15,368	12,874	42,177	201,236	847,371
Salvador	5,198	119	14,741	614	2,917	11,797	5,298	1,006	22,092	987	903	15,763	437	2,306	87	2,392	10,188	19,690	116,535
Mexico	324,799	20,491	481,242	69,466	195,371	655,084	230,349	18,884	456,543	59,658	195,468	872,242	18,575	204,209	29,792	126,575	496,613	1,407,002	5,776,972
Newfoundland	34,014	432	12,101	142	5,084	23,629	6,477	55	22,086	4,258	9,902	20,821	4,892	12,693	12,115	27,661	21,929	39,596	257,887
Jamaica	20,326	.	20,297	4,452	1,475	22,006	5,703	2,023	12,445	3,034	11,870	21,336	3,469	5,718	2,118	14,488	6,736	80,727	238,420
Trinidad	11,773	674	15,207	2,046	2,537	29,680	11,004	544	11,097	3,500	5,498	10,149	2,804	9,395	288	6,733	3,507	46,057	162,493
Other British W. I.	7,940	.	55,411	123	82	29,441	5,031	70	2,080	709	1,232	4,612	679	3,412	5,759	4,010	14,981	56,516	192,088
Cuba	159,680	9,552	776,472	150,112	64,788	780,846	305,125	3,114	290,423	60,959	183,880	537,779	74,867	248,192	21,203	341,613	237,304	1,545,687	5,751,846
Haiti	3,987	105	16,961	2,350	316	1,768	964	. .	903	674	208	3,623	57	535	. .	1,087	560	17,943	52,041
Dominican Rep.	12,349	8	69,324	469	1,265	61,850	17,459	255	9,609	4,515	13,002	32,596	2,735	11,328	13,553	9,960	10,718	118,494	389,489
Argentina	294,176	8,028	163,156	89,552	181,401	278,157	116,314	3,001	392,497	145,959	73,983	902,520	30,834	112,051	12,891	130,842	63,110	902,717	3,90[illegible]
Bolivia	4,738	35	42,979		525	52,815	2,493		6,753	96	1,562	50,747	698	1,275	8,314	5,285	50,025	49,689	279,351
Brazil	65,861	8,055	413,435	23,492	103,694	669,742	110,044	10,984	301,860	34,296	106,403	582,697	76,548	142,261	10,036	301,230	628,185	1,485,648	6,739,622
Chile	98,217	67,399	88,266	3,898	10,353	243,114	41,653	2,507	74,740	70,863	27,836	250,003	12,964	97,367	14,682	26,573	321,194	557,817	2,064,821
Colombia	34,016	861	43,772	10,914	5,651	105,582	33,186	343	48,280	5,189	11,692	114,339	2,986	8,557	12,202	115,056	40,412	196,313	689,351
Ecuador	3,299	156	5,071	132	1,256	7,613	5,905	546	5,370	803	1,240	7,207	118	3,010	....	2,244	6,418	23,591	74,179
British Guiana	6,815	257	298	79	199	6,814	4,076	84	5,800	2,085	3,296	3,589	148	795	25	1,218	35,340	.	70,888
French Guiana		....	19,107	.....	. . .	1,912	. . .		441	257	.....	941	.....	6,283	7,124	1,622	270	12,810	50,767
Peru	24,430	617	96,183	2,995	20,985	111,610	44,783	5,429	106,239	10,193	6,102	225,156	8,746	48,578	3,104	46,552	150,392	571,806	1,501,960
Uruguay	22,603	159	3,610	9,486	43,750	68,589	26,994	2,087	67,110	19,395	8,298	52,170	1,974	19,105	423	9,573	2,735	91,817	449,878
Venezuela	34,839	1,991	37,294	4,999	2,349	37,611	13,842	1,731	38,709	7,841	4,313	62,053	4,195	9,898	73,524	23,507	30,778	120,738	510,217
China	65,541	2,103	552,980	110,460	33,462	139,694	60,604	3,492	50,517	17,336	127,996	735,897	8,742	386,235	2,404	120,591	711,740	944,873	4,086,566
Kwantung	1,204	....	3,529	....	9,222	6,983	.		....	5	4,159	15,571	2,402	4,450		10,109	819	21,671	80,284
British India	83,513	280	376,651	83,373	14,709	286,292	22,154	1,535	24,819	39,995	20,951	898,375	35,872	79,979	27	120,252	251,356	903,055	3,394,616
Straits Settlements	13,247	.....	23,004	8,562	4,545	2,936	7,119	28	6,567	12,043	345	16,580	1,165	575	1,500	96	5,450	36,454	140,215
Dutch East Indies	54,615	1,157	132,647	3,330	7,082	121,919	21,487	125	40,869	18,586	21,837	154,180	36,317	118,849	7,547	209,938	103,121	321,279	1,274,885
Hongkong	11,732	262	11,916	30,705	2,598	2,596	17,306		9,064	3,523	33,993	50,385	409	3,246	6,914	5,079	25,615	48,787	264,130
Japan	71,652	52,782	1,755,041	16,100	91,337	109,571	35,863	10	607	49,805	536,769	1,554,504	235,659	328,385	59,523	233,289	1,082,485	3,346,526	9,631,086
Siam	6,071	.	1,274	5,163	5,212	860	6,139	.	1,661	4,121	3,521	21,324	272	2,271	50	3,119	26,177	15,816	103,051
Australia	185,156	2,539	327,449	21,480	110,336	156,086	121,415	1,485	265,779	77,446	306,275	2,373,722	135,156	242,458	24,785	682,908	908,813	1,495,153	7,433,441
New Zealand	171,928	58	123,698	930	59,986	162,983	29,838	760	62,006	20,623	81,494	329,454	17,481	34,454	4,586	149,627	264,272	412,335	1,928,339
Philippine Islands	106,075	2,573	101,990	32,827	15,486	175,235	37,461	5,497	54,179	34,685	53,461	231,558	8,862	89,880	19,134	104,730	51,040	399,887	1,324,560
British South Africa	96,504	945	302,755	4,998	80,785	83,200	12,165	557	70,162	23,410	57,862	719,465	41,075	73,382	3,451	8,455	201,280	519,394	2,349,047
Egypt	2,338	4,134	3,291	1,353	2,367	1,683	6,470	. . .	6,208	2,287	5,871	13,941	9,982	3,038	. . .	57	. .	23,779	86,3[illegible]
All other	61,494	346	15,253	16,934	8,032	19,889	22,676	668	22,771	19,142	10,042	52,068	2,579	3,778	23,706	19,260	14,195	163,580	476,478
Total per item	3,831,738	433,869	7,942,473	1,270,253	1,637,450	8,573,820	1,848,793	125,045	3,148,635	1,313,614	2,726,448	15,444,564	1,044,393	4,033,299	1,010,891	4,797,923	7,988,440	28,628,982	95,814,885

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WHAT little tendency the market has shown during the past week has been toward further small downward readjustments. There are few of any consequence, and the impression is given that jobbers and manufacturers are getting their prices down as low as possible with the hope of starting a healthy buying movement. The drops in jobbers' quotations reported from various cities include reductions of 20 per cent on sewing machines, 10 per cent on boxes and several other items of wiring material, 7½ per cent to 15 per cent on motors, 5 per cent on pole-line hardware, and weaker quotations on porcelain, rubber-covered wire and flexible armored conductor.

Several large building projects, among them a hotel and an office building, have been proposed in Boston, and residence construction there continues very good. New England business is reported to have been somewhat disturbed by the textile strike. Cotton has had a remarkable rise in the last two weeks, and the territory around Atlanta is optimistic once more.

NEW YORK

The moderate increase in the demand for wiring supplies from the suburban sections continued during the past week. Jobbers feel that this is the forerunner of renewed buying activity, particularly as many of the orders are for larger quantities than heretofore. Of course, most of this business now is the result of work under way on small residential jobs, but it is an encouraging sign. The demand from industrial sources for electrical supplies is still spasmodic and uncertain, so that there is little definite trend to this class of business.

A few changes in prices of standard materials have been made. Quotations on rubber-covered wire and flexible armored conductor are somewhat softer without any definite changes being reported. Two manufacturers have dropped their prices on flush receptacles and plug cut-outs, and an additional 5 per cent discount is allowed on gang boxes. Jobbers' stocks generally are in very good shape.

Rigid Conduit.—Demand and prices for this material remain at the same levels as last week. Jobbers' stocks are fair to good, with quotations as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in., $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft.

Flexible Armored Conductor.—Apparently in sympathy with the wire market, armored conductor shows a tendency toward easier prices. Quotations on No. 14, two-wire, single strip, however, remain at $43 to $45 per 1,000 ft., and double-strip is $45 to $47 per 1,000 ft. in that quantity. It is rumored that in some quarters these prices have been shaded. Jobbers' stocks are good and manufacturers are making prompt deliveries.

Flush Receptacles.—Revision of prices by manufacturers has caused a drop of between 30 and 35 per cent in the price of single and duplex flush receptacles. Single receptacles, which formerly were quoted at 40 cents each in lots of 100, now sell for 25 cents each in that quantity. Duplex receptacles, which were 55 cents, are now quoted at 38 cents apiece in lots of 100.

Gang Boxes.—The discount on black enameled gang boxes in standard-package lots has been increased from 50 to 55 per cent, a decrease of 10 per cent in price.

Plug Cut-outs.—Prices on plug cut-outs have been dropped about 20 per cent by an increase in discount from 50 to 60 per cent.

Porcelain.—The interest in radio equipment has slightly increased the demand for this material, which is never very active in this section. "Nail-it" knobs are quoted at $16.80 per 1,000 in barrel lots and 5/16-in. x 3-in. tubes at $6.90 per 1,000 in the same quantity.

Tape.—Demand is in line with that for other wiring supplies. Both friction and rubber tape is quoted at 36 cents a pound in 100-lb. lots.

Radio.—Jobbers continue to be flooded with requests for radio apparatus, with little possibility at present of obtaining any stock of either complete sets or separate parts. Dealers report a keen demand from customers for radiophone outfits and equipment, and many purchasers appear willing to buy almost any kind of apparatus that can be utilized. It seems possible that under present conditions much equipment of inferior quality may find its way into the hands of the public.

CHICAGO

Electrical business the past week has progressed fairly well. The only price changes were a reduction on rubber-covered wire and conduit. The market situation on wiring materials is spotty and reports from dealers are varied. As a whole this line is selling in fair amounts. Several good orders for high-tension equipment have been filled. The motor line is still marking time, although an increasing activity has been noticed. Radio apparatus continues to be the best moving material.

Wire.—In almost all cases jobbers have reduced the price of No. 14 rubber-covered wire so that it is now available in 5,000-ft. lots at $6.40 to $6.50 per 1,000 ft. It is moving fairly well and dealers' stocks are ample. Weatherproof sells for 16½ cents per pound in 1,000-lb. lots and the demand has been steady. The bare-wire base is about the same, and owing to the impetus of the demand for radio this line is moving very well. Stocks are not large.

Flexible Armored Conductor.—This is selling in small lots and the No. 14 double-wire, single-strip, is quoted at $43 per 1,000 ft. in 5,000-ft. lots. The double-wire, double-strip, sells for $45 per 1,000 ft. in the same quantity.

Rigid Conduit.—A price reduction has been noted on conduit, the ½-in. black pipe now selling for $42.50 per 1,000 ft. in 5,000-ft. lots. The movement has been steady, and stocks are in most cases large enough to supply any need.

High-Tension Equipment.—An order for 66,000-volt outdoor disconnecting switches and choke coils for a Middle Western utility was reported by one company. This manufacturer also shipped some 110,000-volt, three-phase air-break switches to a Scandinavian company. Another company has filled a large order for a complete distribution system in Australia. Series street-lighting equipment has been purchased by three Middle West cities. Equipment for a 45,000-volt outdoor substation in Kansas was reported by another company.

Dry Cells.—Movement has been satisfactory at $30.65 per barrel lots. Stocks are ample.

Lamps.—The mill-type lamp is selling well, while the larger sizes are also moving steadily. The mainstay of the lamp business has been the sale of lamps for home lighting, since most of the industrial plants have not been in the market.

Radio.—The sale of this apparatus is still as heavy as at any time in the last two months. The one objection is that the stocks on hand are low. Manufacturers, however, are constantly increasing their production.

Power Transformers.—Activity has been restricted to the replacement of obsolete equipment, few orders for new distribution transformers having been recorded. Dealers feel that business will pick up when the spring construction of new lines starts. Stocks are ample.

BOSTON

Business shows further tendencies toward improvement, notwithstanding the adverse effects of widespread textile strikes in New England. Rapid gains in the volume of trade are not in evidence, and individual manufacturers and jobbers vary greatly in their reports of conditions. Building and engineering contracts for the week ended Feb. 20 totaled $1,439,300 compared with $2,796,300 a year ago, but within a few weeks this industry is expected to improve substantially. New car repair shops, to cost about $4,000,000, are scheduled for construction this spring by the Boston Elevated Railway, and plans are being made for a very large office building structure to cost about $5,000,000 in the Park Square district. Curtailment of production in textiles due to labor troubles has begun to affect the sale of electrical material somewhat. Price readjustments continue to be announced every few days in electrical material, but no decided change either way is general. The jobbers are buying carefully and retailers are paying closer attention to good merchandising, working hard for sharply competitive business.

Lamps.—Lamp sales in general declined somewhat last week, owing to withdrawal of textile-mill buying. One distributer, however, reports a slightly larger sales volume for January and February than last year. Sign lighting is sluggish. Lamp prices are steady.

Radio Apparatus.—Demand for wireless telephone equipment grows like a rolling snowball. A representative manufacturer reported last week that deliveries are now quoted in midsummer. Increased broadcasting facilities and newspaper publicity are stimulating an extraordinarily brisk trade.

Electric Ranges.—An improvement in production is expected soon, in view of the activity of central-station commercial departments in planning campaigns for the coming warm season. Immediate business is rather quiet, but everything is in readiness for larger outputs.

Pole-Line Hardware.—Sales are increasing slightly and inquiries are more active. Prices are firm.

Wire.—Moderate demand features the market. Rubber-covered wire in the No. 14 size is selling at $7.25 per 1,000 ft. in 1,000-ft. lots, and at $6.75 in 5,000-ft. consignments. Little bare wire is moving, the base being 15 cents this week. Weatherproof base is 15½ cents, with only scattering demands. Stocks are easily meeting requirements.

Dry Cells.—A good demand is reported, with firm prices and excellent deliveries. Hardware stores are absorbing substantial quantities of cells for flashlamp renewals. In barrel lots, No. 6 cells move at $30.35 per 100, the igniters quoting $31.35.

Alkaline Batteries.—Business is quiet, but increasing interest in electric delivery outfits for laundry work is apparent. Prices are steady, barring a recent reduction in the price of electrolyte from 12 to 10 cents per pound.

Appliances.—Lamp-socket devices are moving slowly in comparison with the volumes handled by jobbers and retailers a few weeks ago, but a fair business rewards energetic solicitation. Vacuum cleaners are picking up somewhat, flatirons are not selling badly, and hollow ware is going to the public acceptably. Little is heard about prices as affecting the sale of the lighter appliances.

ATLANTA

A slight betterment in general conditions is in evidence this week, due probably to more pleasant weather conditions and the ability of the rural population to see an opportunity for some out-of-door activity. The hardware stores, as a result, are reporting some increases in the sale of agricultural necessities and a very satisfactory turnover in building hardware. Building permits in the larger centers continue to show very healthy activity. The spectacular increase in the value of cotton during the past few days will lend a healthy tone throughout the rural sections and will be reflected in the liquidation of old accounts and, at the same time, stimulate purchases, the rise having amounted to about $13.20 a bale from the low level of last month. As yet, however, little or no marked change in the activity of the electrical jobbing lines is reported, the movement of seasonal specialties apparently being held up by the combination of short funds and the inclement weather that has existed up to the past week.

Wire.—A price reduction from a 17-cent to a 16¼-cent base on weatherproof was announced recently. Popular sizes of both weatherproof and rubber-covered are moving fairly well, but there is a slowness noted in the larger sizes.

Sewing Machines.—While some movement is to be noted, the trade is not responding to the efforts of the jobbers as well as might be desired. A price reduction of 20 per cent is assisting somewhat in the movement, though stocks continue to be good to heavy.

Meters.—A steady demand is reported, particularly in the 5-amp. and 10-amp. two-wire and three-wire types, the two-wire type in the 5-amp. size being the most in demand. Stocks are reported in good shape.

Fans.—While jobbers have closed contracts for very fair quantities, they have not yet begun to ship to the retail trade. Prospects are good for the coming season, especially in view of a price reduction of approximately 10 per cent, and satisfactory contracts are expected to materialize.

Armored Conductor.—Residential construction and wiring of old houses is creating a ready market for the popular sizes, the two-wire, No. 14 single-strip type leading the field. Prices have stabilized and stocks are reported in good shape.

Flexible Non-Metallic Conduit.—Only a fair amount of orders is reported for this material, the market not having entirely recovered from the heavy stocking of a few months ago. Prices are steady with good stocks on hand.

Lamps.—The last season has been quite satisfactory, though the failure of some of the large industrial plants to make their normal purchases has held the demand below that anticipated. All of the smaller size lamps up to 100-watt are active, with the 40-watt most in demand, while the 100-watt and 250-watt, type C lamps continue very popular.

Washing Machines.—It seems almost impossible to reawaken activity in this line, very few retail sales being in evidence. Sharp price reductions are going to be necessary to move the heavy stocks in the territory.

Outlet Boxes.—A price reduction of 10 per cent became effective on Feb. 20, with sales reported as fairly good. Local stocks are in good condition.

ST. LOUIS

Price recessions made last week tended to break the monotony existing in the jobbing field here, lower prices being announced on motors, outlet boxes, weatherproof wire and pole-line hardware, with a noticeable wavering in porcelain prices. Volume of business continues on about the same basis, but the business obtained last week caused some to feel that an early improvement is coming. Inquiries for wiring materials are more numerous and for larger amounts. Residential construction work is opening up in an encouraging manner, and the industrial field shows some improvement. It also appears that there will soon be an improvement in the amount of distribution-system extensions in the small towns. The volume of such work in St. Louis has been good for some time and now is showing further improvement.

Radio equipment has increased enormously in demand since broadcasting was recently put into effect in St. Louis, and the usual difficulties are found in obtaining deliveries. As a result of this new field those handling radio equipment are enjoying a business with its profits which others are unfortunately lacking.

Motors.—Revised prices are out, giving reductions varying from about 7½ per cent to 15 per cent. The principal demand is for sizes up to 25 hp., this demand having improved somewhat in the last few weeks. Most of the sales were for out-of-town plants. Fractional-horsepower motors are also reported to be selling better. Local stocks are in good shape in all sizes up to 150 hp., and early delivery can be given on all larger sizes.

Wire.—Prevailing prices on rubber-covered were reduced last week, one jobber reducing the price on No. 14 rubber-covered in 5,000-ft. and 10,000-ft. lots from $6.60 per 1,000 ft. to $6.25 per 1,000 ft. The demand is also showing some improvement, principally for No. 14, as residential building is steadily increasing in volume. The base prices on bare and weatherproof remain the same, that on bare being around 16.35 cents per pound and that on weatherproof being generally quoted at 16 cents per pound.

Pole Line Hardware.—Prices are lower by about 5 per cent. Movement continues to be slow, though inquiries have improved somewhat in the last few weeks. One jobber reports that the volume of business is only about one-half of that obtaining at this time last year.

Porcelain.—Prices are in the process of adjustment downward, and definite quotations have not been determined. The reduction promises to be about 10 per cent, which will bring "Nail-it" knobs to about $17.50 per 1,000, 2½-in. tubes to about $5.50 per 1,000, 3-in. tubes to about $6.25 per 1,000, and cleats to about $13.50 per 1,000—all prices being for barrel lots. Inventories will not be seriously affected as stocks have kept low. The demand showed some improvement for the week.

Outlet Boxes.—Prices were lowered about 10 per cent last week, representative quotations now being as follows, for orders of 100 or more: 3¼-in. round black, $7 per 100; 3¼-in. round galvanized, $8 per 100. Sales continue in about the same volume, and stocks are small.

Lamp Cord.—Following are representative quotations for lots of 5,000 ft: No. 18 twisted cotton, $11 per 1,000 ft.; No. 18 twisted silk, $27 per 1,000 ft.; parallel silk, $27.60 per 1,000 ft. Stocks are generally in good condition, but the demand is falling off.

Safety Switches.—A healthy condition is found in this line, with stocks low and with demand improved and substantially better than a year ago. The size finding the principal demand is the 30-amp., two-wire and three-wire.

PORTLAND—SEATTLE

General business conditions continue slow, but the tendency is toward a very gradual improvement. Lumber production for the week ended Feb. 18 was only 10 per cent below normal. New business was 12 per cent below production, with shipments practically equalling new business. Lumber camps are gradually opening up and will continue to do so until all of the snow in the mountains disappears. Wages, however, are very low, the scale for common labor now being about $3 a day. Although there is considerable non-employment, the general situation affecting employment has improved considerably in recent weeks. This is due to improved conditions in the lumber industry, the beginning of road work and the activity in building.

The electrical trade shows little change from week to week. Business is still slow, but active inquiries indicate that improvement may be looked for. Prospects for an active demand for pole-line material and wiring devices are very good. Portland reports that activity in electric ranges is also very promising. Particularly is this true in respect to the many new apartment houses now being planned. The big question locally nowadays in regard to the better class of apartment houses seems to be not whether they will install gas or electric ranges, but rather what particular type of electric range will be installed.

Dealers report business slower than for January, but as being approximately normal for this time of year. Contracting business is picking up, and the prospects are good, although competition is very keen. Owing to the great amount of construction under way fixture business is quite active.

Household Appliances.—A drop of about 5 per cent is reported on certain types of washing machines and about 10 per cent on ironers. Sewing machines are also showing a drop of about 5 per cent.

Wire.—The demand for wire continues about normal. No. 14 is quoted at $7.50 and No. 12 at $7.90 per 1,000 ft. in 5,000-ft. lots. Bare copper wire dropped from a 15½-cent base to a 15-cent base, effective Feb. 23.

Rigid Conduit.—This material is moving very well. Prices remain unchanged, although further reductions are expected. Stocks are in good shape in all sizes.

Radio Apparatus.—The wide popular interest in radio communication which has sprung up since radiophone broadcasting has become general has created an excellent demand for radio apparatus. At the present time a considerable shortage exists in some sections, and customers often find it impossible to get what they want from local stocks. The demand for portable sets is growing rapidly. Many of these sets will be used by outing parties during the summer season, dealers report.

SAN FRANCISCO

There is an unusually heavy amount of snow on the Sierra summit, providing ample irrigation for the coming crops. Twelve feet of now is reported at the summit packed by the recent rains so that it will store well. Business has been considerably impeded by the influenza epidemic, which, although not serious in itself, has considerably disturbed production.

Lamps.—Especially keen efforts are being made to improve the efficiency of agents. The manufacturers, instead of appointing new agents, will attempt to get new business this way. Lamp business has been good this winter.

Ranges and Water Heaters.—A survey of installations over the lines of California power companies indicates an increase in recent months of about 30 per cent in the number of ranges on the line and an even greater percentage of increase for water heaters. About 50 per cent of the range installations are accompanied by water heaters. This increase is largely accounted for by the efforts of companies in the northern and central parts of the state. At the present time two distinct methods are being advocated, one providing that the power company sell at cost to popularize the use of the range and for the present at least disregard the dealer. The other method, which is being overwhelmingly advocated and will probably become effective in the near future, allows the dealer a handling profit and invites his co-operation. Approximately 100 ranges a month are now being added to the power lines around San Francisco Bay.

SALT LAKE CITY—DENVER

There are several favorable indications relative to business conditions in the Intermountain country. Reports show a steady increase in output in most of the basic industries. The copper industry is getting in better shape, gradual resumption being the tendency. Steel and iron have shown about a 10 per cent increase in the past sixty days. Coal production continues at a satisfactory rate. Farm products are gradually finding their way to the country's markets. Packing plants are also getting orders for their products at a better rate. The money market is considerably easier, and capital for building purposes is plentifully available at around 7 per cent. This is a better rate than has been in effect for several years, and it is believed certain that it will stimulate construction in a substantial way.

The market for electrical merchandise is rather sluggish, retailers placing small orders and jobbers generally trying to reduce their stocks to a more consistent level. The usual spring drive on washers and vacuum cleaners is beginning. Some liberal advertising campaigns are being mapped out, and with lower prices prevailing there is every reason to look forward to a good season.

Fixtures.—Dealers who feature electric lighting fixtures report a disappointing season. In a period of economizing there have been few replacements in homes, and with building at a low ebb new installations have been few. Stocks are somewhat excessive at the present time.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wakefield Brass Reports Increasing Business

Substantial increases in business are reported by the F. W. Wakefield Brass Company, Vermilion, Ohio, manufacturer of lighting specialties. In addition to regular production of the company's "Red Spot" hangers for commercial lighting units, the Wakefield plant has been engaged upon a considerable order for suspensions for "Keldon" units for the Ivanhoe-Regent Works of the General Electric Company. Output since the first of January is about 100 per cent above the same period last year.

Repair Company Erects New Factory

The American Electric & Maintenance Company, 51-57 Taylor Street, Springfield, Mass., which specializes in the repair of electrical machinery of all kinds, is erecting a new building in that city at 128-130 Liberty Street. The company expects to occupy its new quarters on April 1. Most of the sales and factory effort of the company at the present time is being devoted to the rewinding of transformers for central stations. F. R. Collins has just become connected with the company and will devote his time to central-station sales work. A. M. Sofield is president and general manager, and E. G. Young is vice-president.

MacGovern & Company Reorganize and Expand

The business of MacGovern & Company, Inc., Engineering Building, New York, has been reorganized, and new capital has been obtained, according to the announcement of Nathaniel F. Paige, formerly of the General Electric Company, who recently has been made vice-president and general manager. The company is well known among public utilities, steam and electric contractors and industrials, its business consisting of the purchase and sale of all kinds of new and used electrical and steam machinery and equipment. A new company has been incorporated under the same name and will take over all the assets and liabilities of the present corporation. The old company was incorporated in 1912.

The plant of the company is at Linden, N. J., on the main line of the Pennsylvania Railroad, the property including six acres of shops, land and sidings, fully equipped. Executive offices are maintained in the Engineering Building, New York, and branch offices in Montreal, Pittsburgh and Seattle, while it has sales representatives in most other important cities of the country. A large foreign business is done through the Montreal office and other connections, central-station and industrial apparatus being sold through these channels in the Canadian territory as well as Japan, China and other Far Eastern points.

The new board of directors includes Frank MacGovern (president), Nathaniel F. Paige (vice-president and general manager), Herman J. Woltman (vice-president), H. G. Scott, J. B. Spencer (treasurer), Howard H. Nieman (secretary), and Charles F. MacDonald. In its statement announcing the change the company expresses its confidence in steadily increasing business and its belief that its financial expansion will enable it not only to maintain its present business but materially to widen its distribution and service.

Trumbull-Vanderpoel Deliveries Not Delayed by Fire

Although the warehouse of the Trumbull-Vanderpoel Company, Bantam, Conn., was recently destroyed by fire, the company has stated to the Electrical World that deliveries have not been affected. The company manufactures switches, switch and panel boards and cabinets. The main plant was uninjured by the fire, but the warehouse in which were stored three carloads of box lumber and a large supply of slate and porcelain was a total loss. This material was replaced promptly, and deliveries, it is stated, can be made on a normal basis. The loss was estimated at $30,000. A fireproof warehouse will be constructed, though plans have not been made to do this work at once.

New Chicago Jobbing House Established

The Electrical Supplies Company, 511 West Jackson Boulevard, Chicago, has been organized to engage in the electrical jobbing business with A. A. Togesen as manager. The announcement made in the Jan. 28 issue of the Electrical World stating that this company had been formed from the Crescent Electric Company was incorrect, as the Crescent Electric Company has moved to 562 West Van Buren Street and will continue in the electrical contracting business. F. C. Reimers, who had been manager of this concern, will continue to act in this capacity.

Medart Adopts New Name

The name of the Medart Patent Pulley Company, Inc., has been changed to the Medart Company, effective Feb. 20, according to the announcement of W. R. Medart, president. The change was made for the reason that the phrase "patent pulley" failed to indicate the whole line manufactured by the company and was in effect misleading. The company started in 1879 to manufacture steel-rim pulleys, but later this line was extended to include all kinds of mechanical appliances for the transmission of power. The change, it is stated, does not mean a reorganization and will not apply to the ownership, policies or personnel of the company.

The company was originally a copartnership, with Philip and William Medart as the partners. The only thing manufactured at the time was the Medart patented pulley, so that the name chosen was clearly indicative of the business at that time. The founders of the business died about ten years ago and the management of the company came into the hands of Walter R. Medart, who incorporated it in 1913 and became its president and treasurer.

Nesbitt Succeeds Canadian Krantz Company

The Nesbitt Electric Manufacturing Company, Ltd., 95 King Street, East, Toronto, has been organized to succeed the Canadian Krantz Company. The new company will manufacture and sell in Canada the equipment formerly manufactured by the Canadian Krantz Company, such as panelboards, switches, switchboards, motor starters and other equipment. R. H. Nesbitt is president of the new organization, A. Ross Osborne is vice-president, and Walter, Warren, until recently manager of the Central Electric Supply Company, is treasurer. The offices of the Krantz Manufacturing Company are at 160 Seventh Avenue, Brooklyn, N. Y.

Better Demand for Passenger "Electrics"

Orders for passenger electric vehicles since Jan. 1 have exceeded those in the last half of 1921, recently stated H. H. Doering, sales manager for Rauch & Lang, Inc., Chicopee Falls, Mass., to a representative of the Electrical World. Since starting production about a year ago at the new factory, the plant has been running on full time, although some reduction in forces was necessary during the year. Mr. Doering stated that the company sold six "Electrics" each at the New York and Chicago automobile shows and that a remarkable increase in "prospects" resulted from these and other displays. The Eastern seaboard is recovering more rapidly than other parts of the country from the depression. New representatives have been arranged for in various places, and the bringing out of a new model car has been a factor in recent improved sales. Mr. Doering believes that the passenger electric vehicle will come into its own in 1922 and pointed out that, with the exception of one or two makes of gas cars, more publicity was accorded "Electrics" at the recent New York show than to any other type.

The distributers added to the company's connections are as follows: Rauch & Lang Electric Company of Chicago, J. P. O'Brien manager, 2416 Michigan Avenue; Electric & Gas Car Garage, Omaha, Neb.; Russell Electric Car Company, Kansas City, Mo.; Bottom Brothers Motor Company, Tulsa, Okla.; United Motors Company, Louisville, Ky., J. C. Boyd manager; Schnake Electric Car Company, Evansville, Ind., Walter Schnake proprietor; and E. F. Upson, 412 Church Street, Hartford, Conn.

Business Improving at New England Westinghouse Plant

A marked improvement in business arising chiefly from increasing popular interest in radio telephony and telegraphy is in evidence at the East Springfield (Mass.) factory of the Westinghouse Electric & Manufacturing Company. A. B. Reynders, factory manager at East Springfield, informed the ELECTRICAL WORLD last week that 150 more employees have just been added to the payroll and that a total force of about 1,500 is now at work on a five-and-a-half-day weekly schedule. Vigorous efforts are being made to shorten deliveries on radio equipment, and at present the principal factor in deliveries is the demand for material used in making this class of apparatus. While the demand for small motors for appliance applications is not varying much either way at present at East Springfield, there is a better feeling in the market for automotive starting and lighting sets which is now reflected in orders being put through the factory at the present time.

A drive for "over-the-counter" sales of small motors has been initiated by the company, and according to the announcement good results are expected from this method of selling small motors. The plan, though not altogether a new one, has not been extensively tried before this time, but the Westinghouse company believes that there are many practical uses for small motors both in the home and in commercial and small industrial establishments, few of which are now being exploited by the motor manufacturer. To help its dealers and the public the company has issued a booklet entitled "Popular Motor Mechanics" in which are described many methods of putting small motors to work on tedious jobs. Among the illustrations of the applications that can be made are motor-driven ice-cream freezers, grindstones, erasers for drafting rooms, forge fans, revolving window displays, egg, cream and batter beaters, sewing machines and a number of others. The booklet also contains a short description of simple motor mechanics for the layman.

Slate Producers Confer to Decrease Cost, Increase Use

A gathering of producers and users of slate was held at the Engineers' Club, New York, on Feb. 8, with the object of discussing methods of reducing production costs and increasing demand for slate. This conference follows one held recently in Washington with government officials with the same object in view. Large use has been found for slate in electrical switchboards, but, according to statements made at the conference, consumption of the product has been seriously curtailed. Producers of slate, it was declared, had decreased in number about 50 per cent in the past few years.

The most promising outlook for slate is in the electrical field, according to a talk made by G. F. Loughlin, United States Geological Survey.

"We are living in an electrical age," said Mr. Loughlin, "and recent indications, for example the Superpower Survey completed last summer, give hope of accelerated development of electrical power. The instructive tests on electrical slate recently completed for the Structural Slate Company of Pen Argyl, Pa., give us some much needed facts as to the adaptability and limitations of slate for electric switchboards and should aid in gaining proper recognition for slate in this field."

A continuance of the efforts at standardization and the formation of a distinct body to promote use of slate were recommended as means of increasing sales and getting the industry back on its feet.

Suction-Cleaner Manufacturer Moves to Own Building

The F. Bissell Company, Toledo, Ohio, jobber of electrical supplies and power apparatus and manufacturer of suction cleaners, has recently moved from 226-230 Huron Street to its own building at 812-822 Lafayette Street. The new location covers practically a half block, permitting the company to combine all of its departments and stocks under one roof, with the exception of the lighting-fixture studio, which is being continued under the original plan of using a large residence for display and sales rooms.

The concentration of stocks and modern handling methods, which include a completely inclosed and heated driveway and loading docks and a railroad siding into the building, together with the proximity of all outbound freight stations, will enable the Bissell Company to increase service to the trade.

Crossarm & Conduit Company Changes Name

The American Crossarm & Conduit Company is the new name of the company formerly called the American Line Materials Company. The change in name became effective on Jan. 31. The main offices of the company are in the McCormick Building, Chicago.

The Varney Electrical Company, Evansville, Ind., is planning for extensions in its plant and operations. The capital has been increased from $250,000 to $400,000. H. A. Robertson is manager.

The A A Wire Company, Newark, N. J., has opened a new branch office in Cleveland to handle the business in that city and the territory contiguous to it. A. B. Barker is opening up this branch, established in the Sloan Building, 815-23 Prospect Avenue.

The Wilson Welder & Metals Company, 132 King Street, New York City, manufacturer of arc-welding machines and certified welding metals, announces the appointment of R. L. White as district manager in charge of the Detroit office at 809 Kresge Building.

The Hardinge Company, 120 Broadway, New York City, announces that it has acquired the coal-washing equipment, consisting mainly of the James automatic balanced jig, formerly supplied by the Coal Washing Equipment Company, Pottsville, Pa., and another device, which is a combination of pulsating classifier and table, capable of lowering the sulphur and ash content of slack sizes of coals and of washing river coals and anthracite culm. All of this equipment is now manufactured in the shops of the Hardinge Company.

The Roller-Smith Company, 233 Broadway, New York, has appointed Pendleton E. Lehde, 609 Whitney Central Building, New Orleans, as a special representative in Louisiana and the southern part of Mississippi. He will handle the Roller-Smith Company's line of electrical instruments, meters and circuit breakers in that territory.

Betts & Betts Corporation, 645 West Forty-third Street, New York, manufacturer of electric sign flashers, etc., has engaged F. R. Ewing, formerly with the Western Electric Company, New York, to do sales work in southern Wisconsin, Illinois, Michigan, Indiana and western Ohio. The territory of V. H. Walker has been extended to include New Jersey, Pennsylvania, Maryland, Delaware, Virginia, District of Columbia and West Virginia.

The Efficient Electrical Display Company, Inc., 26 Court Street, Brooklyn, N. Y., has announced that it is intending to increase its production to about 100 large signs per month and is in the market for equipment for this purpose. Later on in the year, according to Walter T. Fassig, president, the company intends to buy about 15,000 two-piece sign receptacles and 20,000 ft. of No. 14 rubber-covered wire.

The Cutter Electrical & Manufacturing Company, Philadelphia has awarded contracts for a large addition to its factory at Nineteenth and Hamilton Streets.

The Oriental Fixtures Company, 1318 Ridge Avenue, Philadelphia, has gone into the hands of a receiver. Joseph Selzman has been appointed by the courts to make settlement.

Foreign Trade Notes

ELECTRIFICATION OF THE OTIRA TUNNEL, NEW ZEALAND.—The Otira tunnel in New Zealand, which cost £800,000, according to *Electrical Industries*, is nearing completion. The tunnel will be equipped for electrical operation, which will add £382,000 to the cost of the project.

PROPOSED WATER POWER DEVELOPMENT IN NEWFOUNDLAND.—Negotiations are under way between the Newfoundland government, Messrs. Armstrong and Whitworth and the Reid Newfoundland Railway Company, according to *Electrical Industries*, regarding a proposed water-power development on the west coast of Newfoundland. It is estimated that a total of 235,000 hp. could be developed, which would be utilized in connection with a proposed paper mill with a daily capacity of 400 tons of newsprint paper, a factory for smelting aluminum and other industries. The associated companies have asked the government to guarantee the interest on £1,000,000 at 6 per cent, with a sinking fund of 1 per cent for thirty-seven years.

HYDRO-ELECTRIC PROJECTS IN TASMANIA.—Owing to the high price of money, according to *Electrical Industries*, no new developments are proposed in this year's estimates in connection with the large hydro-electric scheme of the Tasmanian government.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An American having an established mercantile business in Australia (No. 845) is in the United States and desires to secure an agency for the sale of household labor-saving devices, etc.

A business man in Persia (No. 848), who is soon to organize a commercial house for the importation of goods, wishes to receive catalogs and samples with a view to selling electrical apparatus, etc.

A manufacturing company in Canada (No. 862) wishes to purchase about 5,000 round electric lamps per year, 1¼ in. in diameter and ½ in. thick, of about 20 cp., with medium-sized sockets, to be used at the bottom of artificial flowers; also artificial flowers and rose petals, fireproof, to be used on portable electric floor lamps.

Inquiries have been received by an American consul in Canada (No. 878) for amateur wireless telegraph outfits and catalogs and price lists are requested.

A merchant in Spain (No 907) wishes to secure an agency for the sale of electrical machinery, supplies and novelties in the electrical trade.

The purchase is desired by a mercantile firm in Canada (No. 943) of an electric generating outfit of from 6 kw. to 10 kw. capacity, 110 volts, generator either belt-driven or directly connected to kerosene, gasoline or crude oil engine. An agency is also desired.

An automobile salesman in Spain (No. 950) desires to purchase accessories for motor cars, such as lamps (electric and carbide), speedometers, motormeters, horns and sirens, etc.

A firm in Norway (No. 960) desires to secure an agency for the sale of technical specialties, apparatus, equipment and supplies for mines, steamships, forestry and timber, etc., and practical and handy tools, specialties and patents for the automobile, motor cycle, and electrical lines.

New Apparatus and Publications

SUPERHEATER.—The Whitlock Coil Pipe Company, Hartford, Conn., is distributing bulletin No. 30, describing its all-steel superheater.

WIRING DEVICES.—"Ben-ox" interchangeable wiring devices for suspending industrial and commercial lighting units are described by the Benjamin Electric Manufacturing Company in its bulletin No. 19.

REFLECTOR.—The Standard Corporation, Columbus, Ohio, is distributing a leaflet describing and illustrating its reflectors for flashlights, locomotive headlights and floodlights. A new lens developed by the company is also described.

COMMERCIAL LIGHTING.—The Brascolite Company, St. Louis, has issued No. 4 of its series of booklets describing the use of "Brascolite" lighting units. This booklet deals with commercial lighting.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and supply-part bulletins, dated January, 1922.

PHOTOGRAPHIC ARC LAMP.—The Photogenic Machine Company is distributing a leaflet describing its "Hi-Power" twin-arc lamp for photographic processes.

FOOD MIXER.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 301, describing the "Reco" food mixer.

AMPERE-HOUR METER.—The Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 58, superseding bulletin No. 50, describing its locomotive type ampere-hour meter.

SWITCHES.—The Trumbull Electric Manufacturing Company, Plainville, Conn., is putting on the market a new line of externally operated punched-clip-type "C" switches, 30 amp. to 200 amp., two, three and four-phase, 250 volts to 500 volts.

New Incorporations

THE BOSTON (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $2,000 by R. W. Atcher, N. B. Langsford, and Charles E. Sprigg, all of Boston, Ky.

THE OAKVILLE (ONT.) ELECTRIC, LTD., has been organized with a capital stock of $5,000 for the purpose of distributing hydro-electric power in Oakville. H. C. Christie is president.

THE VERA LIGHT & POWER COMPANY has been organized at Tulsa, Okla., by W. E. Page, E. J. Doerner and H. O. Bland, all of Tulsa. The company is capitalized at $10,000 and proposes to supply electricity for light and power in the town of Vera.

THE LAKE CITY (IOWA) UTILITY COMPANY has been incorporated with a capital stock of $40,000, to erect and operate an electric light and power plant. H. D. Yetter is president.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 7, 1922)

1,405,812. Annunciator Drop; Frank W. Wood, Montclair, N. J. App. filed Oct. 24, 1919. Shifted both into and from operative position at will.

1,405,819. Mine and Like Electric Bell; Josef B. Eder, Johannesburg, Transvaal, South Africa. App. filed Feb. 18, 1918. Moisture-proof for mine use.

1,405,849. Vibration Detector; Herman T. Kohlhaas, Brooklyn, N. Y. App. filed July 28, 1919. Detects vibrations propagated through water.

1,405,905. Radio Receiving Apparatus; Francis W. Dunmore, Washington, D. C. App. filed Feb. 4, 1921. Vacuum-tube system.

1,405,935. Mounting Plate for Electrical Protective Apparatus; Frederick R. Parker, Chicago, Ill. App. filed June 1, 1921. Three metal plates assembled broadsidedly.

1,405,942. Starting System; Elmer H. Schwarz, Glen Rock, N. J. App. filed July 5, 1918. Starter and manifold heater operate together.

1,405,956. Electric Regulator; William A. Turbayne, Niagara Falls, N. Y. App. filed Aug. 26, 1918. Utilizes a compressible pile.

1,405,965. Motor Generator; Charles H. Bunch, Cleveland, Ohio. App. filed March 31, 1920. For storage-battery charging with removable stator winding.

1,405,979. Ignition Apparatus; Farnum F. Dorsey, Rochester, N. Y. App. filed July 26, 1917. Means for mounting and incasing induction coil.

1,406,002. Protective Means for Electrical Apparatus Having Windings; Joseph Goodman, Hayes, England. App. filed Nov. 20, 1917. By spark gap grounded through condenser and choke coil.

1,406,039. Electric System for Motor Vehicles; Thomas L. Lee, Rochester, N. Y. App. filed Nov. 4, 1919. Protective resistance for short circuit.

1,406,048. Intake Heater for Gasoline Engines; Eldrige V. McCulloch, Hutchinson, Kan. App. filed Dec. 4, 1919. Electric element.

1,406,057. Electrically Heated Radiator; James H. Mills, Gallipolis, Ohio. App. filed April 5, 1920. Automatic cut-out for room use.

1,406,100. Electric Water Heater; Richard M. Stephens, Irving, Tex. App. filed June 23, 1920. Two hollow carbon cylinders with water to complete circuit.

1,406,149. Electrical Device; Theodore W. Case, Scipio, N. Y. App. filed Jan. 22, 1918. Amplifier and detector of changes in voltage in a primary circuit.

(Issued Feb. 14, 1922)

1,406,164. Automatic Electric Incubator; William J. Anderson, Caulfield, Victoria, Australia. App. filed April 5, 1920. Temperature control.

1,406,172. Engine Starting System; William A. Chryst, Dayton, Ohio. App. filed Oct. 23, 1918. Automobile motor-generator set.

1,406,181. Electric Water Heater; Robert J. Frost, Clayton, Victoria, Australia. App. filed Aug. 27, 1920. Water tubes short-circuit transformer core.

1,406,184. Armature for Dynamo-Electric Machines; Nelson R. Haas, Dayton, Ohio. App. filed July 14, 1919. Automobile motor-generator set.

1,406,195. Testing Apparatus for Telephone Switchboard Cords; George W. Kuhn, Brooklyn, N. Y. App. filed Dec. 11, 1920. Portable apparatus to locate trouble.

1,406,221. Telephone Exchange System; Lipa Polinkowsky, New York, N. Y. App. filed June 5, 1919. Machine switching.

1,406,234. Circuit Interrupter; Joseph Slepian, Pittsburgh, Pa. App. filed Nov. 4, 1918. For increasing capacity of electrolytic cells.

1,406,235. Electrical Measuring Instrument; Benjamin H. Smith, Turtle Creek, Pa. App. filed Aug. 30, 1916. Measures volt-amperes of alternating-current circuit.

1,406,236. Telephone System; Arthur B. Sperry, New York, N. Y. App. filed Nov. 8, 1919. For indicating unstandard conditions.

1,406,239. Electrode and Electrolytic Battery; Alexander T. Stuart, Toronto, Ontario, Canada. App. filed July 1, 1919. Oxygen-hydrogen generator.

1,406,245. Laminated Magnetic Circuit Structure for Transformers; Chester H. Thordarson, Chicago, Ill. App. filed Feb. 3, 1916.

1,406,246. Testing and Adjusting Apparatus for Cord Circuits; John F. Toomey, New York, N. Y. App. filed Jan 30, 1920. For proper functioning of telephone relays.

1,406,255. Motor-Control System; Edgar M. Bouton, Wilkinsburg, Pa. App. filed Oct. 3, 1917. For blower motors to maintain constant pressure.

1,406,257. Rheostat; Arthur W. Brice, Rochester, N. Y. App. filed May 16, 1916. Wide range of adjustment.

1,406,285. Trolley Frog; Edward E. Rose, Swissvale, Pa. App. filed May 6, 1919. Relates to approach members for frogs, crossings, etc.

1,406,286. Trolley-Frog Approach; Edward E. Rose, Edgewood Park, Pa. App. filed March 31, 1920. Automatically bends wire when attaching approach member to frog.

1,406,288. Wire-Supporting Structure; William Schaake, Pittsburgh, Pa. App. filed Sept. 17, 1920. Strain plate between the guy wires and the trolley wire.

1,406,312. Indicator for Gasoline, Etc.; Sheldon M. Wessoleck, New Britain, Conn. App. filed July 21, 1920. Float linked with variable resistance and ammeter.

1,406,328. Temperature Regulating Means for Filamentary Electrodes; Alfred J. Atherton, Edgewood Park, Pa. App. filed Jan. 29, 1917. To maintain the filament temperature constant.

1,406,352. Thermostat; Paul E. Demmler, Pittsburgh, Pa. App. filed Nov. 13, 1919. For actuating protective [illegible].

1,406,359. **Miner's Electric Safety Lamp**; Arthur P. Ford, Stoke-Upon-Trent, England. App. filed March 10, 1921. Lamp having two bulbs in parallel.

1,406,360. **Flexible Water Heater**; Frank F. Forshee, Flint, Mich. App. filed June 17, 1920. With refractory resistor-supporting means.

1,406,366. **Alternating-Current Motor**; Valere A. Fynn, St. Louis, Mo. App. filed Dec. 26, 1916. Single-phase synchronous induction motor.

1,406,367. **Alternating-Current Motor**; Valere A. Fynn, St. Louis, Mo. App. filed Dec. 26, 1916. Single-phase synchronous induction motor.

1,406,372. **Electric Oven**; Albert E. Grapp, Minneapolis, Minn. App. filed May 21, 1921. Especially adapted for baking of bread.

1,406,376. **Motor-Control System**; Albert L. Harvey, Wilkinsburg, Pa. App. filed Sept. 10, 1917. Automatic starting device for motors.

1,406,377. **Motor-Control System**; Albert L. Harvey, Braddock Township, Pa. App. filed Nov. 7, 1917. For operating a fluid system at uniform pressure.

1,406,383. **Motor-Control System**; Charles H. Hodgkins, Pittsburgh, Pa. App. filed Sept. 10, 1917. Automatic starting device for motors.

1,406,389. **Controller**; Henry D. James, Edgewood Park, Pa. App. filed Sept. 21, 1916. Motor-starting controller operated by pilot motor

1,406,393. **Resistor**; Howard H. Johnston, Edgewood Park, Pa. App. filed May 14, 1920. Concentrically mounts plurality of tubular resistors of different diameters.

1,406,405. **Automatic Control Mechanism**; William H. McGee and Reni S. Berry, Los Angeles, Cal. App. filed Feb. 21, 1918. Operation of airplane by remote control.

1,406,428. **Telegraph Sounder**; Chester H. Teegarden, Washington, D. C. App. filed Sept. 25, 1918. Pertains to watchcase type.

1,406,429. **Dry Cell**; George W. Vinal and Homer D. Holler, Washington, D. C. App. filed Jan. 22, 1919. Kept in a dry condition as long as desired.

1,406,442. **Radio Receiving System**; Louis Cohen, Washington, D. C. App. filed Dec. 28, 1918. Double coupling, electrostatic and electromagnetic.

1,406,445. **Photographic Receiving Apparatus**; Charles A. Culver, Beloit, Wis. App. filed June 19, 1919. For recording oscillating signals.

1,406,448. **Commutator.** Albert E. Doman, Syracuse, N. Y. App. filed Dec. 18, 1918. Commutator bars split for holding windings.

1,406,452. **Flashlamp**; Louis M. Evans and George W. Steinmann, Washington, D. C. App. filed June 16, 1920. Shutter to limit amount of light.

1,406,488. **Radiotherapeutical Shield**; Marguerite A. Pugh, New Orleans, La. App. filed Dec. 10, 1917. To localize the action of radioactive materials.

1,406,495. **Automatic Commutator Brush Adjuster**; Clarence Rumfelt, Oakland, Cal. App. filed March 3, 1919. Operated by solenoid connected in load.

1,406,500. **Electric Apparatus for Indicating and Repeating Movements at a Distance**; Eugene Schneider, Paris, France. App filed June 16, 1919. Based on principle of Wheatstone bridge.

1,406,507. **Recorder**; James N. Tuttle, Newton Center, Mass. App. filed Sept. 9, 1919. Heated stylus marks on record sheet sensitive to heat.

1,406,510. **Auricular Telephone**; Louis Weber, Charlottenburg, Germany, App. filed Oct. 26, 1920. Receiver can be inserted in auditory duct of ear.

1,406,542. **Electrode**; Irving S. Crocker, Lynn, Mass. App. filed March 17, 1921. Process for making dense arc-light electrodes.

1,406,550. **Electrical Heating Apparatus**; Henry Geisenhoner, Schenectady, N. Y. App. filed June 21, 1920. For soldering irons, etc.

1,406,551. **Electric Heating Apparatus**; Henry Geisenhoner, Schenectady, N. Y. App. filed June 21, 1920. Article heated by passage of current through it.

1,406,565. **Electrical System**; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed Nov. 16, 1917. Control for rolling-mill motors.

1,406,566. **Secondary Winding for Asynchronous Motors**; Arvid Lindström, Vesterås, Sweden. App. filed March 18, 1921. Automatic control of position of conductors in slots of rotor.

Construction News

Projects, Plans, Bids and Contracts
Contemplated or Under Way

New England States

UNITY, N. H.—The Newport (N. H.) Electric Light Company has applied to the Public Service Commission for permission to furnish electricity in Unity.

BOSTON, MASS.—Motors and other electric equipment will be installed in the car inspection shop, 60 ft. x 500 ft., to be constructed by the Boston Elevated Railway Company, at the Forest Hills Terminal, for which bids will be taken until March 10. A. J. Blackburn is engineer.

BOSTON, MASS.—An electric power department will be installed in the junior high school to be erected on Dixwell Avenue, at a cost of about $660,000. James J. Driscoll, 6 Beacon Street, architect.

FALL RIVER, MASS.—A power house and pumping plant will be constructed by the Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, at its proposed oil refining and distributing plant, foot of Slade Street, to cost about $1,000,000.

NORTH WEYMOUTH, MASS.—The Edison Electric Illuminating Company, has purchased a site in North Weymouth on which it will build a large power house.

Middle Atlantic States

BINGHAMTON, N. Y.—An ordinance providing for the installation of an ornamental lighting system on Chenango Street from Court Street to Lewis Street has been adopted by the Council. The installation of an ornamental lighting system on Water Street from Court Street to Ferry Street is under consideration.

CORNING, N. Y.—An electric power department will be installed in the new high school to be erected at a cost of $465,000. F. H. Dewey & Company, 175 Fifth Avenue, New York, are architects.

NEW YORK, N. Y.—Motors and other electrical and mechanical equipment will be installed in the plant addition to be erected by the A. C. Chesley Company, 704 East 133d Street.

HAILESBORO, N. Y.—The St. Lawrence Transmission Company, Potsdam, has purchased the hydro-electric plant of the Uniform Fibrous Talc Company on the Oswegatchie River in Hailesboro. The St. Lawrence company, it is understood, plans to install an additional 1,000-hp. generating unit.

NEWARK, N. J.—By a decision handled down by the State Supreme Court the referendum vote on the question of establishing a municipal electric light, heat and power plant was held invalid. The proposition will be presented again to voters.

NIAGARA FALLS, N. Y.—The Council is arranging an amendment to the city charter to provide for the establishment of a municipal power plant.

NEWPORT, N. Y.—The Newport Electric Light & Power Company is planning the installation of an additional electric generating unit, to cost about $14,000. Application has been made to the Public Service Commission for permission to issue $25,000 in bonds.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has filed notice of increase in capital from $200,000 to $300,000.

TROY, N. Y.—A power house will be installed at the cold-storage and ice-manufacturing plant to be established by the Fitzgerald Brothers Brewing Company, at a cost of $200,000. Ophuls, Hill & McCreery, 112 West Forty-second Street, New York, are architects and engineers.

TROY, N. Y.—The Eastern Malleable Iron Works will take new bids at once for the erection of a one-story power plant, 50 ft. x 175 ft.

EAST ORANGE, N. J.—The Water Commission is planning for the installation of electrially operated pumping machinery at the White Oak Ridge waterworks extension. The entire cost is estimated at $200,000.

EAST PATERSON, N. J.—The power house and other buildings at the plant of the Coirin Chemical Works, River Road, were recently destroyed by fire, causing a loss of about $150,000. Frederick Coirin is head.

ALTOONA, PA.—The Penn Central Light & Power Company has purchased the properties of the Standard Public Service Company of Claysburg and the Freedom Electric Company, charters of which cover the towns of East Freedom, McKee, Claysburg and Sproul.

NEWARK, N. J.—The Gulf Refining Company, Doremus Avenue, has filed plans for an addition to its power house.

NEWARK, N. J.—Plans have been filed by the Lock Joint Rifle Company, Cornelia Street and Albert Avenue, for the construction of a number of shop buildings, including a power house.

CARLISLE, PA.—The County Commissioners have plans under way for a new central power house, to be erected about a mile from the city. Frank G. Fahnestock, Jr., Patriot Building, Harrisburg, is architect.

OIL CITY, PA.—Arrangements have been made by the Citizens' Light & Power Company for issuing $43,000 in bonds, the proceeds to be used for extensions and improvements to its system.

PHILADELPHIA, PA.—Martin H. Walrath & Son are having estimates prepared for a factory, power house and garage on Indiana Avenue.

PHILADELPHIA, PA.—The Oscar Nebel Knitting Company, 3860 Coral Street, has filed plans for the construction of a power house at Fifth and Annsbury Streets, to cost about $75,000.

PHILADELPHIA, PA.—An electric power department will be installed in the three-story plant, 72 ft. x 190 ft., to be erected on Rising Sun Avenue by the Andross Worsted Company, Bridge and Charles Streets, to cost about $350,000. The Ballinger Company, Twelfth and Chestnut Streets, is architect.

PHILADELPHIA, PA.—A power house will be installed in the new factory to be erected by the Gotham Silk Hosiery Company, 515 Fifth Avenue, New York, at Second and Norris Streets, to cost about $200,000. William Steele & Sons, 1600 Arch Street, are architects and builders.

RIDGEWAY, PA.—The Keystone Power Corporation, recently organized with a capital of $1,250,000, will take over and operate a number of power and transmission line companies operating in Elk and adjoining counties. H. S. Clader, 5461 Lebanon Avenue, Philadelphia, is treasurer.

VENANGO, PA.—H. F. King, representing the Venango Electric Company, has applied to the Pennsylvania Public Service Commission for permission to furnish electricity for light, heat and power in the borough of Venango and vicinity.

WILMINGTON, DEL.—The United States Engineers Office will take bids until March 20 for a complete pumping unit for use at Chesapeake City, Md. Alternate estimates will be received for electrical, steam and oil-driven equipment.

WILMINGTON, DEL.—The Board of Street & Sewer Commissioners contemplates installation of an ornamental street-lighting system on King, Ninth, Tenth and Washington Streets.

BALTIMORE, MD.—The Board of Street Commissioners is planning to erect a central automatic fire-alarm station.

KENNEDYVILLE, MD.—The Kennedyville Electric Company has been formed by local interests to construct and operate a power plant in Kennedyville.

SABILLASVILLE, MD.—The Maryland Sanatorium will discontinue its present power plant and will secure electricity from the lines of the Hagerstown & Frederick Railway, for which a contract has been signed.

BUCKHANNON, W. VA.—A power house will be installed at the new planing mill and woodworking plant to be erected by C. E. Hines.

CHARLESTON, W. VA.—The Council is considering an issue of $300,000 in bonds for extensions to the electric lighting and waterworks systems.

North Central States

BIG RAPIDS, MICH.—The Big Rapids Electric Company will build an addition to its power plant, including the installation of an electric generator and oil engine. W. A. Stillwell is secretary.

DETROIT, MICH.—The Ford Motor Company will extend its transmission system from the River Rouge power plant to the works of the Lincoln Motor Company.

DETROIT, MICH.—The Père Marquette Railroad Company is planning the installation of a wireless train-control system, covering about 50 miles of line, to cost about $200,000.

DETROIT, MICH. — The Detroit Edison Company contemplates extensions and improvements to its system during the present year, including the completion of the generating plant on the St. Clair River, Marysville, Mich., and development of the power site for a steam-operated plant on the Trenton Channel of the Detroit River. The cost is estimated at $3,000,000.

MOUNT PLEASANT, MICH.—A power plant will be built by the National Portland Cement Company at its new mill at Coldwater Lake, to cost about $500,000. H. C. Shields is manager.

SAULT STE MARIE, MICH.—The Cadillac Lumber & Chemical Company will build a power plant at its new works at Sault Ste. Marie, for which plans are being prepared.

CLEVELAND, OHIO. — A petition has been submitted to the City Council by residents of Clark Avenue requesting the installation of an ornamental lighting system on that thoroughfare. The Council has authorized the installation of electric lamps on Lenacrave Avenue between East 116th Street and East 131st Street.

MIDDLETOWN, OHIO. — An electric power department will be installed in the proposed new high school, to cost $650,000. T. D. McLaughlin, Savings Bank Building, Lima, Ohio, is architect.

ELIZABETHTOWN, IND. — The Elizabethtown Light & Power Company, recently organized, has contracted with the Interstate Public Service Company for electricity. A transmission line will be erected from Elizabethtown to Mineral Springs, Ind., where connection with the Interstate lines will be made. A substation and distribution system covering a 5-mile radius will be erected at Elizabethtown.

FORT WAYNE, IND.—The Keenan Hotel Company, care of the Anthony Hotel, 128 West Berry Street, plans to install a power plant in the new fifteen-story hotel to be erected at a cost of about $900,000. C. R. Weatherhogg, Citizens' Trust Building, is architect.

CHICAGO, ILL.—The Department of Gas and Electricity has recommended issuing $15,000,000 for extensions to the street-lighting system in Chicago.

DECATUR, ILL.—Plans are under consideration by the Illinois Traction Company, Champaign, for the construction of a new power plant in Decatur, to cost, including equipment, about $100,000.

ELKHORN, WIS.—Plans are under consideration by the Wisconsin Butter & Cheese Company for the installation of an electric generating unit. Cahill & Douglas, 217 West Water Street, Milwaukee, are engineers.

SHOALS, IND. — The Shoals Light & Power Company will extend its system to new coal-mining properties now being opened.

MILWAUKEE, WIS. — The Interior Woodwork Company, 521-529 Park Street, contemplates the installation of electrical equipment in its power plant and for factory operation. Cahill & Douglas, 217 West Water Street, are consulting engineers.

RHINELANDER, WIS.—The Rhinelander Paper Company is considering the installation of additional equipment in its power plant and boiler house. Cahill & Douglas, 217 West Water Street, Milwaukee, are consulting engineers.

FORT MADISON, IOWA. — An electric power department will be installed in the three-story-and-basement high school to be erected in Fort Madison at a cost of $350,000. Owen, Payson & Carswell, Interstate Building, Kansas City, Mo., are architects.

MUSCATINE, IOWA. — Bonds to the amount of $350,000 have been voted for the establishment of a municipal electric light and power plant in Muscatine.

OSKALOOSA, IOWA. — The Council is having tentative plans drawn for the erection of a hydro-electric generating plant on the Des Moines River, near Harvey, Iowa, to cost $350,000. The Fargo Engineering Company, Jackson, Mich., is engineer.

FULTON, MO.—The Council contemplates the installation of additional equipment at the municipal electric plant

LAMAR, MO.—The Osage Power Development Company contemplates the construction of a hydro-electric plant on Lann Creek, to cost about $5,000,000, including a steel-tower transmission system about 100 miles long. W. R. Banks is general manager.

FARGO, N. D.—The Union Light, Heat & Power Company contemplates the construction of a new electric plant in Fargo.

HILLSBORO, N. D.—The Council contemplates improvements to the municipal electric plant. The C. L. Pillsbury Company, 1200 Second Avenue, South Minneapolis, Minn., is engineer.

EDGEMONT, S. D.—The electric light plant of the Western Utilities Company in Edgemont is reported to have been destroyed by fire.

SIOUX FALLS, S. D.—The Tri-County Transmission Company has been organized to take over the power plants in Bridgewater, Marion and Emery, and will erect a 33,000-volt line from a point 10 miles west of Sioux Falls on the Wall Lake Road to Bridgewater, to transmit electricity to the three towns. The company has entered into a contract with the Northern States Power Company whereby it will secure electricity from the latter company for a period of ten years, taking effect about May 1. G. W. Laing, Bridgewater, is president of the Tri-County company.

Southern States

CHARLOTTE, N. C.—An electric power department will be installed in the new high school to be erected in Charlotte, to cost about $300,000. Lockwood, Greene & Company, Piedmont Building, are architects.

ENFIELD, N. C.—Bids to be received at the office of Allen W. Andelton, Mayor, for the construction of an electric light plant, waterworks and sewerage system have been postponed from March 1 to March 15. W. C. Olsen, Kinston, is consulting engineer.

NEW BERN, N. C. — The Council has authorized plans for a new street-lighting system in the business district, to cost about $25,000.

VANCEBORO, N. C.—The Town officials are considering issuing $15,000 in bonds for the erection of a transmission line from the municipal power plant in Newbern to Vanceboro, via Bridgeton, a distance of 18 miles.

CLEARWATER, FLA. — The Council is planning the installation of a municipal electric plant.

ST. PETERSBURG, FLA.—A movement has been started to establish an electric power plant to furnish electricity for street-lighting and for the operation of the city-owned car lines.

SMYRNA, TENN.—The Smyrna Electric Light Company, recently organized, contemplates the erection of an electric transmission line from Walter Hill to Smyrna. Electricity will be furnished by the Murfreesboro Electric Light & Power Company. J. H. Edwards is president of the new company.

YELLVILLE, ARK. — Negotiations are under way whereby the Dixie Power Company will erect an electric transmission line from the proposed Dixie Dam on the White River near Cotter to Yellville. The project also includes the construction of an electric railway connecting the Buffalo River mining and timber region with the railroad here.

COVINGTON, LA. — The St. Tammany Ice, Light & Water Company is considering improvements to its plant. Henry A. Mentz, Magnolia, Miss., is consulting engineer.

BYNG, OKLA.—The Oklahoma Power & Transmission Company, Ada, is contemplating, it is reported, the installation of an additional generating unit during the present year.

FOSS, OKLA.—Improvements to the municipal electric plant and water system are under consideration. H. G. Olmstead & Company, Oklahoma City, are engineers.

HUGO, OKLA.—The Hugo Ice & Light Company has obtained a franchise to erect a high-tension transmission line from Hugo to Fort Towson, via Sawyer.

VALLIANT, OKLA.—The Valliant Light & Power Company has been granted a franchise to establish an electric plant and distribution system in Valliant.

VERA, OKLA.—At an election to be held March 20 the proposal to issue $7,000 in bonds for the construction of an electric light and power system will be submitted to the voters.

DENISON, TEX.—The Texas Power & Light Company has plans under way for the construction of a new generating plant in Denison. The station will furnish service between Denison and Wichita Falls, Tex.

HUTTO, TEX.—Hanstrom & Tinning are planning to rebuild their electric plant, recently destroyed by fire.

KAUFMAN, TEX.—The City Council contemplates improvements to the lighting system.

TEMPLE, TEX.—Steps have been taken to secure the installation of an ornamental lighting system in the business district of Temple.

WILLS POINT, TEX.—The Council is considering the establishment of a municipal electric plant in Wills Point.

Pacific and Mountain States

EVERETT, WASH. — The Puget Sound International Railway & Power Company is planning extensions in its transmission system to cost about $80,000, and also to its distribution lines.

SPOKANE, WASH. — The Washington Water Power Company contemplates extending its high-tension transmission line into Grant County, west of Spokane, a distance of 110 miles. Substations will be erected in Stratford and Neppel. The cost is estimated at $250,000. M. W. Birkett is acting general manager.

GLENDALE, CAL. — Steps have been taken by the San Fernando Boulevard Improvement Association for the installation of ornamental lamps along San Fernando Road between Los Felez Road and Pacific Avenue. R. Johnson, 1133 South San Fernando Road, is interested.

HOLLYWOOD, CAL.—Steps have been taken by the Greater Hollywood Improvement Association for the erection of ornamental lamp posts on a portion of Santa Monica Boulevard.

MADERA, CAL.—The City Trustees are negotiating with the Pacific States Gas Company for the installation of an ornamental electric street-lighting system in the business section. Frank Nikerk is city engineer.

SALINAS, CAL.—The Shell Oil Company has obtained a permit to construct a substation south of Alisal Street, to cost about $15,000.

VENTURA, CAL.—The installation of an ornamental lighting system on Main Street from Chestnut to Crimea is under consideration.

LOGAN, UTAH.—The city officials are considering the installation of electric meters in the city.

PAROWAN, UTAH.—The city clerk has applied to the State Engineer for permission to divert 21.03 cu.-ft. of water from Center Creek in Iron County, to develop 340 hp. to furnish electricity for light and power in Parowan.

SEVIER, UTAH.—The Telluride Power Company, Salt Lake City, has filed application with the State Engineer for the diversion of 100 sec.-ft. of water from the Sevier River below the town of Sevier. The plans call for a development of 900 hp.

DENVER, COL.—Arrangements have been made by the Denver Gas & Electric Company for issuing $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements to its system.

Canada

WINNIPEG, MAN.—The provincial government is having estimates prepared for the extension of an electric transmission line to Brandon.

HALIFAX, N. S. — Plans are reported under way for the establishment of a new lighting system in Halifax.

WASHAGO, ONT. — The Hydro-Electric Power Commission of Ontario, Toronto, is considering the erection of a transmission line from Wasdall's Falls to Washago.

MONTREAL, QUE.—The Ottawa & Hull Power Company, Hull, is having plans prepared for the construction of a dam in connection with a hydro-electric development at Calumet Falls. The plans call for four units of 14,500 hp. each, operating under a 63-ft. head, and one smaller service unit. William Kennedy, 364 University Avenue, Montreal, is consulting engineer.

MONTREAL, QUE.—A joint application has been made to the Quebec Legislature by the Canadian Light & Power Company, Montreal, and the Public Service Corporation for permission to develop a hydro-electric project at Carrillon, on the Ottawa River, to cost approximately $20,000,000, including the erection of transmission lines, transformer stations, etc. The total cost of the project is estimated at about $40,000,000.

Miscellaneous

FRONTERA, MEXICO.—Steps have been taken by an English corporation for the development of an electric power project for the State of Tabasco. The plans include the construction of a 31,000-hp. hydro-electric plant at a waterfall on the San Pedro River and the erection of transmission lines to the principal cities and towns. The company also plans to build a large plant for the manufacture of wood pulp

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary, H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa. Annual convention Baltimore, April 27-29.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field Manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill. Meeting, Chicago, March 15-16.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23, Gordon Square Bldg., West 65th St., and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Convention, Atlantic City, May 15-20.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division N. E. L. A. Secretary, Miss O. A. Bursiel 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St. New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting St. Paul, Minn., June 13-15.

Northwestern Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Oklahoma Utilities Association. Manager, H. A. Lane, 1106 First National Bank Bldg., Oklahoma City. Convention, Oklahoma City, March 14-16.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal. Annual meeting, Los Angeles, May 31-June 3.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla. Annual meeting, San Antonio, Tex., May 3-6.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Convention, Spartanburg, S. C., April 1922.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, W. M. Chester, 1108 First National Bank Bldg., Milwaukee, Wis. Annual meeting, Milwaukee, March 22-24.

Wyoming Utilities Association. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

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"Old Men for Counsel"

FOR the next ten or twenty years we shall be working in a different kind of an economic world. Conditions have been altered and the rules of business will be changed in many ways. And he who senses this most thoroughly will be the most successful.

Through the twenty years just passed we have been trading in a rising market. We have grown accustomed to it. We have shaped our methods and our policies to conform to it. It has inclined our very manner of thinking, because these continuing conditions have become the fundamentals of the business world. But now the war has suddenly confused it all and turned things generally topside down.

SO THE wise economists have studied back into old times to find out what we may expect. And they tell us that for twenty years or more to come we shall be doing business on a falling market. And when you stop to think of it, this is a matter of tremendous import. For it means no less than that we all must change our ways of doing business and cease following the guidance of the very rules that we all have learned to trust.

Most of the knowledge which men use in their affairs comes out of the experience of their own times. They learn by what they do and what they see and what they hear. This plus the judgment left recorded by preceding generations forms our practical workday education. We know what we have learned. And now behold what we have learned is not what we must know.

THE present situation, therefore, will demand a new kind of knowledge and a different way of thinking. Much experience gained under the stimulating influences of a habitually rising market will have to be laid aside and unlearned. And the young men whose memories and experiences fail to reach back to the preceding period of falling markets must take counsel with old men to find out what to do.

After the Civil War there was a period of falling prices that lasted for thirty years. Men who lived in business then remember what it meant and how the times of this succeeding generation have differed. From their records and their recollections there can be developed the essential guidance for the men of the more active ranks today. No one can safely trust to himself alone to find his way in a new country. It is with just this point in view that the new problems of the coming years should be approached. *"Old men for counsel"*—here is a bit of well-seasoned advice that may profitably be applied by business men today.

Edward Julian Nally

Pioneer in the field of communication — an executive whose vision and energy are bringing wireless into worldwide use.

IN ALL of the branches of the electrical art there has been no greater development in recent years than in that devoted to radio communication. While it is true this has been made possible only by engineering achievement, nevertheless it required the broad thinking and direction of an executive to bring its benefits into widespread use.

Such has been the accomplishment of E. J. Nally, president of the Radio Corporation of America. Mr. Nally grew up in the telegraph field and came into wireless in 1913 with all of the traditions of wire communication back of him. His, however, has always been the spirit of the pioneer and here he saw an opportunity to build. His many years in the telegraph field gave him a background of experience which has stood him in good stead and has most certainly prevented many false starts from being made in the field of radio communication.

Mr. Nally was born in Philadelphia, Pa., April 11, 1859. He had opportunity for but few years of schooling. At the age of fifteen he was a Western Union messenger boy in St. Louis, Mo. A little later he became office boy for Colonel Clowry, late president of the Western Union, and was advanced to assistant to the superintendent in the St. Louis and Milwaukee districts. In 1890 he joined the Postal Telegraph Cable Company as assistant general superintendent with headquarters in Chicago. Two years later he was general superintendent, and in 1906 he went to New York as vice-president. Later he was elected first vice-president and general manager and continued as such until 1913, when he entered the radio field as vice-president and general manager of the Marconi Wireless Telegraph Company of America.

In all branches of electrical communication Mr. Nally has pioneered. While in St. Lou's he was temporarily in charge of the first Edison telephone exchange, when the Edison telephone was owned and operated by the Western Union Telegraph Company. He prepared the original estimates for the first telegraph lines to follow all of the transcontinental railroad lines. These lines were constructed during the years 1880 to 1900. During the time he was in Chicago as general superintendent the entire Postal Telegraph system in the Middle and Far West was built, and that in the Southwest after his transfer to New York.

Immediately upon his association with the Marconi company, the radio field began to feel the beneficial effects of his energy and vision. He organized the company for commercial service and just before the outbreak of the war arranged for the first commercial radio service between the United States and Europe. Later in 1914 the Marconi company started a similar service between California and Hawaii and in 1916 completed the bridging of the Pacific by starting service with Japan. When on March 1, 1920, the government returned the radio stations to their owners, Mr. Nally established for the first time a direct transatlantic commercial radio circuit. This was with England and was soon followed by similar services to Norway, Germany and France.

Upon the merger in 1919 of the American Marconi interests and the radio activities of the General Electric Company and the American Telephone & Telegraph Company and its subsidiary, the Western Electric Company, into the Radio Corporation of America, Mr. Nally was chosen president. Immediately plans were made for worldwide wireless. A central radio plant for simultaneous communication with the entire globe was conceived, the first unit of which went in service Nov. 5 last. Mr. Nally also was instrumental in bringing about last fall the co-operative agreement between the four principal radio companies of the United States, Great Britain, France and Germany for scientific and commercial radio development.

Editorial Comment

Electrical World, March 11, 1922

Volume 79 Number 10

Advantages of the Budget System in Utility Operation

THE necessity of a sound financial policy on the part of public utilities cannot perhaps be emphasized too often. Any going concern doing an active business must look sharply not only after its receipts and expenditures but also after the sources of money which may be temporarily or permanently needed during the progress of its operations. Most concerns of every kind are attempting to do vastly more business than their actual financial resources justify, which is why some of them get hard hit at times. The ordinary utility, and particularly the light and power utility, can as a rule look forward with some degree of certainty to its probable earnings during the coming year and know to a reasonable extent its probable outgo. It should also know what it sometimes does not—just where any excess demands for money would come from.

If the budget system were systematically adopted, particularly by many of the smaller companies in which contingencies are a large part of the total possibility of expense, the whole business would be put on a safer basis, for at the beginning of each fiscal year, knowing from experience ordinary sources of income as distributed month by month, it would be practicable to arrange in advance for any accommodation that might be needed, to keep reserve resources in sight in case of extraordinary expense through accident or other cause, and to make sure that at least for a twelvemonth ahead the necessities are fully taken into account. The form of a budget scheme cannot properly be standardized. The system must of necessity vary from company to company. The main point, however, is that the same scheme of foresight which has proved itself so valuable on a large scale can be advantageously used in the everyday operations of the smaller utilities.

The Mission of the Engineer

IN HIS enthusiasm for an enlarged field of activities is the engineer losing his sense of proportion and forgetting fundamentals? The engineer is a member of society, owing a duty to the community proportional to his abilities. His profession is, however, only one of many lines of work that go to make up the sum total of human activity. The needs of his profession have forced him to develop certain talents that can and must be made of immense value in the great problems of government and social affairs. The full use of those talents will not be possible until he is able to see clearly the relationship between the theoretical elements of his profession and the practical needs of every-day affairs.

Engineering, broadly speaking, is a method or group of methods by which the facts in any situation are ascertained and a solution is worked out. Much time has been frequently spent by engineers in working out the technical facts in a problem and little or no time in ascertaining the related facts from the other angles. The engineer's job is never well done until he has weighed all the facts, technical, economical and otherwise, and arrived at a decision that properly represents all those facts. His mission in the world is neither greater nor less than that of every individual. It is to do well and faithfully all things that fall to his lot. Many times that will involve results which are bad if judged by purely technical standards. A service rendered by means of which the comfort and health of many are advanced is worth infinitely more than an ideal service that only a few can enjoy.

Ontario's Hydro-Electric Service Most Costly

THROUGHOUT the country there exists a very general and fixed impression that electricity is cheaper in Ontario than anywhere else. Certainly the Hydro-Electric Power Commission of Ontario, which provides the greater part of the electric service in the Canadian province, believes so, and the hundreds of municipalities which purchase their supply from it are also convinced on that point. It must come as a shock to them, therefore, to be told that the exact opposite is the case, and that the privately owned electric utilities of Quebec and the United States not only supply a cheaper service but a better service as well. A very elaborate report containing this conclusion has just been made by W. S. Murray, who conducted the United States government's Superpower Survey last year. Inasmuch as Mr. Murray has also acted in a consulting capacity for municipal and provincial authorities in Canada, his findings gain added weight, since his leaning would naturally be supposed to lie on the side of government.

With the engineering work of the Hydro-Electric Power Commission of Ontario little fault can be found. It is of a high order. For efficiency no hydro-electric station at Niagara Falls is comparable to the commission's Queenston station, which generates twice as much electricity from the same amount of water as any other station there. But when one delves into costs and gets under the surface of things, as Mr. Murray has done, the picture is not so attractive. Last December, when the first unit in the Queenston station was started, we commented on the fact that whereas the Hydro-Electric Power Commission formerly bought its electricity from a private company at Niagara Falls for $9 a horsepower-year, the commission could not now produce it at Queenston for twice that sum. Mr. Murray is not so considerate. Despite his admiration for Sir Adam Beck, he hews to the line and lets the chips fall where they may. The cost of producing a horsepower-year of electricity in the mammoth Queenston station he estimates at $28.05, and as this station will hereafter be the chief source of power for the municipalities in Ontario, the effect of this increased cost on the present rate schedule is apparent.

Of still greater interest is the comparison made between the municipally owned and the private electric public utilities of Ontario, Quebec and some sections of the United States. This is based on official statistics, and the more these are studied the more they reveal. The Canadian statistics, having been gathered by the Dominion government itself, are obviously not open to question. If the Hydro-Electric Power Commission of Ontario, in the light of facts ascertained by the Canadians themselves, now makes such a poor showing, what will be the result when the political camel finally succeeds in forcing its head and then its entire body under the tent? The record of other government-owned systems throughout the world offers no encouragement to believe that the situation will improve, and believers in private ownership will be confirmed in their convictions by the discovery that this god set up in Ontario has feet of clay.

Why Can We Not Learn This Lesson Now?

ELECTRICAL men have long talked about the investment value of the wiring of a house, but they have never made their point especially strong. The installation of electric service, they say, increases the worth of the property, but it has usually been presented as a matter of theory, a bit of argument, another of a list of statements which the salesman advances in his effort to win an order. And so the advantage that should have been derived from one of the most vital considerations in the mind of every home owner has been virtually lost. It has remained for the "home electric" to provide a practical demonstration of the fact that electrical equipment pays for itself immediately with a large measure of profit.

In Louisville they built a "home electric" which the builder estimated should be sold for a certain figure, but when the house was wired and equipped with appliances and the crowds were looking at it his courage grew and he marked it $4,000 higher and sold it at that price. In Cleveland a "home electric" brought $10,000 more than was intended. In California several of the "modern electric homes" that have been so successfully exhibited there were bought at values greater than the owner had expected before the installation of electric comforts turned his houses into homes and made them worth more than they were before. And so it goes. There is an almost unbroken record of such experiences across the country—each case another bit of undeniable evidence that wiring pays, not in some vague, intangible benefit, but in an immediate and concrete increase in real estate value and salability.

Out of all this will come some day a confidence in our own works. Eventually the central-station salesman and the wiring contractor will believe. But, in the words of Pillsbury, "why not now?" The plumbing industry learned this lesson long ago, and instead of selling just a kitchen sink it began to sell bathrooms in every home. It has had the courage and the skill to sell not just the essential length of pipe and anything that would serve in the way of basin, tub and toilet. It has built up the standard of plumbing until today it sells in every home the utmost in convenience, style and luxury that the customer can possibly afford. And yet, with the lesson of all this before him, the electrical man goes on installing wiring—barely enough—and leaving the appliances to be purchased later. The "home electric" is proving time after time that the clothes washer, ironing machine, dishwasher, refrigerator and vacuum cleaner should be made part of the home when it is built, because they add many times their cost to the market value of the house. Why can we not learn this lesson now?

Continental Development Greatly Stimulated by Necessity

LAST week some late news regarding continental practice was summarized by A. Dyckerhoff which gives an excellent indication of the pace set by necessity on the other side of the water. One of the curious effects of the post-war situation, especially in Germany, seems to be the fervid activity of the manufacturing plants due to the general financial situation, and particularly to exchange rates, which has created a demand for electric power to an extent altogether surprising. In industrial districts the central stations cannot take care of the work that is thrust upon them, and many of them are suffering from low power factor, a condition which seems to be even more serious than it is here.

Apparently no generalized scheme for dealing with the power-factor situation has been worked out, the difficulties on both sides of the Atlantic being obviously the same. A good many Continental plants are introducing rates based on the reactive component of load, although they have not yet a suitable single meter for use under this plan. Following American practice, they are using two instruments, one measuring the active component and the other the reactive. Static condensers apparently have not yet established their usefulness, and synchronous condensers, so successful here, are rarely employed. The usual practice is to deal locally with the chief offenders, namely, the big induction motors, by installing electromagnetic devices. They compensate the reactive currents successfully, but at the cost of what seems at first glance to be considerable complication, complication at least as serious as that presented by the synchronous condenser. There may be cases, however, where the specialized phase advancers could be well employed here to meet some particular requirement.

Engine and boiler practice seem to have been pushed further in the direction of economy than in this country, the high cost of fuel being a vigorous stimulant to bettering efficiencies. In some of the large Continental plants efficiencies of 80 to 83 per cent in the boilers have been reached using coal as fuel, while the extraordinary figure of 87½ per cent has been reported with boilers using blast-furnace gas. Furthermore, guarantees as low as 11 lb. of water per kilowatt-hour are being made on 20,000-kw. units when operating at full load. This size of unit or one approximating it seems to be a favorite, although in one instance at least turbo-generators of 60,000-kva. rating have been put into service. More significant is the renewed activity in big gas engines, which in this country have dropped very much to the rear. The biggest units in regular service abroad are about 4,000 kw., operating at efficiencies high enough to give one net kilowatt-hour per 12,500 B.t.u. Vigorous efforts, too, have been made to utilize the exhaust gases from the engines in the generation of steam, and mixed-power plants involving their use have been installed in various places. Particularly significant is the fact that gas turbines also are making headway, some units of substantial size having been already tested with fairly good results.

On the electrical side of advancement particular mention should be made of mercury rectifiers, of which standard sizes in operation now run as high as 500 kw. each, with a promise of more than doubling this figure. The indications are that this apparatus is sufficiently close to a working success on a large scale to demand very close attention on the part of engineers here.

Reducing Cost of Transformer Inspection

THERE has been lately a great deal of discussion regarding the value of transformer inspection. Such inspection, broadly speaking, should include the condition of bushings and leads, the quantity and condition of the oil in the transformer and the condition of the fuses and lightning arresters. When transformers are banked the inspection should also determine whether or not the transformer is damaged after its fuses have been blown. It is evident that when transformers are not banked any complaint of the customer as to service interruption will usually result in finding the trouble at the transformer.

The ruggedness of present transformers has led many to believe that inspection is not necessary. However, if transformers are to be operated at maximum economy, it may be necessary to load them at peak demands to a point not far from the one at which dangerous temperatures would occur. This is particularly true of lighting loads or any load with a low load factor. Moreover, with higher load factors it is not economical to carry overload of equal magnitude. Evidently operation under such conditions requires constant knowledge of what the transformers are doing and therefore makes inspection necessary. In any case it is important to know the economical loading of transformers and to plan as near an approach to this as possible. Then inspection expenses will be a minimum. An overload indicator, easily visible, appears to be the biggest step in this direction that presents itself nowadays to operators.

The Fundamentals of Inductive Interference

IN ALL of the public discussions on inductive interference it has been difficult to obtain a comprehensive view of the entire problem. To list and discuss all of the details would be a practical impossibility because of the scope of the subject and the fact that many of the problems involved are as yet either unknown or very imperfectly known. However, the time now seems ripe to present from legal, technical and business viewpoints the fundamentals that must be clearly realized before a real solution of any of the numerous detail problems can be arrived at.

Fundamentally the problem is a business one in which business men responsible for solving utility problems must find methods of giving the public several phases of service on which the success of the electrical industry is based, at the least possible cost, with the least interference between classes of service in which the public is interested. Public interest is paramount, and it cannot be assumed that users of electric service must choose which classes of service they will have and which they will do without. With this viewpoint in mind there are certain legal obligations and technical considerations on which the compromises that must necessarily be made where the interests of two or more parties are involved will have to be based. In a series of three articles, the first of which appears in this issue, the problem from its legal, technical and business viewpoints will be presented shorn of the technical verbiage which might render it confusing.

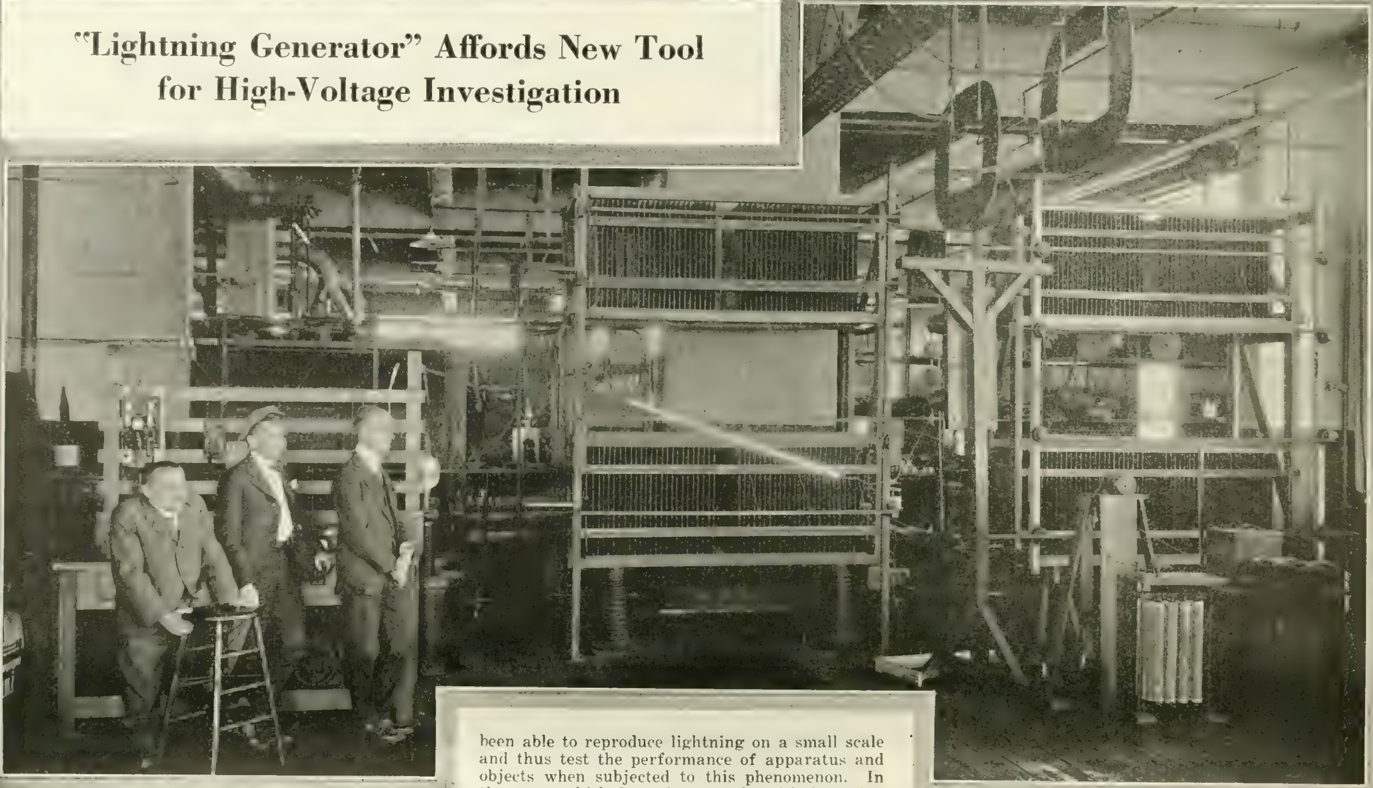
Compromise will be a large factor in the final settlement of any phase of the problem, but haphazard guesswork will not only fail to help but it may complicate the situation seriously. The time has arrived when the fundamental facts must be faced and answers sought to the definite legal and technical questions which will permit of intelligent and effective compromise on the basis of the greatest interest of those who use the service of electric utilities. In the final analysis this is the only true interest of the electrical industry.

Skin Effect in Large Stranded Cables

THE unequal distribution of alternating current over the cross-section of the conductor, commonly known as the "skin effect," is due to the greater magnetic flux surrounding the inner filaments of current, thus increasing their inductance. For circuits containing no iron, inductance, as usually understood, is a property of the dimensions of the circuit alone. For alternating currents, however, owing to the skin effect, the frequency becomes a factor in the value of the inductance. The problem of a statement of the exact value early attracted the attention of electricians versed in mathematics, for the problem is by no means simple. Solutions have been given by Sir William Thomson, Lord Rayleigh, and recently by Alexander Russell, who considers various positions of the return conductor.

For commercial frequencies and the sizes of solid conductor usually appearing in practice the skin effect is negligible. Until recently, therefore, engineers have been content to use simple but approximate formulas, such as that of Steinmetz, giving maximum possible values of the skin effect. With the introduction of the high frequencies of radio transmission and of the large stranded conductors of low-voltage distribution an entirely new set of special cases have arisen, for which neither the exact nor approximate formulas will serve. A recent A.I.E.E. paper by Middleton and Davis gives some interesting experiments with large stranded cables at commercial frequencies. One of the theoretical formulas referred to above indicates that a close approximation to the skin effect may be had by assuming that all of the current carried is limited to a surface layer of conductor of definite thickness, depending on the frequency. This applies to solid circular conductors. In the paper referred to the interesting conclusion is reached that large stranded cables obey the same law if the depth of penetration is calculated from the pitch diameter of the outer layer of strands. The agreement is found to hold for four widely different types of stranding. It is remarkable that there should be this close agreement between an exact theoretical deduction for the case of a solid circular conductor and the measured results on a large stranded conductor which departs radically from the assumptions used in the theory. The agreement therefore must be accepted as a happy outcome for the cables in question. It cannot, however, be safely assumed to hold in the cases of other types of cable nor at other values of frequency. As pointed out by the authors, it is highly desirable that similar experiments be made on other types of cable. If the same agreement can be found for all types of cable, it will be all the more remarkable and fortunate.

"Lightning Generator" Affords New Tool for High-Voltage Investigation



BY MEANS of apparatus which will give a momentary discharge of 10,000 amp. at 120,000 volts, Dr. C. P. Steinmetz, chief consulting engineer of the General Electric Company, and his co-workers J. L. R. Hayden and N. A. Lougee have been able to reproduce lightning on a small scale and thus test the performance of apparatus and objects when subjected to this phenomenon. In the tests which have been made with lightning arresters it has been found that their occasional failure to function properly is due to causes far different from those heretofore imagined. The apparatus consists essentially of 200 large glass plates arranged as a condenser for charging with rectified high-voltage electricity. Although the power and voltage back of the discharge produced are only one five-hundredth of the values for natural lightning, this apparatus will shatter blocks of wood and tree branches. There are prospects of making a still more powerful lightning generator.

Hydro-Electric System of Province of Ontario Investigated

W. S. Murray Finds It Inefficient, Expensive and Wasteful and That, Notwithstanding All the Claims Made for It, Service from Private Utilities in the United States and Canada Is Cheaper and Better

LARGEST AND MOST EFFICIENT STATION ON THE NIAGARA FRONTIER AND YET THE MOST UNECONOMICAL

THAT the Hydro-Electric Power Commission of Ontario, despite its broad powers, the cheapness of its funds and the advantageous location of its generating stations, does not supply such cheap or such reliable electric service as the privately owned electric utilities of Canada and the United States is the statement of W. S. Murray, former head of the United States government's Superpower Survey organization, in a report just made public by the National Electric Light Association.

This assertion is buttressed by a mass of contributory evidence gathered first-hand in Canada by Mr. Murray and Henry Flood, Jr., over a period of six months. The printed report they make contains more than 225 pages and charts. In it the engineers trace the development of the Hydro-Electric Power Commission of Ontario since its inception. They compare its growth and operation with the growth and operation of electric public utilities in the Province of Quebec and in sections of the United States, and give comparable and pertinent statistics on the bonded debt, revenue and operating expenses, taxes, wages, etc., of municipally owned and privately owned Canadian electric utilities.

The investigation was made for the purpose of obtaining complete economic data from which to draw a comparison between governmentally owned and privately owned utilities. This naturally led to a consideration of the political and economical structure of the Hydro-Electric Power Commission of Ontario, which operates the largest government-owned system in existence, and to a comparison between it and others privately owned and operated but subject to public regulation.

In summarizing the results of the investigation, Mr. Murray concludes that no such system of electric service as that operated by the Hydro-Electric Power Commission of Ontario is applicable in the United States, for the reason that it is subversive of American policy and custom and in addition is inefficient, expensive and wasteful. He shows that service rendered by privately owned utilities is cheaper and better than that rendered by governmentally owned utilities, and that even in Ontario, which is generally looked upon as furnishing the most successful example of government-owned utilities, private capital and enterprise have contributed most to the upbuilding of civic, industrial and commercial life.

A complete statement of Mr. Murray's conclusions and of the premises on which they are based is given on page 474.

At the very outset Mr. Murray points out the advantages possessed by hydro-electric stations situated at Niagara Falls. He says:

"The fact should not be permitted to escape for one moment that out of all the power generated for which the Hydro-Electric Power Commission stands sponsor in Ontario, 87 per cent is produced at Niagara, which, through the constancy of flow of the river bearing that name, in combination with a sheer drop at the escarpment at Niagara Falls of 220 ft. and a total drop of 326 ft. between Lake Erie and Lake Ontario within a distance of 27 miles, offers a site unexampled in the world where hydro-electric power can and should be produced cheaply. Therefore, in making cost comparisons with other power systems in the States and Canada, it must be remembered that not only are most of the other hydro-electric systems handicapped through their sites lacking the physical conditions which prevail at Niagara, but, owing to incomparably lesser drainage areas than that offered by the Great Lakes basin, their stream flows have great seasonal variations and, in general, are supplemented by steam-produced power."

COMPARATIVE STATISTICS FOR MUNICIPALITIES IN PROVINCES OF QUEBEC AND ONTARIO

(Derived from publications of the Dominion Bureau of Statistics for 1919)

	—Cities Over 100,000—		From 25,000 to 50,000		From 10,000 to 25,000		From 3,000 to 10,000	
	Quebec	Ontario	Quebec	Ontario	Quebec	Ontario	Quebec	Ontario
Number of cities	2	3	3	2	6	15	24	45
Aggregate population	821,150	715,153	81,824	64,629	91,774	254,246	141,097	229,134
Taxable property—total $1,000	696,859	850,439	40,908	48,673	96,706	169,833	55,304	115,625
Per capita—dollars	849	1,190	505	753	1,155	668	392	505
Bonded debt—$1,000	134,427	133,083	9,227	7,154	13,236	34,664	9,365	15,557
Per capita—dollars	164	187	113	111	145.50	136.50	66.50	68.00
Per cent bonded debt to taxable property—per cent	19.3	15.6	22.5	14.7	13.70	20.40	16.9	13.5
Compulsory taxes—total $1,000	14,727	26,224	674	1,406	1,782	6,263	1,008	4,599
Per capita—dollars	18.00	36.90	8.25	21.78	19.40	24.60	7.10	20.00
Average tax rate—mills per dollar	21.1	30.9	16.4	28.9	18.4	36.8	18.10	39.9
Total ordinary receipts—$1,000	22,527	49,263	1,195	2,454	2,998	11,613	1,886	7,218
Total ordinary expenses—$1,000	24,426	42,500	1,455	2,641	2,676	10,312	2,239	6,983
Excess receipts over expense—$1,000	1,899	6,763	260	187	322	1,301	353	235
Net sum required by taxation—$1,000	16,626	19,461	934	1,593	1,460	4,962	1,361	4,364
Per capita—dollars	20.20	27.20	11.41	24.65	15.90	19.60	9.68	18.95
Net tax rate required to balance receipts and expense—mills per dollar	23.9	22.8	22.8	32.75	15.10	29.20	24.80	37.8
Total ordinary expenses per capita—dollars	29.80	59.50	17.70	40.90	29.10	40.60	13.50	31.60
Per dollar of taxable property—mills	35.1	50.0	35.60	54.20	27.60	60.50	34.20	62.5
Total sinking fund	1,959	4,704	120	73	164	925	320	1,085
Per cent of sinking fund to bonded debt	1.45	3.54	1.30	1.02	1.24	2.67	3.41	6.97
Sinking fund in mills per dollar of assessed valuation	2.81	5.50	2.93	1.02	17.0	26.7	5.8	9.4

The Hydro-Electric Power Commission of Ontario, of which Sir Adam Beck has been chairman since its formation in 1907, is clothed with unusual powers. According to the power commission act it is a public service commission, an engineering company, an electric utility company, a holding company, a construction company, a banker, a manufacturer, a supply dealer and an underwriters' inspection bureau. It has exclusive jurisdiction as to all matters conferred upon it and nothing done by the commission within its jurisdiction is open to question or review in any action or proceeding or by any court. As a matter of fact no suit can be brought against the commission without fiat from the Attorney-General, and to date no fiat has ever been granted.

The Hydro-Electric Power Commission is the trustee for the generating and transmission properties of the utilities of Ontario, and to a very large extent it controls the electrical investments and operations of the municipalities themselves.

The government electric utilities in Ontario have grown from a league of seven municipalities formed in 1907 until now the vested interests of the people in this class of property are represented by investments totaling nearly $200,000,000, the bonded indebtedness of which is guaranteed by the Province of Ontario and which in 1920 represented 70 per cent of the debt of the province itself.

No greater attestation of the faith of the people of Ontario in the Hydro-Electric Power Commission could have been made, says Mr. Murray, than that which is represented in the authority conferred upon it by the laws now on the statute books in the province, and in no man can there exist a greater honesty of mind and purpose than in Sir Adam Beck, who has been the indefatigable leader and chairman of this commission.

The Question of Taxes

All property held by the government electric utilities in Ontario is tax-free with the exception of that applicable to land, so that the effect of taxes on the cost of power in Ontario is insignificant. Nevertheless the report shows that the taxes are not eliminated, they are merely redistributed. In this connection Mr. Murray appends a list of some of the taxes paid by the electric utilities in the districts other than Ontario.

The taxes received from the principal private companies in the Province of Ontario amounted to 7.1 per cent of their annual income, which affected the price of their power by 0.6 mill per kilowatt-hour generated and purchased. For the privately owned electric utility companies in the St. Lawrence Valley of the Province of Quebec the taxes were 6.53 per cent of the annual revenues and affected the cost per kilowatt-hour generated and purchased in the amount of 0.46 mill.

The rate structure as adopted by the Hydro-Electric Power Commission is remarkable because of its complete dissimilarity to anything else in existence.

In Ontario each system has a power center. Immediately in the vicinity of that center the cost of power is minimum. At the point farthest from the power center (measured in transmission distance, not distance in a straight line) the cost is maximum. For example, in 1920 the interim rate for power at Niagara Falls was $11.50 per horsepower-year, while at Windsor, 235 miles away, the cost was $36 per horsepower-year. Several systems of the Hydro-Electric Power Commission overlap zones taken about Niagara Falls as a center, and power sold to a municipality from one system may be at a price more than 500 per cent higher than that sold to a municipality within the same zone, but receiving power from another system.

The commission uses an interim wholesale rate. It is an estimated rate to the municipalities, and at the end of the year the municipality is credited or debited, depending upon whether the actual cost has been respectively lower or higher.

In the 1920 annual report of the commission the interim wholesale rates for 169 municipalities are given, while the actual wholesale rate paid can be computed for 174 municipalities. The highest interim wholesale rates that were quoted in this report were between $80 and $90 per horsepower-year, while the highest actual wholesale rates paid per horsepower were between $150 and $160 per horsepower-year. Altogether, there were nine municipalities which paid a rate higher than the maximum interim rate quoted.

Comparison of Government-Owned and Privately Owned Utilities

A mass of statistics is presented in the report to disprove the claims of the advocates of government ownership. The Province of Ontario in 1920 owned approximately one-half of its electrical utilities, and of the total utility income two-thirds was derived from those governmentally owned, while in Quebec the government-owned utilities, representing but 4 per cent of the investment in that class of property, receive about 5 per cent of the total revenue therefrom.

That the cost of power to the entire people of the Province of Quebec is less than that to the people of Ontario is shown in the report, and it is interesting to note the higher productivity as gained from salaries and wages paid in that province. The revenue per dollar of salaries and wages paid is also seen to be 32.5 per cent greater in Quebec than in Ontario.

In respect to economic operation as between governmentally owned and privately owned electric utilities in Ontario and Quebec, it is shown that the operating ratios between the privately owned and governmentally owned companies indicate a much lower per cent for the former.

Average Cost of Power

Analyzing the actual average cost of power to the consumers per kilowatt-hour generated, the following comparisons are given:

In the Niagara district of Canada the government-owned electric utilities furnish this power at 9.25 mills; the private electric utilities of this district furnish it at 7.6 mills per kilowatt-hour generated, and the weighted average of these two supplies is 8.78 mills per kilowatt-hour.

DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN CANADA FROM PRIVATE AND GOVERNMENT-OWNED ELECTRIC UTILITIES

Item	Unit	Private Electric Utilities	Government Electric Utilities
Total capital invested	$1,000	287,568	128,954
Proportion of capital invested	Per cent	69.0	31.0
Total annual revenue	$1,000	35,553	22,301
Proportion of total revenue	Per cent	61.5	38.5
Total operating expense	$1,000	19,202	15,140
Proportion of total operating expense	Per cent	56.0	44.0
Total generating capacity	Kva.	1,115,494	375,266
Proportion of total capacity	Per cent	75.0	15.0
Operating ratio	Per cent	54.5	67.7
Proportion of operating expense in salaries and wages	Per cent	30.1	36.7
Average salary or wage per employee	Dollars	1,161	1,225
Revenue per employee	Dollars	6,870	4,970
Revenue per dollar of salary and wages	Dollars	5.91	4.05
Revenue from lighting	Per cent	29.2	44.2
Revenue from power and other properties	Per cent	70.8	55.8

In the United States, for a comparable zone supplied by Niagara Falls power, the average price of power to the consumer is 7.65 mills per kilowatt-hour generated. In the Province of Quebec, where power to the extent of 96 per cent is generated by private electric utilities and where the general zone of transmitted power is not unlike that of Ontario, the average cost to the consumer per kilowatt-hour generated is 6.6 mills.

The average cost of power—that is, the revenue per kilowatt-hour generated—for the American Niagara power district is about 17 per cent less than that for the total operations of the Hydro-Electric Power Commission and the municipal commissions for wholesale power delivered in the Canadian Niagara district, and it is about 13 per cent less than that for all the electric utilities in that district.

DOMINION STATISTICS IN RESPECT TO THE COST OF POWER IN QUEBEC AND ONTARIO

Item	Unit	Ontario	Quebec
Total investment	$1,000	$192,908	$130,000
Investment per capita	Dollars	73.50	52.40
Proportion of total capital in government-owned electric utilities	Per cent	49.7	4.0
Total revenue	$1,000	$26,007	$16,554
Per cent of revenue from government-owned electric utilities	Per cent	60.0	5.0
Total operating expense	$1,000	$16,021	$9,326
Generating capacity	Kva.	661,555	497,559
Generating capacity per capita	Kva.	0.252	0.20
Proportion of total capacity in government-owned utilities	Per cent	35	2.8
Revenue per dollar of invested capital	Cents	13.5	12.7
Operating expense per dollar of invested capital	Cents	8.3	7.2
Operating ratio	Per cent	61.3	56.5
Salaries and wages per dollar of invested capital	Cents	3.01	1.94
Per cent of total operating expense in salaries and wages	Per cent	36.3	27.1
Average annual salary or wage per employee	Dollars	1,225	1,055
Revenue per employee	Dollars	5,500	6,920
Revenue per dollar of salaries and wages	Dollars	4.49	6.65
Proportion total revenue from light	Per cent	27.6	26.6
Proportion total revenue from power and Other uses	Per cent	72.4	73.4

Comparing the average cost of retail power to the people residing within the municipalities served by the Hydro-Electric Power Commission in the Niagara district, it is found that the average cost of power to the people in the American district is less by about 4.45 mills per kilowatt-hour, or 40 per cent.

The report also calls attention to the fact that in the American Niagara district for each 1,000 of population a capacity of 65 per cent in excess of that in Canada is used. This greater capacity contains reserve against interruption of service, and notwithstanding a very considerable percentage of capacity in steam-operated, the cost of power to the consumers per kilowatt-hour generated on the American side is less.

Analysis shows that the average cost of power to the people of Quebec is 32 per cent less per kilowatt-hour generated than the cost to all the people receiving hydro-electric power in the Province of Ontario, while it is 27 per cent less than to the consumers in the Canadian Niagara district, whether they are served by government or privately owned electric utilities.

Relation of Capital Expenditures to Revenue

The efficiency of management of an electric utility may to some degree be gaged by the capital expenditure per dollar of revenue received, if the service rendered by the utility is on comparable conditions. This is particularly true when the relation is analyzed over a period of years, rather than for a single year. When the facilities for the production or distribution of power have been placed in operation, the fixed charges must be paid from revenue.

In connection with the operations of the Hydro-Electric Power Commission and those of the municipalities in Ontario, the capital additions in per cent of revenue are greater by 200 per cent than those for the American companies in the Niagara district, and by 350 per cent than those for the Quebec companies operating in the St. Lawrence Valley.

The Queenston-Chippawa Development

Inasmuch as the new Queenston-Chippawa development of the Hydro-Electric Power Commission of Ontario will be the largest in the world and will constitute the commission's chief source of power a large part of the report made by Messrs. Murray and Flood is devoted to it. The cost of the project is dwelt on and its effect on the cost of service in Ontario. Some confusion exists apparently on its probable maximum output, this being variously estimated from 495,000 hp. to 650,000 hp. Operating with a net head of 305 ft., the Queenston station will develop 29.4 hp. per cubic foot of water per second used compared with 14.6 hp. for the Ontario Power Company. Nevertheless, Mr. Murray shows in this report that whereas the Hydro-Electric Power Commission of Ontario formerly purchased 100,000 hp. from the Ontario Power Company at a trifle more than $9 per horsepower-year, the cost of power to the municipalities of Ontario from the Queenston-Chippawa development based on the diversion of water in accordance with the existing international treaty will be $28.05 per horsepower-year plus $9.40 for transmission from Niagara Falls to the municipalities, or $37.45 in all. This is an increase over the cost of $19.80 per horsepower-year stated by the commission in its 1920 annual report of $17.65 per horsepower-year, or 89 per cent. The increase in production cost per horsepower-year at the point of delivery to the Niagara system from $10.40 for 1920 to $28.05 amounts to approximately 170 per cent.

Summary of Conclusions

After a careful analysis of the governmentally owned, controlled and operated electric utility structure as represented in the Hydro-Electric Power Commission of Ontario, I am of the opinion, first, that the principles of its application can find no place in the United States; second, that to attempt the substitution of its principles of control and operation within the States would not only be to strike a blow at economic structures the present existence of which is far better equipped to protect the public interests in their conjunctive relation with the public service commissions of the states regulating their rates, but it would also be to strike an equal blow at the shareholders of the electric utilities which are now serving the American public; and, third, that the Hydro-Electric Power Commission owes its being only to the fact that a public service commission on the order of those operating in the States was not in existence in the Province of Ontario at the time of its creation.

I support the above statement in the following conclusions:

1. Power as applied in Ontario from the governmentally owned and controlled system in associate relationship with the Hydro-Electric Power Commission to be superior in kind to that supplied by the privately owned electric utilities of the United States must be more adequate, more reliable and cheaper. The facts show, however, that the electric utilities of the States hold more power in reserve and sell more energy per capita served; that by that token they can claim a greater reliability of supply and that the supply is cheaper to the consumer.

2. At the end of the fiscal year 1920, out of the total power-plant capacity operated by the Hydro-Electric Power Commission only 23 per cent was constructed by the Hydro-Electric Power Commission. The remainder represents plant capacity constructed at the initiative and risk of private investors, and in acquiring ownership of it such intangibles as franchise rights, good will and other intangibles were included in the purchase. This intangible cost, therefore, is represented in power "at cost." If a governmental plan of like characteristics to that of the Hydro-Electric Power Commission is to be inaugurated in the United States, it must include the purchase of or the contracting of power from existing utilities, and the same problem of including intangibles will be presented here.

3. The building of new power-plant facilities under the auspices of governmental ownership, as shown in the cases of Nipigon and Chippawa, both in respect to policy and cost, is not to the economic interest of the people.

4. The advocates of government or municipal ownership of electric utilities claim reduction in the cost of power in virtue of (a) elimination of taxes, (b) elimination of dividends, (c) elimination of high-salaried executives, (d) more economical wage and higher efficiency in labor scale.

With regard to (a), taxes are not eliminated. Just as much money in taxes is paid. The difference is in their distribution. In the case of private ownership, only the users of service pay the tax bill, while in the case of government-owned utilities all the people pay the bill.

With regard to (b), (c) and (d), notwithstanding dividends, high-salaried executives and the wage and labor claim, the answer is that, when the total operations are summed up, the people receive the power at less cost through private ownership under regulation.

5. The investment of capital in electric utilities under private interest control is far better protected from extravagance than when that capital is governmentally owned, for the reason that plans and estimates for such capital expenditures not only must gain the approval of a trained engineering and managerial staff and an experienced board of directors of the companies, but it also must have the critical review of the banker and the private financial investor. In the case of government-owned utilities the directing heads are seldom specifically trained in the business under their jurisdiction, and value of securities is not based upon the value of the property or the efficiency of management, but upon the taxing power of the government.

Arms, legs and body are useless without the head. A high-salaried executive usually saves many times (his salary included) the losses incurred by the cheaper and less efficient executive. Accomplishment by individuals in control of private enterprise is under keener observation than is the case when those in charge are governmental or municipal officers.

6. Governmental ownership eliminates all incentive for gain and throttles initiative. This is evidenced by the far greater growth of privately owned utilities.

7. The Hydro-Electric Power Commission is the judge of its own acts. A commission cannot fairly be the judge of its own (and others') rights in contentions.

8. Honesty of purpose does not necessarily reduce the power bill. The structure under which it is administered counts just as much—so far as the price is concerned.

9. The American companies in the Niagara district are supplemented by steam power far more than those on the Canadian side, and yet on the American side power is being furnished at less cost to the people.

10. The commissions of the States fully realize that protection to the people lies in protection to the electric utilities from which they are receiving power. The authority delegated to them to regulate rates, and the constitutionality of the law standing behind any action on their part or on the part of the electric utilities, provides a structure constructively balanced to do justice to all parties.

How to Organize and Conduct a "Home Electric"

A Detailed Plan to Guide the Selection of the House and Its Furnishing, Equipment and Operation, Based on the Experience Gained by the Successful Carrying on of Three Such Homes in Cleveland

By **J. E. NORTH**
Commercial Agent Cleveland Electric Illuminating Company,
Chairman Electrical League of Cleveland

THE MOST CONVINCING ARGUMENT POSSIBLE FOR THE HOME ELECTRIC IS THAT THE PEOPLE COME AND SEE. NEARLY 35,000 VISITED THIS HOME IN CLEVELAND, BECAUSE THEY WANTED TO KNOW MORE ABOUT MODERN ELECTRIC COMFORT

UNDOUBTEDLY the "home electric" idea has at last sold itself to the electrical men of America. There have been "home electric" demonstrations for many years and in many cities, and so far as I know they have all of them been successful measures of educational publicity. But the idea took hold slowly and much time has passed. Today, however, there seems to be a well-formed wave of interest sweeping across the country, and we are continually hearing of some new "home electric" demonstration, the good news coming from New England, the Atlantic States, the South, the Middle West, the Rockies and the Pacific Coast. It has become a national movement and great benefit will result from it, because every "home electric" gives a fundamental education in the uses of electrical appliances in the modern home which is of more influence as a selling force than years of ordinary advertising and canvassing from door to door.

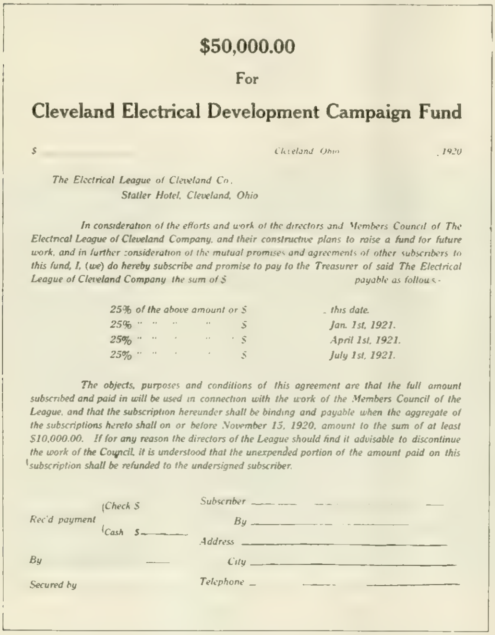
Last year in Cleveland three "home electric" demonstrations were organized under the management of the Cleveland Electrical League. Out of these three homes came experience and data that will prove invaluable to us in the organization of the fourth "modern electrical home," which we plan to open this June. I have felt, therefore, that it might be of very definite benefit to other cities where similar exhibitions are in prospect to resolve this experience into the form of scheduled recommendations that will give some guidance as to how to conduct a "home electric." These suggestions are offered, not with the idea of setting up our solution of this problem as perfect, but merely in the hope that they may be helpful, as they are based on actual experience and careful deductions from it.

Our three "homes electric" were features in a larger program of co-operative electrical development for which a fund of $68,000 had been subscribed by the electrical interests of Cleveland. It embraced also a school of salesmen, a scholarship contest based on a course of study in electricity and its uses, an industrial lighting exhibit, a commercial lighting demonstration and a broad program of educational publicity. The project for each of the homes was developed in co-operation with a builder, and we selected our locations, picked our property, planned our homes, built them and furnished and equipped them complete through the cooperation of local merchants, organizing and conducting each demonstration entirely under the direction of our own committee.

Of course, no orders were taken and nothing was sold. We were selling an idea only. Yet a large accumulation of evidence gave convincing proof of the great value of the tremendous opportunity to demonstrate thoroughly the convenience of electrical household equipment to so many people. The educational influence, we know, has been far-reaching and has led to the building and selling of many homes with up-to-date installations, the wiring of many convenience outlets and the sale of large numbers of appliances. And such is the history of every similar enterprise. Out of this experience I have drawn up the following suggestions as a plan for the organization and operation of a "home electric," and I believe that they will apply in almost every community.

HOW TO PUT ON A HOME ELECTRIC

1. *Time of Year for Exhibit.*—May or June is the most desirable time. People at that season are just getting away from the fireside and are most responsive to opportunities for diversion. September would be third choice of months, when attendance would be the least affected by the weather.



$50,000.00

For

Cleveland Electrical Development Campaign Fund

$ Cleveland Ohio 1920

The Electrical League of Cleveland Co.
Statler Hotel, Cleveland, Ohio

In consideration of the efforts and work of the directors and Members Council of The Electrical League of Cleveland Company, and their constructive plans to raise a fund for future work, and in further consideration of the mutual promises and agreements of other subscribers to this fund, I, (we) do hereby subscribe and promise to pay to the Treasurer of said The Electrical League of Cleveland Company the sum of $ payable as follows-

25% of the above amount or $ this date.
25% " " " " $ Jan. 1st, 1921.
25% " " " " $ April 1st, 1921.
25% " " " " $ July 1st, 1921.

The objects, purposes and conditions of this agreement are that the full amount subscribed and paid in will be used in connection with the work of the Members Council of the League, and that the subscription hereunder shall be binding and payable when the aggregate of the subscriptions hereto shall on or before November 15, 1920, amount to the sum of at least $10,000.00. If for any reason the directors of the League should find it advisable to discontinue the work of the Council, it is understood that the unexpended portion of the amount paid on this subscription shall be refunded to the undersigned subscriber.

Rec'd payment (Check $
(Cash $
By
Secured by

Subscriber
By
Address
City
Telephone

THIS FORM OF CONTRACT WAS USED BY THE ELECTRICAL LEAGUE OF CLEVELAND IN FINANCING THE CO-OPERATIVE HOME ELECTRIC PROJECT

2. *Sponsoring the Movement.*—The object being educational in nature, care should be taken not to give it a commercial aspect; consequently the movement should be sponsored by an electrical league or club and not by any individual sales organization. If need be, form a league, club or electrical information society.

3. *Forming Committee.*—The chairman should be a man who has ability and enthusiasm and can devote the time necessary to check up every detail. It is suggested that the committee include one representative each from the central-station company, the manufacturer (wiring devices), the jobber, the residence wiring contractor, the lighting-fixture dealer, the furniture dealer, the builder and one man to handle publicity and advertising.

4. *Electrical Home Fund.*—After estimates have been made and a budget set up it should be agreed by all concerned with the project that a thing worth doing is worth doing right. Absolute control of the exhibit must be held by the electrical group; otherwise the so-called electrical home exhibit may turn out to be a furniture show, a builders' show, an art museum, or something other than originally planned. Be sure to hold control, and the best way is for the electrical interests to put up most of the money. The three homes in Cleveland were financed by electrical men, no outside interests having been asked to contribute to the fund. Contributions to the general fund were made by the following groups in the percentage indicated: Central-station company, 33.22; jobbers, 23.91; manufacturers, 22.44; lighting fixture dealers, 5.82; industrial and commercial contractors, 5.74; appliance dealers, 5.33; residence wiring contractors, 3.46. It is a wise plan to have the money in the bank before obligations are contracted.

5. *Subscription Agreement.*—The accompanying form of contract was used to secure subscriptions to a general fund of $50,000, in which the electrical home budget was included.

6. *Selecting Builder.*—If possible, arrange with a liberal advertiser to build the home, one who will agree to spend more than usual for wiring and fixtures and who understands that a few dollars will have to be spent in retouching after the exhibit. I did not inquire about this item of expense with the second and third homes, but with the first home the builder's total expense for cleaning spots from walls and revarnishing floors was $59.

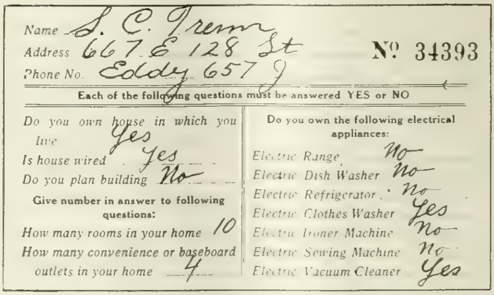
The builder should be one who appreciates the first opportunity of its kind in the city for a home builder to put across his ideas in building to thousands of people who otherwise would never inspect one of the homes which he builds. He must give his full co-operation and turn the house over to the committee without rules and regulations governing the exhibit, demonstrators and visitors.

7. *The Furniture Dealer.*—Select a "live" one that sells moderate-priced furniture—one willing to furnish the home from basement to attic and include floor covering, curtains, draperies, bedspreads, everything. None of the furnishings should be very elaborate and novelties should be discouraged.

The furniture dealer who furnished our homes used plain but good furniture. The curtains and draperies were made of good material that harmonized with the home. In the second home draperies had a retail value of $1,400 and were made to order, the dealer taking a chance on selling them with the home. We were obliged to remove a handmade bedspread because at times it was the only thing in the room that attracted attention. No other exhibits, such as paintings or anything that will detract from the electrical features, should be permitted.

8. *The Location of Home.*—When considering the location of the home, it is better to select a builder whose principal business is to build and sell houses, rather than a real-estate dealer and builder. Our homes No. 1 and No. 3 were built on the only vacant lot on the street, and No. 2 was almost entirely surrounded by houses, some of which had been completed for many years.

The home should be accessible and on the street most used by automobilists. In these days it need not be on a car-line street. However, it is preferable to have it convenient to the car line. If possible, avoid the undeveloped "new addition" in choosing a site. We assisted in the selection of a site by visiting a number of vacant lots previously inspected by the builder. The builder then purchased the lot agreed upon as the most desirable.



Name S. C. Tremm
Address 667 E 128 St
Phone No. Eddy 657 J
№ 34393

Each of the following questions must be answered YES or NO

Do you own house in which you live	Yes
Is house wired	Yes
Do you plan building	No
Give number in answer to following questions:	
How many rooms in your home	10
How many convenience or baseboard outlets in your home	4

Do you own the following electrical appliances:

Electric Range	No
Electric Dish Washer	No
Electric Refrigerator	No
Electric Clothes Washer	Yes
Electric Ironer Machine	No
Electric Sewing Machine	No
Electric Vacuum Cleaner	Yes

THIS REGISTRATION CARD WAS USED IN CLEVELAND AND PROVIDED AN EXCEEDINGLY VALUABLE SURVEY OF HOUSEHOLD CONDITIONS

9. *Kind of Lot on Which to Build.*—The lot should have width enough to allow a reasonable amount of space on each side. The depth should permit building the front line of the house at least 40 ft. from the sidewalk. Then, with floodlamps in front and color from the shades in the interior, the appeal of the house is seemingly irresistible.

10. *Value of Home.*—All classes of people are interested in the more elaborate high-priced home. Out-of-the-ordinary architecture adds to the attractiveness. Columns and what some called "gingerbread architecture" on our most expensive home ($48,000) made it the most desirable show house.

When our modern electric home campaign was planned we were of the opinion that the inexpensive wage-earner type of home should be chosen for the display. We are now agreed that the wage earner will visit the high-priced home for the suggestions it offers, and he learns that many of the things on display are within his reach; but the same person has not the same curiosity or interest in the home of the type in which he is accustomed to live.

11. *Architect's Plans.*—When plans are submitted they should be carefully considered, perhaps first by the furniture-dealer member of the committee to make sure that the best possible provisions have been made to accommodate the furniture. The same care must be exercised to provide suitable places for some of the electrical appliances.

The route which visitors are to take should be considered. Perhaps arrangements for connecting doors or omission of closet partitions will facilitate the handling of visiting groups. After the location of all furniture and equipment has been agreed upon, then the outlets can be located and specifications prepared.

THE THREE "MODERN ELECTRIC HOMES" EXHIBITED IN CLEVELAND LAST YEAR. THE HOUSE AT THE LEFT WAS NO. 1, THE UPPER HOUSE WAS NO. 2 AND THE ONE AT THE RIGHT WAS THE THIRD. EACH HOUSE WAS SOLD DURING THE DEMONSTRATION

12. *Wiring the Home.*—All residence-wiring contractors who assist in financing the electric home exhibit should be permitted to bid on wiring. In our case bids were asked from the members of the Residence Wiring Association, and although each contract was awarded to the lowest bidder, the sign on the exterior read "Wired by the Residence Wiring Association of Cleveland."

At the time wiring is being installed the committee should visit the home to check the outlets as specified in the plans. Frequently it is found advisable to move an outlet or add one that has been unintentionally omitted.

13. *Selecting Lighting Fixtures.*—Fixtures can be best selected by a committee composed of a lighting fixture dealer, a builder and a furniture dealer. The committee should agree upon design of fixture, glassware, shades and size of lamps to be used and then draw up specifications for fixtures as found best. These may be furnished by a few or by a drawing of rooms. All fixture dealers may have a chance to install one or more fixtures.

In Cleveland a committee from the Lighting Fixture Dealers' Society selected designs and presented them to the electrical home committee for approval. Then orders were placed with local lighting-fixture manufacturers. Lighting-fixture glassware was distributed among glassware manufacturers.

14. *Selecting Appliances.*—The assortment of appliances to be displayed should be determined by the committee, then a questionnaire mailed to each contributor to the fund who might be able to supply one or more of the appliances, the names of all appliances which will be loaned for the exhibit to be filled in by the contributor and the questionnaire returned to the committee. Cards can then be used to list each make of appliance, and from these each appliance can be selected by drawing any number within the limits of the total number of makes listed. A public drawing eliminates complaints.

15. *Demonstrators.*—If possible, employ special demonstrators who can be made to understand the object of "selling" the public as regards the use of the things on display and not the particular make of articles in the exhibit. It is my opinion that this is the only way to guarantee harmony during and after the exhibit. At least five demonstrators should be provided, one each for living room, dining room, kitchen, bedroom and laundry. All of the bedroom and bathroom appliances, as well as the sewing machine, can be displayed and explained from one bedroom. It is preferable, however, to divide these articles and add another demonstrator to work in the second bedroom.

At the opening of the first home we were of the opinion that only demonstrators with electrical experience could be used. Later we employed two very capable girls and had no difficulty in training them to lecture on and demonstrate equipment in certain rooms. I think, if necessary, inexperienced help can be used in every room, except possibly the kitchen and laundry.

Electrical home organization required: Five or six special demonstrators; one doorman to receive visitors and have full charge of home; one night watchman who will do porter work; one maid.

16. *Electrical Energy.*—An estimate must be made on this item unless no charge is to be made.

17. *Miscellaneous Items of Expense.*—Lamps, cleaning supplies, brooms, mops, bathroom supplies, fire and liability insurance, must be provided.

18. *Registration Cards.*—We used 3-in. x 5-in. registration cards at the second and third homes. The lucky name was drawn at 10 p.m. each night, and the prize awarded was either a flatiron, a radiant heater or some inexpensive appliance. About 85 per cent of the visitors filled out cards on which we asked for various information.

The registration counter should be in the basement. Pencils should be provided, attached to strings. A box for the cards should be conveniently located. Modern electric home booklets and registration cards can be explained and given out by the laundry demonstrator. Booklets or cards when given out at the front entrance cause visitors to pay less attention to lectures and exhibits.

19. *Hours Open to the Public.*—Our first home was open from 10 a.m. to 10 p.m. With the second and third homes the hours were changed from 1 p.m. to 10 p.m. We do not think that the attendance was affected by the change, and with the latter plan there was less difficulty in arranging a schedule for the persons employed at the home. Half of the demonstrators were off for dinner from 4 p.m. to 5:30 p.m. and half from 5: 30 p.m. to 7 p.m. Each female demonstrator was given one afternoon off from 1 to 5:30 o'clock to reduce her time to the hours permitted by state law.

20. *Handling Visitors.*—Lectures that can be given in from three to five minutes should be prepared and demonstrators trained in advance of the opening date. Throughout the period of operation there will be slack hours and busy hours. For the slack hours a five-minute, or possibly a ten-minute, schedule can be arranged.

A TYPICAL SCENE DURING THE SECOND HOME ELECTRIC IN CLEVELAND, WHEN AN AVERAGE OF 1,199 PEOPLE VISITED THE DEMONSTRATION DAILY FOR FOUR WEEKS

For example, during the slack hours visitors can be seated in the living room until time for the next lecture to start; then the group can be passed on in a systematic way through each room, unless, however, the number in waiting reaches, say, fifteen people. Then the lecture should be started at once and new arrivals held at the front entrance until the living-room lecture is completed and that group has passed on to the next room. To explain our method of handling visitors, I will outline a trip through house No. 2:

Lecture No. 1: In living room, on lighting the home, portable lamps, the importance of convenience outlets, electric piano, talking machine, electric logs, fan on hanger.

Group was then passed through sun room and back through living room, then upstairs, where it was directed to bedroom No. 1. No lecture was given in this room. After inspecting this room the group was then directed to bedroom No. 2.

Lecture No. 2. In bedroom No. 2, on heating pad, blanket, vibrator, violet ray, sewing machine, radiant heater, bed and dresser lighting brackets, "elexits" and convenience outlets. Group was then passed on to bedroom No. 3.

Lecture No. 3: In bedroom No. 3, on master switch, curling iron, hair dryer, vacuum cleaner, milk warmer, "elexits" and convenience outlets. Group was then directed to bedroom No. 4, which was furnished for inspection.

During the busy periods every evening and Sunday afternoons the groups on the second floor were directed by a man in the upstairs hall. On signal from the man at the front door, group in bedroom No. 4 was directed to dining room.

Lecture No. 4: In dining room, on lighting fixture, teapot, coffee percolator, toaster, egg boiler, fan on hanger, floor outlet, candlesticks on buffet and convenience outlets in wall, 36 in. above floor for convenience in connecting heating appliances and vacuum cleaner. Demonstrator then called attention to triple receptacle at level of breakfast table, the waffle iron and grill, which was inspected as group passed through the breakfast room to kitchen.

Lecture No. 5: In kitchen, on range, dishwasher, power table, refrigerator, water-heater switch, flatiron and pilot lamp. Group was then directed to basement.

Lecture No. 6: In basement, on refrigerator equipment, clothes washer, centrifugal dryer, electric air dryer, ironing machine, water heater, ice-cream freezer, bell-ringing transformer, furnace regulator, stationary vacuum cleaner and foundation meter box. After this lecture announcement was made concerning electric home booklets and registration cards. After registering and depositing cards in box, visitors passed out the back door to the garage, which should be used to exhibit electric pleasure vehicle and garage lighting and equipment. We did not avail ourselves of this opportunity.

At this home the builder set up an office on the back porch, and all inquiries made to demonstrators were referred to his representative, whom each visitor was obliged to pass after leaving from the back door. Demonstrators should not be permitted to participate in sale of house.

Naturally one of the first questions in connection with any project is concerning the cost; therefore I would suggest that a budget be prepared after making estimates on the following items of expense:

21. *Newspaper Space.*—

	Inches Morning Paper	Inches Evening Paper
Second day prior to opening	75 (five col., 15-in.)	75
First day prior to opening	75 (five col., 15-in.)	75
Day of opening	75 (five-col., 15-in.)	75
Second day	20	..
Third day	..	20

and 20 in. every other day in each paper during exhibit.

22. *Booklets* — Original order should be on basis of 5 per cent of the population, giving one booklet to each family—printer to hold form in the event that more copies should be needed. We distributed 43,800 sixteen-page booklets, only for visitors at the homes. Booklets will cost from 4 cents to 6 cents each, depending upon amount of art work, stock and quantity.

23. *Special Invitations or Announcement Cards.*—Make estimate on basis of 100 for each electrical firm in city, these to be inclosed with statements, letters, etc.

24. *Special Letters.*—These should be sent to each architect, builder, general contractor and real estate man in the city. Another form of special letter should be sent to the president of each woman's club, specifying the date on which members are invited to be guests at the electrical home. From one to three clubs, if necessary, can be invited for the same day. Announcement cards can be inclosed with letter.

25. *Exterior Illumination.* Not fewer than four floodlamps should be used to illuminate house front and rear.

26. *Arrows.*—A hundred arrows, 3 ft. long, 8 in. wide, ⅞ in. thick, painted with white background and red letters, "To the Modern Electric Home," should be provided and placed on poles 8 ft. from ground on all principal streets near and leading to the home. These will cost from 50 cents to $1 each.

27. *Auto Signals.*— Special waterproof signs may be provided for all automobiles and trucks owned by electrical men, and by the builder and the furniture dealer who furnishes the home. These may merely announce the opening dates of homes.

28. *Billboards.*—Use of billboards is not advised unless locations are the most desirable in the city.

29. *Street-Car Cards.* — Inside cards are not advisable. Car cards should be used if space on front or back of car can be secured.

30. *Window Cards.*—In large city, *no;* in small city, *yes,* provided that card which has been prepared for some other use can be used in windows.

31. *Special Publicity Stunts.*—(a) Christening home on opening date. Contest can be conducted prior to opening. High-school students to vote for the most popular girl to christen home. Most newspapers will conduct contest of this kind gratis. Award prize to girl. (b) Flag raising on opening date by most popular club woman. (c) Arrange for some popular motion-picture actress or some noted person to visit home.

32. *Co-operative Advertising.* — Arrange with all electrical advertisers to give space to the electrical home in connection with their advertising. If possible, have the builder and furniture dealer put all that they would spend for advertising in the general publicity fund and give credit to each in all advertisements.

33. *Cost and Attendance (Cleveland).*—

	Value of Homes	Date Opened	Days Open	When Sold	Number of Visitors
Home No. 1......	$37,000	May 15	32	Fourth week	34,354
Home No. 2......	48,000	Sept. 11	29	Second week	34,790
Home No. 3......	17,000	Oct. 13	29	Second week	13,965

Record of visitors by man at front door with hand counter; attendance at third home affected by location, kind of house, and 10 days rain or snow.

34. *Cost of Wiring and Fixtures (Cleveland).*—

	Cost of Wiring	Per Cent of Home Cost	Cost of Fixtures	Per Cent of Home Cost	Total Cost Wiring and Fixtures	Per Cent of Home Cost
Home No. 1............	$654	1 96	$759	2.28	$1,413	4 24
Home No. 2............	800	1.85	618	1.43	1,418	3.28
Home No. 3............	425	2.77	350	2.28	775	5.00

Average wiring cost per outlet: No. 1, $5.50; No. 2, $5.67; No. 3, $5.52.

Calculations made on basis of home cost being 90 per cent of selling price.

35. *Total Expense and Net Cost per Visitor (Cleveland).*—

	Net Expense	Cost per Capita*		Net Cost per Visitor
Home No. 1..........	$6,718.07	$0.0074		$0.19
Home No. 2..........	5,048.33	0 0056		0.14
Home No. 3..........	2,928.61	0.0032		0.20
Total..............	$14,695.01	$0.0162	Average	$0.176

* Population of Greater Cleveland, 900,000.

36. *Comparison of Costs for Visitors to Electrical Home and Electrical Show (Cleveland).*—Average of $0.176 per visitor to electric homes. Electric show 1920, gross cost per visitor, $1.52. This does not include gratis car card space for 1,200 cards, three 40-ft. illuminated boards, one electric sign on public square, or gratis newspaper space, the value of which has not been calculated.

Some Thoughts on Standardization

The Evolution of Electrical Standards—The Spirit that Has Made Them Creative and Progressive Rather than Restrictive—The Future Need in the Effort for Still Fuller Service

BY E. W. RICE, JR.
President General Electric Company

FROM the beginning electrical work has been naturally attractive to the bold spirit of youth. Its leaders without exception were mere youngsters or relatively young men. Whatever standards or rules were found necessary or thought desirable for the industry were made by these young men, grown a little older, aided by a countless host of other young spirits, better trained in formal science but no more enthusiastic than the early pioneers.

I think we have here the reason why these rules or standards have not cramped and paralyzed the industry, but have rather aided it. They were made by those who were busily engaged in developing the same industry. Care was taken that the rules should guide development, not restrict it. The standards were made by those who were to obey them; they were made by, with and for the benefit of those who had created and were using the products of our great scientific industry. This, I submit, is as it should be, and I firmly believe that any other method would have been unfortunate, if not disastrous.

Our industry is more firmly based upon science perhaps than any other, and electricity could not have become the important branch of scientific endeavor which it is today without the early work of those greatest of all standardizing committees, the international electrical committees, which between 1893 and 1900, at different places, determined and defined our fundamental and practical electrical units—the ohm, volt, ampere, watt, henry, coulomb and others; so that all those engaged in electrical work think and talk the same language. We suffer no such handicap as has existed in other fields, such as is imposed, for example, by the different monetary units and the variety of standards of weights and measures, with the resultant waste of time and energy.

In the beginning of our industry, back in the eighties of the last century, there was, of course, no need for commercial standards as no industry existed. It is interesting, however, to remember that very soon after the electric arclight began to be used for commercial purposes the need of a standard current for the series arc circuit was felt. Early in 1881 9.6 amp. was selected by Prof. Elihu Thomson of the Thomson-Houston Company, and this continued to be the standard of the industry for many years. Edison also adopted about the same time a standard of 110 volts for his incandescent lamp. I am informed that a committee of the Power Club in co-operation with a committee of the National Electric Light Association has adopted standards which in the case of transformers have effected large reductions in the number of listed specialties, odd rates, voltages and sizes. The elimination of such apparently useless variations has been estimated at between 50 per cent and 60 per cent of the total listed units. Such action must increase the effectiveness of the engineering and sales personnel and improve the quality and reduce the cost of the service rendered by the manufacturing companies to their customers and to the public.

Need for Standard Plugs

Naturally, I am an enthusiastic user of the many electrical devices which have been developed in recent years, such as percolators, fan motors, vacuum cleaners and toasters; but as these various devices were introduced into my home I found that each one required the use of a different type of attachment plug. Each different plug represented, I was informed, a great advance in the art. Unfortunately, the new plugs did not fit any of the types of wall receptacles already installed in the house. I understand that the Associated Manufacturers of Electrical Supplies have co-operated in the standardization of the attachment plug and wall receptacle now known as "convenience outlet," and this work of standardization has my profound respect. It will add to my comfort and peace of mind in my declining years.

It is gratifying to note that it has been fully recognized by our manufacturing organizations that in many instances the field of standardization is so broad that co-operation with other organizations and societies is necessary and that a spirit of good sense and friendly co-operation has been displayed in all such cases. I trust, however, that no one will imagine that because I am stressing the value of standardization I am not alive to the necessity and desirability of progress and to the fact that this involves increasing complexity. I believe it is essential to guard and preserve individuality. Variety is still the spice of life. Electricity has made its enormous progress because of its ability to meet the infinitely varying conditions of our industrial, city and home life. It can transport matter, transmit thought and transfer energy in its most useful form with maximum economy and almost without limitation. New methods, new ideas, new devices are therefore to be encouraged and are the life-breath of our industry.

However, variety which is the result of haphazard methods of growth, variety based upon ignorance or prejudice, or which merely exists for the sake of itself, is of doubtful economical value at best and may easily become a source of great economic loss. It is a useless by-product of our advancing industry.

Influence on Costs

I think it is obvious that we of the electrical manufacturing industry and those we serve have not obtained the benefit which should follow the increased volume of our business, for the reason that the variety of sizes and the number of different units have increased generally more rapidly than either the increase in total number of units or the volume of business measured in dollars. The inevitable result has been to increase the "overhead," or the cost, not only of manufacture, but of distribution of the units of industry. I believe that if our industry is to continue to grow and increase its service to the public as it could and should, our costs must be reduced. I am sure that we shall all agree that if the number of separate units could be reduced, the total cost of production and distribution would be materially lowered. This would redound to the benefit not only of the manufacturers, large and small, but of all those connected with the distribution of our product and be of equal benefit to our real employers, the public. I believe that a large reduction in the number of sizes and varieties can be made, not only without sacrifice of real service to the public, but with an increase in the value and improvement in the character of our service. It cannot be done by any manufacturer alone; it can only be brought about through the co-operation of all interested parties.

Full success will require a sympathetic attitude on the part of our governmental authorities at Washington, which apparently now happily exists. All these organizations of ours have a great opportunity and an equal responsibility. Splendid work has already been done, but we should, in my judgment, patiently but vigorously continue the work to the end that our profession and business may render that full service to man which we all visualize, but which so far with all its importance is but a promise of a greater and more useful future.

Development of Austrian Water Powers

SINCE the end of the world war stress has been laid on the fact that exploitation of her water powers is a vital necessity to Austria, with her new restricted frontiers. It has taken about three and a half years to find a way in which to start this large and useful task in earnest. It was necessary to clear up the legal position as regards water power, to pass bills with a view to specially favorable treatment regarding taxation and to draw general and detailed plans. This preliminary work in a region which previously had been neglected has involved much time, trouble and expense, especially as certain interests at variance with each other had first to be reconciled. It appears that all difficulties to the development of the water powers of Austria have now been removed. The most important question is, perhaps, that of financing, and even this question may now be considered as solved. The progressive depreciation of money has made it impossible to take the direct routes heretofore known, and new methods had to be found by which investing capitalists were offered complete security against further depreciation.

The most important water powers in Austria are in the Province of Styria. The immediate development of the water powers of this province is planned. Styria has reserved to itself all rights of granting concessions and has combined all important water-power concessions resembling a monopoly in a limited company in which the province itself is a shareholder. It appears that the present plan is that a combined working of all valuable water powers shall be arranged in such a manner that plants on rivers the flow of which varies considerably shall be supplemented by storage plants in the mountains and by steam plants in brown-coal pits. The plants, united under one control, are to average their output by high-tension mains and in this manner put to profit all the energy which it is possible to extract from the water powers. The total concessions to be exploited provide for 450,000 hp., which is about one-fifth of all the water powers in Austria possible of development. The entire project is to be finished in fifteen years.

Legal Phases of Inductive Interference

Definition of Mutual Responsibilities of Power and Signal Systems Must Be Developed—Present Legal Status Confused Because Few Decisions Have Been Made on Broad Fundamental Principles

THERE are certain legal aspects of the inductive-interference problem that must be definitely analyzed and formulated. This statement does not mean that answers to the questions involved must be obtained through court and commission action. Such a course is one of the ways, but the process would be a long and expensive one. Public resentment would be aroused at many stages, and in the end it is doubtful whether the result would be satisfactory to any one. The shorter and easier course would be recognition by the interested parties of certain fundamental propositions that must eventually appear in legal form and a mutual working out of the details of the problem. Either through the course of legislation or the example of consistent practice, the establishment of fundamental considerations should be allowed to come about in a logical and natural way. It is the aim in what follows to state some of these fundamentals without in any way placing the responsibility therefor, except the responsibiity that none can escape, which is the duty so to conduct the electrical industry that the fullest service is rendered to the greatest number and that the industry itself may develop along those lines that best meet the needs of the public from both the physical and the economical viewpoint.

Nature of Systems Involved

Broadly, two systems, which may be classed as power and signal systems, are involved. The operations of both are based on the same fundamental principles, and the manifestations of energy that cause the so-called inductive-interference problem are not confined to circuits of either system, but can be found within either system or between circuits of the two groups. Underlying the specific problem that has become known by the name of inductive interference are certain inherent tendencies that need to be thoroughly realized. They are not peculiar to either system. These tendencies may be stated as follows:

1. A signal circuit, including its connected apparatus, is inherently a sensitive one, operating with minute current and energy values. It is sensitive in varying degrees, with harmful results, to inductive influences either from paralleling signal circuits of the same or different character or from power circuits which it parallels. The character of construction and operating methods used within the signal system can accentuate or decrease sensitiveness to the inductive influence of paralleling circuits.

2. A power circuit is not sensitive to harmful interference caused by induction from paralleling circuits of any nature. It exercises an inductive influence on paralleling circuits that can be accentuated or decreased by the character of construction or operating methods within the power system itself.

Except for the matter of sensitivity to inductive influence that creates harmful effects, the two statements can be reversed, viz., the signal circuit exercises inductive influence on a paralleling power circuit and the power circuit responds to that influence. Fundamentally, therefore, the inductive relations of the two classes of service are the same, the difference between the two lying in the effect on the service rendered by each.

One question to which the answer must finally assume a legal form deals with the extent to which either system can go in its development without respect to the presence of the other. Left to develop without consideration for any other system, a signal system could progress in any way that it might choose. Sensitivity could be increased as far as the physical limits of apparatus would permit. Use of the ground-return system in important service would be governed by good practice in communication engineering, and the protection against inductive effects would be only that necessary to prevent induction between signal circuits themselves, because there would be no other systems to consider.

On the other hand, the power system, left to itself, might be able to use the ground-return system of power distribution, subject only to the limits imposed by public safety and the electrical limits of such transmission. When forced to operate in close proximity to circuits of other systems, the question at once arises of how far either can go in developments that may make its own service cheaper but with the possible or probable result of interference with the service of the other, either by inviting interference on its own circuits and compelling the other to limit its service or by employing construction and operating methods that increase inductive influence and therefore limit the service of the other. A legal limit on the extent to which either can go along certain lines of development must be established and a clear mutual responsibility placed on each that will give the public the greatest possible service.

Use of the Highways

Limitations along some lines of development as indicated above are a fundamental part of highway problems. Highways were originally established to facilitate travel. In perhaps the majority of cases the highways have been dedicated by adjoining property owners for travel uses. If such use is at any time abandoned, the land in many cases reverts to the property from which it originally came. Public utilities have had the use of the highways, subject to the prior rights of the public for travel purposes, because of the greater possibility of service that such use has created. The public is, therefore, a third party that must be considered, whose rights seem to be such that the signal and power systems must adjust their operations to meet the prior claims of this third party. The claim of priority of occupancy of the highways has been raised by signal interests, and in some cases efforts have been made to forbid a power company the occupancy of a highway on the ground that it would seriously impair if not destroy the service of the prior occupant. In other cases pleas for separation have been made on a basis that would give the older company the complete monopoly of at least some of the highways. The particular claim, if established, would apply equally to cases where power lines were on the highway first, and could have the effect of barring signal lines from the highway if improper power-line construction and operating methods were used. The questions that must finally receive legal answers, therefore, involve the rights and duties of power and signal companies that occupy the highways. What must each do within its own system to limit sensitivity to or a tendency to exercise inductive influence? What burden, if any, can the first occupant place on a later comer by reason of prior occupancy, and can the burden be carried so far as to prevent service of any but one type to the public which originally gave the highways for public use? And, finally, what mutual responsibilities exist for the working out of co-ordinated control of the forces involved?

If it were desired to invite inductive troubles, the ground-return signal system would be perhaps as good a plan as could be devised. On the other hand, the alternating-current power distribution system in which one wire and the earth are used as the circuit for supplying customers is an equally efficient producer of inductive influence on other circuits. Inherently the character of either circuit is such that few practical and effective methods can be adopted to limit sensitivity to or a tendency to cause inductive interference. Certain types of signal circuits that make extensive use of the ground return as a standard of construction are of a character that is less sensitive to inductive troubles from neighboring circuits than are the telephone circuits from which the larger part of the difficulty from inductive troubles has arisen. It may therefore be necessary in the final analysis to make some separation between these two types. The separation will probably be necessary more from a technical viewpoint than from a legal one.

Differences of Degree and Specific Remedies

The differences in inductive troubles are those of degree and specific remedies needed. They are not differences in the fundamental principles on which the circuits are designed and operated. From a fundamental legal viewpoint the status of the ground-return circuit may possibly be the same regardless of the type of service. In the telephone field the most frequent questions arise with rural lines. Generally these are in bad physical condition, which accentuates the inductive troubles both as between circuits of the same character and power circuits. A number of cases have come before courts and before commissions in which the owners have sought to throw the burden of remedies on the later comer in the field who has aimed to give power service.

The other types of ground-return signal circuits are generally in the hands of utility companies which keep them up to as high an average of physical condition as any utility properties display. The legal issues likely to arise are therefore two in number. The first will be in connection with those circuits that at best are most sensitive to inductive troubles, are in poor condition physically and have plants poorly designed even in their prime. The argument for such systems is that, though they may be poor from the standpoint of the best practice in the art, they are the best that the consumers can afford and must have protection against interference. The same argument has been advanced to a limited extent for the ground-return power line. If the argument holds for one, it naturally must for the other, and it is easy to imagine that the result in any specific situation would be the establishment of one service and the barring of the other. The practical effect of establishing this form of protection would be monopolization of the highways in specific cases by one service against the other. Such a situation could not exist for long, and sooner or later some definition of the responsibilities of the owners of such construction must be established.

The second legal issue that will develop from the other class of signal circuits will be their right to existence on the ground that they are well maintained and have been in satisfactory use for a long period of years. While inherently they are sensitive in a certain degree to inductive disturbances from paralleling circuits, which canot be prevented because of the character of the signal circuits, the claim will be that they are entitled to protection even at the expense of barring other classes of service. The standing of the ground-return power line will eventually be the same as that of signal lines of the same type.

The Present Legal Status

The issues mentioned are by no means all. An interminable list could be drawn out, but on careful analysis it is believed they all could be traced back as "relatives" of these few fundamental issues. A study of present legal decisions reveals opinions that can support almost any contention that it is possible to make. This is because the cases have presented only a part of the issues and few decisions have been made on broad fundamental principles. It is impossible to say at the moment that any of the main issues have attained standing on a firm legal basis that leaves no doubt as to the answer. It is not probable that such a position will ever be attained on the question in its entirety. As the problem grows older more and more stability will be reached. A fundamental principle of our system of law is that property cannot be taken without due process and that compensation for losses must be returned. Another fundamental principle is that an individual may not use his property to the damage of his neighbor or the community. Many times the application of the first principle, if made in accord with the views of the owners, is in conflict with the rights of others, and in the succeeding adjustments the owner is, in his opinion, deprived of his property without due compensation. Legal decisions are never on the rights of the individual without consideration of his relationships to the community, and the application of the two principles of law enumerated above is never on an absolute basis. The result is an apparent shifting in principle that is in reality a shift in relative conditions affecting the individual. Legal decisions in such matters as this, in the development stage, are therefore shifting constantly as the problems develop and drift away from theoretical individual rights toward the needs of the community. In this particular situation the rights of two interests are involved, but those rights are modified by the right of the public to a service which in the final analysis is the only reason for the existence of the electrical industry.

The final answer to the legal phases of the problem, whether secured through the painful and expensive method of legal procedure or the more pleasant and immensely more profitable method of mutual agreement, will be the one that will give the public the greatest benefit of both services with the least possible interference to either.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Quick Success Must Not Be Expected in Electrical Industry

To the Editors of the ELECTRICAL WORLD:

I have read with interest your recent editorial comment on the dwindling number of students in electrical engineering. Having been in the profession for more than thirty years, keenly watching its development, I think I can suggest the reason. It is simply this, that the rewards have become on the average quite too meager to attract ambitious young men in the former numbers. When a science, art or business is in a period of very rapid growth not only does the demand for men outrun the supply, but, what is more important, there is a vastly greater opportunity for initiative to win success than exists at later stages. As the business becomes stabilized the individual tends to become a wheel in a well-ordered machine, highly useful but replaceable by a spare part within reach on short notice.

For the last twenty years there has been a rush to electrical engineering that has kept up remarkably well. The general scale of living has increased, but the pay of the young engineer has lagged behind. Nothing but very extraordinary ability or strong "pull" has saved him from sinking into a status of decent penury, even if he has been able to hold his job in the face of the slacking activity in the business. A surprising number of men out of work have recently come within my knowledge, showing that the employment lacks stability.

The grim truth is that, despite the immense possibilities in the electrical field, the chance for anything more than honorable poverty is uncomfortably small for the average young man just starting to follow his profession. The chap really in demand is he who can sell for $5 a two-dollar suit of underwear to a man who doesn't want it. Now and then one hears of comparatively recent technical graduates who are getting big salaries. However, it has been the writer's observation that the recipients have often followed a business quite remote from the profession for which they trained. For example, there are within my ken two very successful and highly respected undertakers, a vice-president of a manufacturing corcern, a treasurer of another, three or four well-paid salesmen and a couple of purchasing agents, all in fields wide of their professional training. The youngster has no longer a tolerable chance of jimmying an upper window of his chosen calling; he must climb the stairs.

The condition is much the same as that which has prevailed in civil engineering. A half century since, in the booming days of railway building, many a young engineer won fame and fortune, as fortunes then were, in a few years, and in that group are some of the great figures in the profession. Later on things settled down and the clever young graduate was lucky if ten years of hard work saw him assistant superintendent of waterworks of modest dimensions at the pay of a journeyman plumber. Similarly, the automobile business is settling down to the point where even a combination of skill and luck no longer brings the fortune assured a decade ago.

To reach such a condition a business does not have to cease growing, but merely to become somewhat stabilized and standardized, as is the electrical business of today. Therefore a young man who looks for quick success as the reward of earnest effort is less likely to find it here than in fields where the springs of progress are in boiling activity. For myself I have not advised any ambitious young man to go into electrical engineering for at least a decade. Probably some day the situation will change for the better; then the rush will be on.

LOUIS BELL,
Boston, Mass. Consulting Engineer.

No Ground for Fear

To the Editors of the ELECTRICAL WORLD:

I have read the annual summary of the reports on registration in electrical engineering in the colleges and your editorial comment thereon, both published in your issue of Feb. 11. You express the fear that the falling off in registration this year may indicate a want of appreciation on the part of young men of the opportunities open to them in the electrical field. I believe a close examination of the figures will show that they give no ground for this fear.

The present decrease in registration is obviously the normal reaction after the greatly stimulated college attendance following the war. The increases at that time were due to the return of young men from war duty, to the oncoming of the suspended wave of high-school output, and to the emphasis given by the war to the importance of technical training. The first two courses were abandoned and a reaction after them is natural. Some interruption, if not a setback, in the normal increase in registration might have been expected as a result of the war, but the figures appear to indicate that an actual gain rather than a setback has resulted, for the new registration of the present year still shows an increase of from 25 to 30 per cent over the last pre-war years.

In addition to this the figures indicate a remarkable growth in the attendance at electrical trade and vocational schools. There is no decrease this year over the registration of the two earlier years, only a slowing up, and the increase in attendance over the pre-war years is more than 100 per cent. This indicates that the demand for trained young men in the industries and the response to that demand are well sustained. In view of the present period of business depression it is remarkable that the slowing up this year is not greater.

The figures also seem to reveal an increased appreciation of the value of the best possible type of training; for while of the present recorded 9 per cent decrease for combined freshman and sophomore registration about 6 per cent is to be found in the highest grade of school and 3 per cent in the second group, nevertheless the 1920-21 peak showed an increase over the pre-war years of 85 per cent for the former and only 50 per cent for the latter.

In my opinion, therefore, in spite of the decreased entering registration this year, the figures still indicate an increase in the numbers of young men seeking education in electrical engineering and an increasing interest in its higher grades.

J. B. WHITEHEAD,
Professor of Electrical Engineering.
Johns Hopkins University, Baltimore, Md.

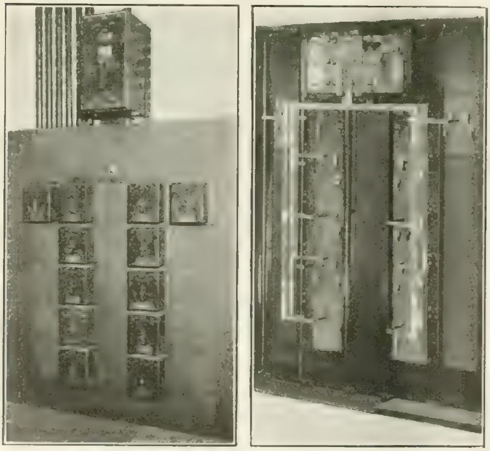
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

New Circuit Breakers Replacing Fuses Reduce Maintenance

MANY of the objections to fuses, such as the necessity of replacements and the annoyance and wasted time in searching for a blown fuse, have been eliminated by the installation of the new "U-Re-Lite" circuit breakers at the Twenty-second and Racine Streets substation of the People's Gas Light & Coke Company, Chicago. A feature of these breakers is the signal window, which indicates a closed circuit when a colored disk is visible, this disk dropping out of sight when the circuit opens. These factors have reduced maintenance costs to a minimum.

The question of a proper mounting for the circuit breakers was solved when the writer designed the "dead-front" sheet-steel panelboard shown on the left in the illustration. The main consideration was to build a compact foolproof and yet accessible board. This panel is 59 in. high, 52 in. wide and 11 in. deep and has four main aisles for twenty breakers. Although at present only twelve are installed, ten 30-amp. and two 60-amp. breakers, the other compartments are fitted with covers so that if another breaker is needed this cover can be removed and then the insulated breaker base can be screwed into the same holes which held the cover. The main center cover is removable, making the rear buses accessible. In order to provide for continuity of service a three-pole service switch was installed. By this means, if the motor-generator set fails, a transfer can be made directly to the central-station lines. A main 200-amp. breaker is mounted directly above this panel. The use of conduit has further simplified the appearance of the entrance cables. The easy accessibility is readily seen in the figure on the right, which shows a rear view of the panel. All circuits can be reached from the center aisle.



DEAD-FRONT PANELBOARD THAT MAKES A NEAT AND SAFE INSTALLATION, WITH BUSES READILY ACCESSIBLE

No actual economic data on the maintenance and operating costs of this board are available as yet, but a comparison between the costs of a regulation panel switchboard and this safety cabinet may be of interest. At the present time a single-panel switchboard consisting of twenty circuits, with 60-amp. knife switches fused on the front of the panel and terminals at the top of the panel with a main switch, would sell for $400. The safety cabinet with twenty "U-Re-Lite" circuit breakers mounted as shown would sell for $854. To offset this difference, the yearly fuse replacement costs must be considered against the first board, since maintenance costs of the second board are almost nothing.

People's Gas Light & Coke Co., JOSEPH SUERTH.
Chicago, Ill.

Synchroscope Connections Should Be Checked Before Using

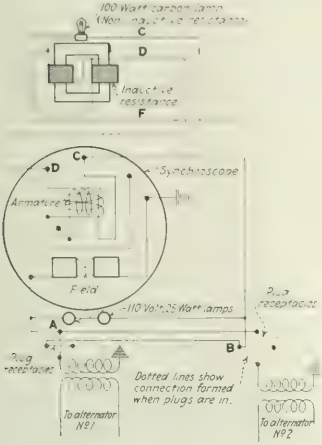
WHEN a synchroscope is first put in service its connections should be checked by inserting lamps in the same phase and one other, because it will often be found that the synchroscope pointer is either 90 deg. or 180 deg. off the synchronous position when the machines are really in synchronism. Usually synchroscope brackets are equipped with receptacles for a pair of lamps in the same phase, so it is only necessary to connect the extra set of lamps in one other phase.

The lamps alone do not positively indicate that the machines are in phase, all that they do being to indicate zero emf., so that the lamps should become dark at the same time that the synchroscope records synchronism. If not, it is a sure indication of trouble with the synchroscope connections, machine connections or potential-transformer connections.

The type of synchroscope considered is the one found in general use and in which the armature consists of two coils at right angles connected in parallel, a non-inductive resistor in series with one and an inductive resistor in series with the other. The stationary field coil is connected to the supply bus and the armature to the incoming machine.

If both sets of lamps become light and dark simultaneously and, when they are dark, the synchroscope pointer is 90 deg. from the synchronous position marked on the dial, it will be found that the external inductive resistance and non-inductive resistance leads are reversed, that is, leads *C* and *D* should be reversed. After the connections are reversed it is well to check the synchroscope by putting voltage from the same phase of one alternator on each side of the instrument, as at *A* and *B*. The position that the pointer assumes will be the correct position for synchronizing. This, of course, should be the position marked on the dial.

If it is found that the lamps on both phases go light and dark simultaneously, but that when the lamps are dark the synchroscope pointer shows that the machines are 180 deg. out of phase, this may mean one of two things. Either both the phases are reversed or the synchroscope pointer was reversed when it was assembled. Where potential transformers are used the trouble may also be due to reversed potential transformer leads. Great care must be used when such a condition occurs to check everything very carefully. The synchroscope should be checked by putting voltage from the same phase of one machine on each side of the instrument as previously outlined. If the pointer is found to be 180 deg. off, then it can be reversed. If it is found to be correct, then either both the phases or the potential transformer secondary or primary leads are reversed.



SYNCHROSCOPE CONNECTIONS SHOWING INTERNAL AS WELL AS EXTERNAL RELATIONS

EUSTACE C. SOARES,
Electrical Engineer.
Ophuls, Hill & McCreery, Inc.,
New York City.

Safety Rules for Electric Welding

RULES for the safe use of arc-welding sets which have been adopted by one Pacific Coast industrial concern have shown their usefulness through the reduction in accidents which has resulted since their enforcement.

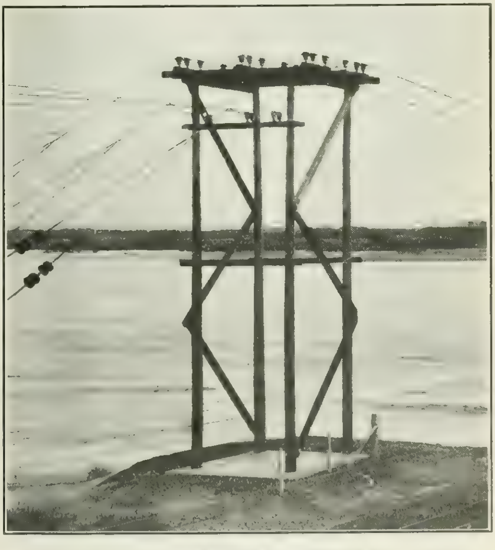
The rules given below are simple, but complete, and each welder is instructed to follow them closely:

1. *Goggles.*—When more than one person is working in a booth, each must wear amber or blue goggles to protect his eyes from accidental flashes from adjacent arcs when his hood is off.
2. *Hood.*—Always wear a hood or use a shield with amber or blue-glass window for protection of the eyes and face against harmful ultra-violet and infra-red rays from the arc.
3. *Clothing.* — For protection against burns from incandescent particles expelled from the arc, closely woven clothing, gauntlets and leather shoes having bellows tongues should be worn.
4. *Cable.*—Always have cable above the ground so that it will not be stepped on. On scaffold or platform work run the cable under the platform so that it will not be tripped over. Keep all cables as far as possible from the arc.
5. *Ground.*—Be sure the material to be welded is properly grounded before starting to weld.
6. *Scaffold Work.*—When working on a scaffold be sure that hot electrode stubs or drops of hot metal will not fall on persons below the scaffold.
7. *Footing.*—Be sure you have a substantial footing before starting the weld.
8. *Ventilation.*—There must always be sufficient ventilation in the booth to keep it clear of fumes.
9. *Welding Booths.*—Welding must be done in a booth inclosed on three sides to prevent injury to persons working in the vicinity.

San José, Cal. D. N. LOUIS.

Towers for 1,390-Ft. River Span Built from Poles

IN ORDER to avoid the cost of special steel towers on the 33,000-volt transmission line of the Central Power Company, which is needed for crossing the Platte River near Grand Island, Neb., the writer built the towers, as shown in the illustration, from four standard poles. The tower shown consists of four 45-ft. class B Western red-cedar poles, while those on the far side of the river are of the same class but 60 ft. in length. These poles are each set in a concrete cylinder 30 in. in diameter and 8 ft. deep and then tied together at the ground line with a 2-ft. concrete mat. All the "Z" bracings are built from 6-in x 8-in. fir beams, making a 7-ft. horizontal spacing between conductors. The crossing-span conductors are carried back over six pin insulators, which are slightly elevated from the outside of this tower to the center in order to distribute the thrust more evenly. Then the conductors are attached to guy rods through guys insulated with four Hewlett-type porcelain-disk insulators. Two guys were used in order to obtain a higher factor of safety on each strain string. The guy anchors are set in concrete "deadmen." The conductors consist of $\frac{9}{16}$-in. Siemens-Martin strands with a clear length span of 1,390 ft. and a maximum sag computed for all conditions of loading of 21 ft. at mid-span. The maximum tension under the worst conditions of loading is under 2,750 lb. per conductor.

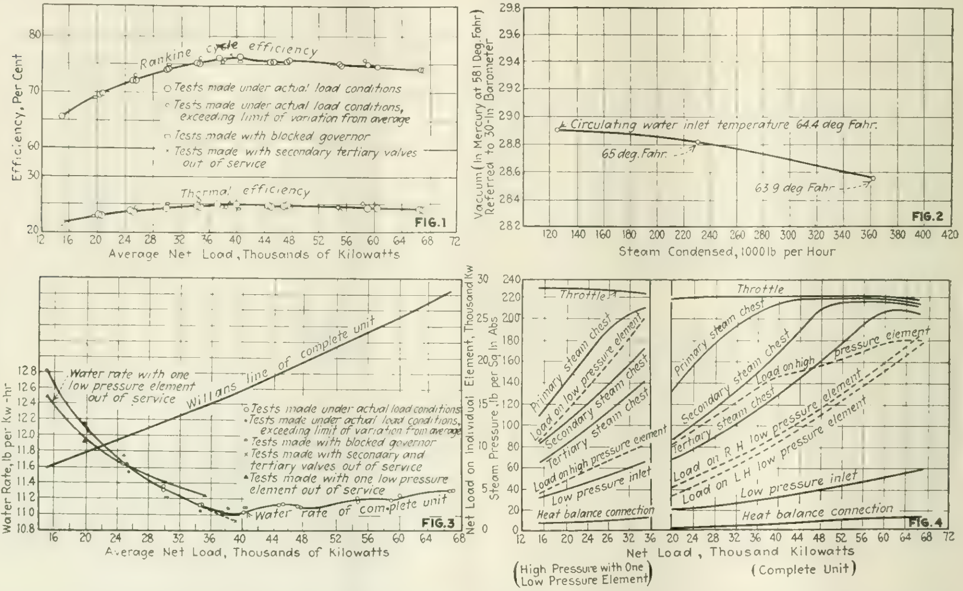


CONCRETE BASE HOLDS POLES IN POSITION ON 1,390-FT. TRANSMISSION LINE

Middle West Utilities Company, R. J. ANDRUS.
Chicago, Ill.

Water Rate of 11 Lb. per Kilowatt-Hour Developed by 60,000-Kw. Turbine

Recent tests made on the 60,000-kw. cross-compound, triple-cylinder steam turbine installed in 1918 at the Seventy-fourth Street station of the Interborough Rapid Transit Company show that a water rate of 11 lb. per kilowatt-hour can be obtained while operating the complete unit under normal conditions. The highest Rankine and thermal efficiencies obtained were 76 per cent and 25.1 per cent respectively. With the high-pressure turbine and one low-pressure turbine in service the lowest water rate was 11.25 lb. per kilowatt-hour. When operating this way the water rate is better than that for the complete unit at loads below 25,000 kw., as is seen in the variations in the water-rate curves under different operating conditions illustrated in Fig. 3, while the efficiencies and steam pressures at different points throughout the turbine are shown in Fig. 1 and Fig. 4 respectively.



PERFORMANCE TESTS OF 60,000-KW. TURBINE SHOW LOW WATER RATES AND HIGH RANKINE AND THERMAL EFFICIENCIES

Fig. 1—Rankine-cycle and thermal efficiencies. Fig. 2—Vacuum obtained during condenser tests. Fig. 3—Water rate and Willans line for a 60,000-kw. unit. Fig. 4—Variation of steam pressure with the load at various points throughout the turbine.

Most of the tests were of three hours duration. With the exception of a few special tests, the turbine was operated under normal conditions. The load was controlled from the switchboard through the remote governor-control system provided for that purpose. This method of controlling the load subjected the turbine to the full swings of the railroad load. Two series of tests were run, one with the completed unit in service and the other with the high-pressure turbine and one low-pressure turbine in service. A few tests with the governor blocked were made so that the unit operated under a steady load. There was no improvement in the efficiency under steady load conditions, as shown by the small squares in Fig. 1. The lowest water rate was obtained while operating with the secondary and tertiary valves out of commission and the load adjusted so that the primary valve was wide open.

The performance of the condenser—that is, the relation between the load and vacuum for the entire unit—was determined in separate tests with the results shown in Fig. 2. The condenser equipment for each low-pressure turbine consists of a two-shell, two-pass condenser, two centrifugal circulating pumps driven through reduction gears by turbines and two turbine-driven centrifugal condensate pumps. This entire equipment was supplied by the Westinghouse Electric & Manufacturing Company. Three Le Blanc air pumps serve the entire unit.

The 60,000-kw. turbine is of the Westinghouse type, consisting of one high-pressure and two low-pressure elements, each element driving a separate generator. The normal steam pressure at the throttle is 220 lb. absolute with a superheat of 150 deg. Fahr. exhausting into a vacuum of 29 in. referred to a 30-in. barometer at 58.1 deg. Fahr. The speed of all three elements is 1,500 r.p.m.

The high-pressure element is of the single-flow, straight-reaction type having a total of twenty-five stages. In addition to the primary steam inlet, which takes care of all loads up to 40,000 kw., secondary and tertiary inlet connections are provided. The secondary inlet bypasses the first six stages and is opened automatically by the governor at a load of approximately 40,000 kw. This takes care of all loads up to 50,000 kw., after which the tertiary inlet, which bypasses the first ten stages, opens and increases the capacity to 60,000 kw. The generators are able to carry a maximum load of 70,000 kw. for two hours. In order to carry this load a hand-operated quaternary valve has been provided which bypasses four more stages. Since there is no relief valve on the exhaust of the high-pressure turbine it has not been possible to make full use of the automatic features.

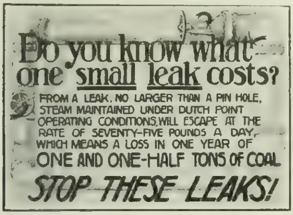
After passing through the high-pressure element the steam is exhausted through the connection on top of the casing. In the low-pressure elements the steam enters through the top of the casing and passes through a single-flow element consisting of ten stages. After passing through this intermediate section the steam divides and passes through two low-pressure sections, each containing six stages, after which it is discharged to the condenser.

FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Anti-Waste Posters Hit Bull's-eye at Hartford

STRENUOUS attacks on waste are being waged by the Hartford (Conn.) Electric Light Company within its operating organization, and to drive the lesson of economy home in few words and with telling illustrations a number of posters have been prepared, one of which points particularly to the evil of neglected steam leaks. The Hartford company by no means represents an inefficient organization, but even among companies noted for thrift so-called "little leaks" are at times permitted to creep into the daily work of employees. The "human interest" appeal of some of these posters and the absence of technicalities in their composition are of more than local interest.



Do you know what one small leak costs?

FROM A LEAK, NO LARGER THAN A PIN HOLE, STEAM MAINTAINED UNDER DUTCH POINT OPERATING CONDITIONS, WILL ESCAPE AT THE RATE OF SEVENTY-FIVE POUNDS A DAY, WHICH MEANS A LOSS IN ONE YEAR OF ONE AND ONE-HALF TONS OF COAL

STOP THESE LEAKS!

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Electric Range Service Cost Reduced by Auto-Transformers

THE use of auto-transformers for supplying service to electric range loads from existing lighting secondaries has been found by the Portland (Ore.) Railway, Light & Power Company to be very economical for this class of business. This differs from the usual practice of installing an individual transformer for each range in order to avoid unbalancing the load. The auto-transformers eliminate the expense of extending the primaries and hanging an extra transformer. These auto-transformers are merely balance coils the outside leads of which are connected to the 220-volt secondaries. The 110-volt tap serves as the neutral line feeding the load. This reduces the voltage drop by placing the entire load on the 220-volt secondaries. The auto-transformers are rated at 3 kva. and will correct a 3-kva. unbalance in load on the range. They are provided with two 5 per cent voltage taps which may be used for compensating for voltage drop.

By the use of these auto-transformers the cost of an average range service has been reduced to $40 from the former cost of $85. These figures do not include the cost of transformers but do embrace the handling and mounting of the transformer and the expenses of running service wires, etc.

W. C. HESTON,
Industrial Power Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

Operating Instruction for Handling Excitation Troubles

A GOOD operator must know among other things the proper course to follow when there is trouble on the exciting circuits or apparatus of generators. Some good information regarding such trouble has been compiled by the Pennsylvania Water & Power Company, a part of which is given in the paragraphs following. The instructions quoted refer particularly to the operation of water-power generators at the Holtwood station of this company. Some of the instructions which have been issued are:

Opening of Field Breaker.—Should a generator field breaker accidentally open while the unit is on the bus, and the unit has not fallen out of synchronism, close the breaker immediately. If the unit has fallen out of synchronism, reduce the gate opening until it falls in step and then close breaker. In case a generator is accidentally or otherwise cut off the bus or is needed quickly and is still running at approximately normal speed with an open field, connect the generator directly with the bus without synchronizing and a few seconds later close the field breaker. This is permissible only after a serious disturbance to service or large loss of load or at a time when the system is suddenly overloaded, due perhaps to trouble developing in parallel steam plants. This operation will cause a 5 to 8 per cent disturbance in voltage.*

Use of Master Field Switch.—In stations that have this type of switch, in case of a complete shutdown or at other times when the generators for one reason or another have fallen out of synchronism and are cut loose from the bus and a large generating capacity is quickly needed, all the generators may be paralleled simultaneously by connecting them with the bus, without fields, and then closing all the fields simultaneously by means of the master field switch. Such generators as may not be concerned in this operation must have their single-pole field-relay switches in the "hand-control" position. Two or more generators may at any time, whether during an emergency or not, be paralleled by this method of tying them together and closing their fields simultaneously.

Field Rheostat Trouble.—If an open circuit occurs in a field rheostat while in service, open the field breaker and take the machine out of service. When its generating capacity is badly needed leave it in service without field, but generating as much as possible, until steam capacity or another generator can be paralleled. It may be possible to restore the full capacity of the generator, when necessary, if the break in the field rheostat is at a point which can be cut out by running the field rheostat contact arm farther toward the out position. In case this cannot be done, repairs must be made at once by short-circuiting the open-circuited section of the rheostat with a jumper of sufficient carrying capacity.

If the field discharge switch fails to open when a breaker is closed, open and close the breaker again, repeating once or twice as required. In case the discharge switch fails to open in this manner, leave the breaker open and open the discharge switch by hand. The field discharge resistance will burn out if the breaker is allowed to remain closed while the field discharge switch is closed.

FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

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*Applies only in this case

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Wage Problems of the Central Station

A Graphic Analysis of the Real Value of Compensation Paid to Different Classes of Employees

AN INTERESTING method of studying central-station wages from the angle of their actual purchasing power used by the Hartford (Conn.) Electric Light Company is shown in the charts on this and the following page. The underlying principles of this method were described by Samuel Ferguson, vice-president of the company, on page 26 of the Jan. 7 issue of the ELECTRICAL WORLD. In brief, the procedure is to plot percentage changes in wages and cost of living against time, the ratio between the money wage and the cost of living curves giving points on a third curve designated as "real" earnings and so indicating the true or actual purchasing power of the employee's compensation.

Typical employees' wages at Hartford have been studied from this angle, and in general 1914 standards of living were taken as the base. Where a long period of disproportionately higher purchasing power has been shown, the wages have in some cases been readjusted downward, as on Chart No. 2 for ashmen. Where the purchasing power has run below normal for a considerable period or has not exceeded normal for an undue time, the presumption favors the retention of the present wage. The method is naturally applied with a knowledge of local conditions and personnel not reducible to computation, but it does offer a "yardstick" of compensation which has quantitative merit.

Not the least interesting of these charts is No. 3, which shows that the wages on capital—that is, dividends on company stock—dropped from the "real" earnings standpoint to about 50 per cent of normal in 1918, and up to the end of 1921 had barely attained 60 per cent of their pre-war purchasing power. No better evidence than this could be shown as to the effect of war costs on the investor, who has received far below his fair reward in buying-power for the capital invested.

Effective Office Arrangement Viewed as a Good-Will Asset

THIS picture, showing the attractive and convenient arrangement of the office of the East St. Louis Light & Power Company, drives home the thought that the use of space for central-station offices and display rooms is not a matter for offhand settlement. The picture was taken from in front of the cashier's window and shows the complaint department located adjacent to the consumers' ledger department to facilitate reference to original records. On the left are the appliance and lamp renewal counter, the general office of the contract department and the new-business manager's office. The repair department for servicing appliances is in the basement and can be reached by using the elevator on the right-hand side or the stairway just beyond.

Too much thought cannot be given to laying out the

Relation of Money Wages, Cost of Living and "Real" Earnings for Linemen, Unskilled Labor and Capital

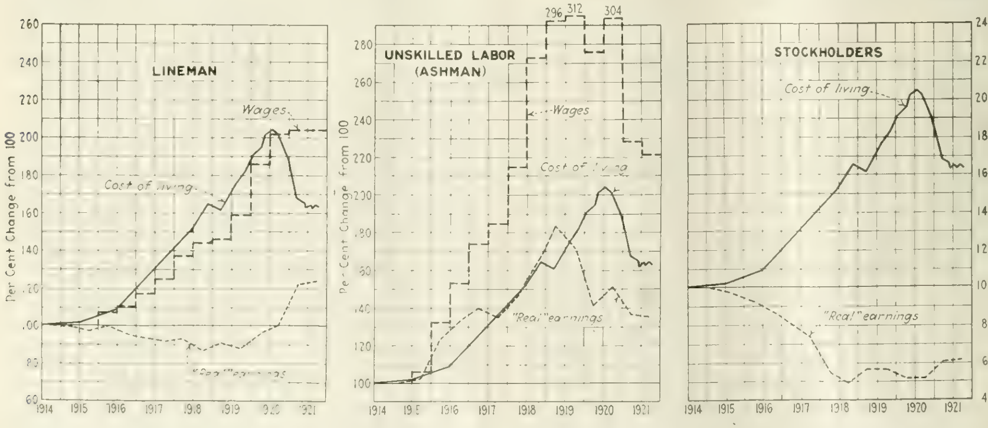


Chart 1.—In this case a lineman's "real" wages did not catch up with the cost of living until more than a year after the war ended. The accumulated deficit in purchasing power in this case warranted a continuation of the maximum wage shown to the end of the chart period.

Chart 2.—A wage reduction here was clearly shown to be fair when the purchasing power of the wages from 1914 on was plotted. War-time expansion of pay brought rapid and continuous prosperity to the grade of unskilled labor included until about a half year after the armistice. Not until the end of 1920 did a permanent wage reduction take place, and the accumulated surplus buying power as compared with 1914 amply justified it.

Chart 3.—The wages of capital expressed in real earnings of dividend money slumped so far during the war that the stockholder was grossly underpaid in comparison with many classes of employees. This chart expresses what happened to people with fairly fixed incomes during the war and shows that only within the past year or two has a change for the better begun to appear.

office and display room of the public utility, for it is here that most people form their impressions of the company. The severe formality of banking-house furnishings is forbidding to the average customer, and a slipshod, just-sufficient-to-answer-the-purpose office reflects on the company in the minds of the public. But a pleasant, comfortable-appearing office, like that of the East St. Louis company, encourages appliance sales, facilitates the routine work of handling customers who come in to pay bills or to make inquiries about their accounts, creates a favorable first impression on new customers and adds to the prestige of the company.

VIEW OF EAST ST. LOUIS COMPANY'S SALESROOM AND OFFICES

A Real Testimonial to Utility Service

THE Cumberland Valley Light & Power Company of Harrisburg, Pa., recently extended its service to several towns adjacent to its lines in Adams County. Upon completion of the work this letter was received from the county commissioners:

To the Cumberland Valley Light & Power Company:
Harrisburg, Pa.

GENTLEMEN: At a meeting of the electric light committee representing East Berlin and Abbottstown, held on Feb. 3 in the office of P. C. Smith in East Berlin, I was instructed to extend to your company sentiments of appreciation of the pleasant business relations our committee experienced with your people in all of our transactions. Our committee appreciates the expedition with which the work progressed and the comparatively short time in which our dreams came true.

The service reflected in the homes and on the streets of our communities is so good that it must be gratifying to you to know that we think you did a good job. The patience, tact and candor of your Mr. L. Weiss in the solution of our problems indeed contributed very much to the success of our project.

Wishing you a prosperous business, and pledging you our moral support in this enterprise in our communities, we are yours truly,
GEORGE W. BAKER,
For the Committee.

More depends on what the neighbors say than on the protestation of the utility only, and no form of evidence of character has been devised that carries more persuasion and conviction than a testimonial. Letters like this should be secured wherever possible and treasured not in a corner but in the light of day where men may read and understand.

What Other Companies Are Doing

Oklahoma.—Two towns, Geary and Watonga, will discard municipal plants soon, having voted bond issues to build transmission lines to connect with the transmission lines of the Enid division of the Oklahoma Gas & Electric Company. Completion of these lines will make a total of 43 miles of transmission line operating from the Enid plant.

Miami Beach, Fla.—The Miami Beach Electric Company reports a very satisfactory increase in the use of electric ranges by its customers. More than 300 electric ranges are now in use on the company's lines, and one or more additional ranges are added each week. R. L. Ellis is general manager of the company.

Chicago.—Electric energy output at the subsidiary properties of the Standard Gas & Electric Company for January, 1922, was 9.2 per cent greater than for the same month of 1921. The output for the year 1921 was 5.7 per cent in excess of that for 1920.

Cambridge, Mass.—The Cambridge Electric Light Company plans to conduct an active campaign for the sale of electrical merchandise during 1922. In the power field an engineer has been added to the staff to specialize on isolated-plant users and the year will see vigorous efforts to introduce the company's service where it will save operating costs or improve the quality of the product manufactured.

Relation of Money Wages, Cost of Living and "Real" Eearnings for Metermen, Executives and Clerks

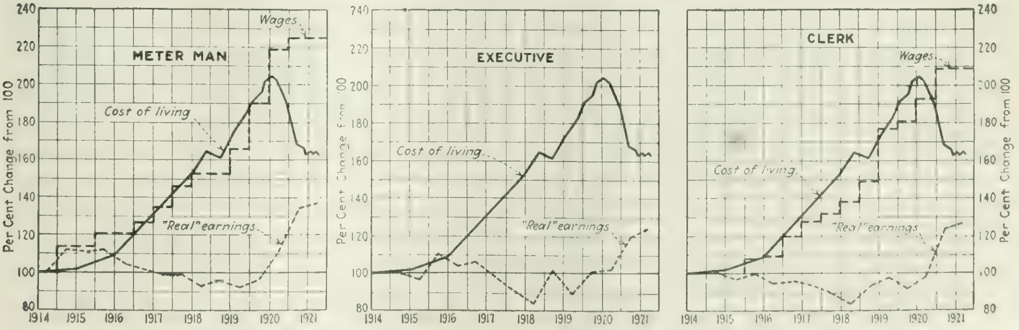


Chart 4.—At first the buying power of a meterman's wage increased faster than the cost of living, but later, notwithstanding continued increases in the wage, the rise in living cost overtook and passed the "real" wage, so that up to the end of 1920 the meterman was little if any better off than in 1911, taking the period as a whole. Some increase in the standard of living usually accompanies higher wages, and this has to be taken into account in studying wage trends.

Chart 5.—This executive appears to be little if any better off than in the pre-war period, and the chart presents no evidence of undue compensation. The popular idea sometimes set forth that public utility executives share, ex officio, huge profits through increases in their salaries has no foundation here.

Chart 6.—The clerk whose wage trend is shown here was in much the same case as the lineman of Chart 1, and similar comment applies.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

What Will Happen When the Nickel-Chromium Patents Expire?

By M. C. Turpin

Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

THERE has been considerable speculation of late among the manufacturers of electric heating devices as to what may be expected when the nickel-chromium wire patents expire in 1923. Similar conditions have arisen in the electrical industry before, but when the blow fell it was generally found to be a blessing in disguise. One example was the case of the induction-motor patents.

M. C. TURPIN

Prior to their expiration, when induction motors were made only by the holders of the patents and their licensees, it was feared that when the bars were let down the market would be flooded by a host of poorly designed, inefficient, and crudely constructed motors that would give a bad name to the whole electric motor industry. What really did happen? A lot of firms did enter the field and began the manufacture of electric motors, and, as always happens, the weaker ones fell by the wayside and helped to fill the graveyard of disappointed hopes. Those who built a good motor and marketed it along sound merchandising lines are enjoying a well-deserved success today. The original motor-manufacturing companies redoubled their efforts, improved their products, began to search for new fields of motor application, and as a result where one horsepower of motor capacity was used before hundreds of horsepower are in use today.

A somewhat analogous case, though not involving the patent situation, was presented with the advent of the tungsten and gas-filled lamps. When this improvement was first introduced calamity howlers raised their voices to the heavens and predicted an early receivership for the central-station industry because of the reduction of revenue that would ensue. Have any central-station companies gone into bankruptcy because of the substitution of the highly efficient "Mazda" lamp for the old-style carbon-filament lamp? The same thing was true of the gas companies on the introduction of the Welsbach mantle for gas burners.

In much the same manner, it seems to me, we may expect the expiration of the nickel-chromium wire patents to affect the industry. There possibly will be some additional entries into the field of electrical appliance manufacture by firms or individuals of varying degrees of financial and merchandising ability. However, the restrictions under which the appliances have been manufactured have established their high quality in the minds of the public, which will continue to demand the same standards of performance, finish, beauty of design and service. There have been and are many cheaper appliances on the market, but we believe that the quality of product made under the Marsh patent license is what the public wants. If this is the case, any reductions in prices will be dependent on further reductions in materials and wages.

Public Will Demand Quality and Service

The quality prop may be withdrawn, but the manufacturers, if they hold up quality and margins of distribution, will still have to maintain present prices on the majority of appliances in order to stay in business. Cheaply constructed appliances may be sold, but they won't stay sold. The public has been educated to expect service from electrical devices. People have been taught to expect repairs to be made free of charge when caused by defective design or workmanship, and it can hardly be supposed that they will put up with anything less.

I do not want to convey the impression that there is not much work, and hard work, ahead of the present manufacturers, for there is. But they have the advantage of the prestige they have created for their product in the minds of the public by consistent advertising, quality product, and other essentials of good merchandising practice. These activities must be redoubled and every effort made to capitalize on the reputation already gained.

The remarkable increase in the use of electric appliances during the last few years has been accentuated to a large degree by the shortage of domestic labor and the rapid extension of high-tension lines by the power companies. This means a much wider market for appliances, which will continue to grow with the added impetus of such developments as electrically wired furniture, the establishment of "electrical homes," the installation of convenience outlets, and other movements under way in the industry.

Summing up the situation, it appears that after the expiration of the patents we may expect some new arrivals in the field, but the only survivors will be those who supply a quality product, marketed along the lines of modern business principles. The public has been educated to expect quality and service and will continue to demand it. Increased demand for electrical appliances will continue and invite competition, which, if fair, will not be feared by existing manufacturers. Those manufacturers who have built up a name for themselves and their product will, if they increase their activities along proper advertising and merchandising lines, be able to maintain their prestige.

Manufacturers Should Limit the Number of Representatives in Territories

By Willard W. Low
President Electric Appliance Company, Chicago

MANUFACTURERS of electrical supplies who have had any large experience in the sale as well as the manufacture of their products are usually eager to secure the co-operation of the electrical jobbers in marketing these supplies. Manufacturers as a whole concede that the electrical supply jobber is an economic factor in the distribution of electrical supplies by the very fact that they are making use of their facilities. But the jobbers at the present time are not prospering.

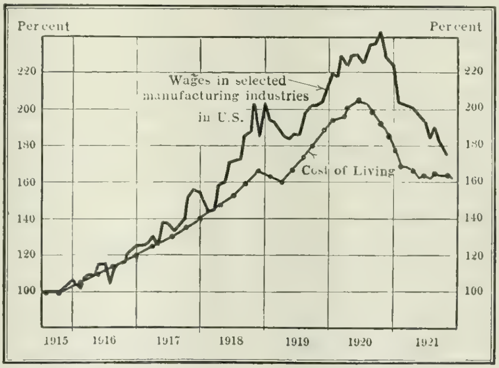
The trouble appears to be that too many manufacturers feel in some way or other that the economics should all be on one side. They are eager to utilize the service of the electrical supply jobber because an equivalent service inevitably costs the manufacturer more when undertaken by himself than it does when the electrical supply jobber performs that function for him. But the same manufacturer will seek to make the compensation to the electrical supply jobber for this service a good deal less than the experience of the electrical supply jobber indicates to be necessary and desirable.

The manufacturer probably also has in the same city a number of representatives or agencies, in addition to the jobber, that regularly carry the manufacturer's products. Obviously this practice creates a duplication of sales effort and stock investment—that is, of the very facilities that the electrical supply jobber is already maintaining in that territory for the manufacturer. The question is, therefore, Should the manufacturer thus utilize the jobber's service and then turn so many dealers into jobbers, duplicating that service so far as sales expense is concerned, and duplicating the warehousing requirements of the jobber?

To come right down to specific opinion, I believe that manufacturers of stable electrical products should confine themselves to factory stocks. The obvious situation that would come out of this is that the electrical supply jobber who is doing a real job in warehousing stocks would not be at the mercy of the manufacturers who carry stocks in many places and supply so-called jobbers who are in fact only retailers. The difficulty in this whole situation is not so much in any misunderstanding that exists either on the part of the manufacturer or the buyer as to the function of the electrical supply jobber. The trouble lies largely in the misinterpretation of the jobber's function upon the part of the manufacturer, by the partial use he makes of the jobber's warehouse or the competition which he himself sets up.

To sum up the whole thing in a few words, the distribution of electrical supplies through electrical supply jobbers is acknowledged to be economical by the very fact that the manufacturers utilize this service to their advantage and therefore desire it. What is needed most in the situation is to turn the minds of both the manufacturer and the user to a proper appreciation of the service of the jobber. They must realize that they cannot get the most out of the jobber when they themselves set up a sales resistance against him and weaken his ability to serve.

Living Costs Decline More than Wages



From *New York Evening Post*

THIS chart should have more than passing interest for the manufacturer and distributer of electrical appliances. It shows that wages in selected manufacturing industries continue relatively higher than the cost of living. This margin of wages over living costs, if properly developed, offers a strong potential market for the sale of electrical devices to the home.

A Warning to Exporters

By Julius Klein
Director Bureau of Foreign and Domestic Commerce, Washington, D. C.

WELL-AUTHENTICATED confidential advices received by the Department of Commerce from various sources indicate the recurrence in a virulent form of an old evil which has from time to time imperiled individual interests in the export trade, but now seems to be directed against certain exporting industries as a whole. The means employed are to tie up the American exporter in an agency agreement and to push competing goods of foreign make under the protection of the existing agency agreement.

It is absolutely essential for the present prosperity and the future welfare of the American export trade to exercise the most rigid scrutiny over the details of agency agreements which tie up the exporter in a certain territory. Is your agent bound by open or secret affiliations to interests other than American? Does the agency agreement permit him to paralyze the active promotion of your interests and to devote himself actively to the sale of competing goods? The danger outlined is not a mere bugaboo but actually exists and flagrant cases have been submitted as evidence.

The problem which the situation presents is exceedingly delicate and difficult. The solution—to intrust the agency of an American firm to a strictly American agency organization—is simple enough, but cannot be everywhere applied in practice because such organizations are comparatively few. It has been suggested that where an American firm cannot be found a native firm, free from any suspicion of foreign affiliations, should be intrusted with the agency, but even this expedient may not always answer. In many markets the distribution of goods has never been in native hands.

It is the obvious and immediate task of American business to create throughout the world a network of American agencies, or at least agencies whose loyalty is not pre-empted by racial or commercial ties antagonistic to American interests. The thing to be done at once is to examine the basis of all agreements with foreign agents and analyze their affiliations carefully.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

The Petersen Earth Coil.—R. N. CONWELL and R. D. EVANS.—The essential part of this apparatus is a suitable reactor connected between the neutral of a circuit and ground. This reactance is chosen at such a value as to neutralize the capacitance of the circuit when an accidental ground of one phase takes place. Under this condition the reactor is electrically in parallel with the active capacitance, and by the well-known fundamental law the only current that flows to the combination of the inductance and capacitance in parallel is the current necessary to supply the energy lost in the combination. The advantages and disadvantages of the Petersen earth coil are enumerated.—*Journal of the A. I. E. E.*, February, 1922.

New Viewpoints in the Criticism of Chain-Type Insulators.—W. WEIKER.—A close scrutiny of the relative advantages and disadvantages of the two most-used types of chain-type insulators—viz., the link type and the cap-and-pin type. The author investigates outer form, disk diameter, assembled length, arcing and puncture values, capacity, distribution of voltage, mechanical strength, economy and installation. The study shows in almost all instances a theoretical superiority of the cap-and-pin type, although practical experience extending over a period of several years proves that the link-type insulator shows good performance in practical service. A few of its inherent shortcomings compared with the cap type can be easily overcome by enlarging its disk diameter, crossing of the cable loop between adjacent disks, arcing horns, etc. However, all this has been based so far on voltages of not more than 110 kv. In general it may be safely assumed that the two types are about equal in their performance, and only future experiences with a higher voltage may lead to a definite decision in favor of the one or the other. The article contains a great many characteristic curves and photos of arc-overs under various conditions.—*Elektrotechnische Zeitschrift,* Dec. 22 and 29, 1921.

Lamps and Lighting

Recent Departure from Usual Lighting Practice in Public Spaces and Offices.—A. D. CURTIS and J. L. STAIR.—This article deals with some special requirements that had to be met in buildings of unusual size or construction. Some of the examples are the Dixie Terminal in Cincinnati, the "great hall" of the Cunard Building in New York City, the Field Museum of Natural History and the Cosmopolitan State Bank of Chicago.—*Transactions of the I. E. S.*, Dec. 30, 1921.

The Lighting of Signs and Billboards.—J. M. SHUTE.—A study of the problem of constructing electric signs and billboards to obtain maximum effectiveness. The author discusses the design of letters as to spacing, size and type in signs with visible lamps and the selection of lamps as to size and type for large metropolitan roof signs, small and low-hung signs and talking signs. Results of a study of signs with concealed lights and of painted signs and billboards illuminated by reflected light are also given.—*Bulletin L.D. 131 of the Edison Lamp Works.*

The Use of "Alignment Charts" for Illumination Calculations.—L. BLOCH.—In all branches of electrical measurements and calculations the use of the so-called "alignment charts" becomes daily more popular. The author describes in a general way the principle of these charts and opens up a new application of them to different calculations in the illuminating field.—*Elektrotechnische Zeitschrift*, Jan. 19, 1922.

Generation, Transmission and Distribution

Oil for Power Production.—J. H. DOBSON.—An investigation carried on in behalf of the South African Institution of Engineers into the use and production of fuel oil in South Africa. The article also contains a description of the use of oil in boilers and in Diesel and semi-Diesel engines.—*Journal of South African Institution of Engineers*, December, 1921.

Power Transmission in Industrial Plants.—KENNETH M. RAYNOR.—A description of the power-transmission installation at the Bethlehem Steel Company worked out by the electrical department of this company to insure reliability and continuity of service. The system installed in this plant consists of a 6,600-volt, 25-cycle, three-phase balanced-current overhead loop.—*Journal of A. I. and S. E. E.*, January, 1922.

Heating the Domestic Water Supply Electrically.—J. A. MACDONALD.—A cost comparison between heating water for home use by coal and heating it by electricity. With coal at $15 per ton, electricity at a flat rate of $3 per kilowatt per 720-hour month is shown to be cheaper.—*Electrical News*, Jan. 15, 1922.

Recent Development in the Electrical Industry of England.—T. P. WILMSHURST.—A review of the developments in the electrical industry tending to cheapen the supply and to render service more reliable. A general discussion is given on power plants using both coal and oil fuel, with examples of standard practice. Remarkable advancement is shown in the use of transmission cables.—*Journal of Institution (British) Electrical Engineers*, December, 1921.

Traction

Electrification of the St. Gotthard Railway.—The actual equipment of the railway that runs from Lucerne to Chiasso on the Swiss-Italian frontier is described. Two hydro-electric generating stations, one at Amsteg and the other at Riton, supply energy at 60,000 volts for transmission. This is reduced to 15,000 for trolley use. The locomotives are manufactured by the Oerlikon company.—*Engineer (London)*, Jan. 20, 1922.

Hydraulic Transmission for Electric Locomotives.—WITTFELD.—The use of a hydraulic transmission between the motor and the drivers of an electric locomotive for single-phase alternating current brings with it a number of advantages and improvements. Such transmissions have been developed by Lentz and have shown an efficiency as high as 90 per cent. Synchronous 50-cycle motors could then be used and would afford great advantage over the present 16⅔-cycle systems, which require special power houses or inefficient frequency-changer sets.—*Elektrische Kraftbetriebe und Bahnen*, Jan. 10, 1922.

Installations, Systems and Appliances

The Electric Furnace.—H. M. ST. JOHN.—An account of the mechanical and semi-automatic features of the electric furnace whereby an operator who follows instructions can produce a uniformly high quality of product with less labor and less metal wastage than was previously possible. With the fuel-fired furnaces a cause of much loss of material is that there is either too much oxygen and the charge is oxidized or there is too little and the fuel is partly unconsumed, causing a loss in metal as the unconsumed products of combustion attack the molten matter. This difficulty is overcome in the electric furnace. In conclusion this article describes what the electric furnace has accomplished in melting brass.—*Electrical Review and Industrial Engineer*, January, 1922.

Direct Current or Alternating Current for Magnetic Chucks.—B. WITTKUHNS.—The author made some tests on a magnetic chuck for alternating current to determine its properties when compared with direct-current chucks. A three-phase model was tested, the energy consumption of which was 120 watts in Y connection and 450 watts in delta connection on 220 volts. A similar chuck for direct current requires only 60 watts. The heating of the alternating-current chuck was 90 deg. after three-quarters of an hour and 160 deg. after two hours, which is very much higher than for a direct-current model. The power factor of the alternating-current chuck was about 0.3, which would be very undesirable for a shop using any appreciable number of these chucks. The attractive power was only about one-third to one-half that of a direct-current chuck of same size. The only advantage of the alternating-current chuck is the instant demagnetization attained with its use, but there are a great many insurmountable disadvantages.—*Elektrotechnik und Maschinenbau*, Jan. 29, 1922.

Calculation of Anode-Furnace Charges in a Copper Refinery.—C. M. BRISTER, JR.—The method of making up charges for an anode furnace in a modern electrolytic copper refinery is described. Analyses of various brands of blister copper are given, and the calculations are performed in detail to show the various factors.—*Engineering and Mining Journal*, Jan. 28, 1922.

Electrochemistry and Batteries

Small Silver-Reclaiming Plants.—G. EGER.—At the present European prices of chemicals in general and acids in particular it has been found cheaper to reclaim silver out of the dust of mints, jewelers' refuse, etc., by the electrolytic process rather than by purely chemical methods. Using nitrate of silver as an electrolyte, a potential of 1 volt per cell and a current density of 250 amp. per square meter will give best results. Four cells are used in series, each containing six cathodes and fifteen anodes. To prevent the growth of silver deposit from the negative plates on the anodes, which would short-circuit the cell, the cathodes are inclosed in muslin bags and are, in addition, moved slowly backward and forward during the process. A standard set of four cells is described, which gives 35 kg. of refined silver in eight hours, consuming 280 amp. at an efficiency of 96 per cent.—*Siemens Zeitschrift*, January, 1922.

Electrolytic Production of Metallic Magnesium.—S. T. ALLEN.—The new electrolytic process of obtaining metallic magnesium developed by the Magnesium Company, England, is described. In this process magnesium chloride is reduced by metallic sodium. To obtain satisfactory yields the magnesium chloride must be anhydrous, in which form it can be electrolyzed for the direct production of magnesium.—*Electrician* (*London*), Jan. 27, 1922.

Telegraphy, Telephony and Signals

Radio Service on the French Fishing Fleet.—Radio apparatus ranging from 250 watts to 1,000 watts capacity are installed on more than 200 French fishing schooners where in 1918 there were only thirty thus equipped. —*Radioelectricité*, January, 1922.

High-Speed Wireless Telegraphy.—A. C. T. CUSINS. —The author describes apparatus which has been designed and experimented with between London and Cologne. The aim of the equipment is to provide apparatus which shall enable wireless communication to be carried on mechanically, both in transmission and in reception, at speeds up to the maximum of Wheatstone apparatus.—*Electrician* (*London*), Jan. 20, 1922.

Mechanical Action of Sound Produced by a Telephone Receiver.—K. KUROKAWA.—The article describes, with photographic illustrations, some remarkable mechanical actions of sound produced by a telephone receiver traversed by an alternating current of telephonic frequency. These actions are: (a) Attraction or repulsion between a suspended disk and a sounding receiver; (b) pumping action of sound or a receiver; (c) driving of a small wheel by air currents induced by sound; (d) dancing of grains of powder between the cap of a sounding receiver and a horizontal plate. The author gives explanations and qualitative results of these mechanical actions.—*Journal of Institute of Electrical Engineers of Japan*, January, 1922.

Miscellaneous

New English Electrical Instruments and Relays.—All recent developments of electrical instruments in England shown at the annual exhibition of the Physical Society and the Optical Society of London are described in this continued article.—*Electrician* (*London*), Jan. 13, 20 and 27, 1922.

Some Developments in the Electrical Industry During 1921.—JOHN LISTON.—Review of the progress that was made in the manufacturing branch of the electrical industry last year. One important development of the twelve months was the successful generation, insulation and measurement of current at commercial frequencies with potentials exceeding a million volts. The practical results from this are problematical, but the data obtained make it possible to calculate transmission lines utilizing potentials greatly in excess of those used at present. Another very important feature of the year was the great increase in the use of automatic generating stations and substations. The first Diesel-engine electrically propelled merchant ship in the United States was completed. Marked progress was made in steam-road electrification, arc and induction furnaces, electric welding, high-voltage and capacity transformers, and in the radio field.—*General Electric Review*, January, 1922.

New Books

Reviews of the latest contributions to technical, industrial and commercial literature of particular interest to members of the electrical industry.

GRIMSEHL'S TEXTBOOK ON PHYSICS. Edited by Dr. Hillers and Dr. Starke. Vol. I—Mechanics, Acoustics, Thermics, Optics. 1,030 pages, 1,049 illustrations, 10 colored tables. Fifth edition. Vol. II—Magnetism, Electricity. 635 pages, 548 illustrations. Fourth edition. Leipzig and Berlin: B. G. Teubner.

These volumes are among the best and most widely used textbooks on physics in Germany and other German-speaking countries. Grimsehl himself succumbed in the war, but his lifework has been carried on admirably by Hillers and Starke, who have edited both the latest editions. The high pedagogical value of these volumes lies in the use of a host of specially devised experimental apparatus built in such a manner as to demonstrate to the student the many physical phenomena in the most plausible way; but at the same time drawings and photographs of the practical and actual use of the described apparatus are given in each case. The volumes are fully up to the minute, including, for example, the latest theories of Millikan on the electron theory and Einstein's theory of relativity.

SILVANUS PHILLIPS THOMPSON, D.S.C., LL.D., F.R.S.: His Life and Letters. By J. S. Thompson and H. G. Thompson. New York: E. P. Dutton & Company. 372 pages, illustrated.

As one reads this altogether charming and admirable biography the regret grows that he who wrote such excellent lives of Faraday and Kelvin could not have found time to add one on that great forerunner, Benjamin Franklin, with whom he had so much in common in mental alertness, literary ability, political opinions, insatiable thirst for knowledge and swift insight into new physical conceptions. It has sometimes been a wonder why Dr. Thompson did not line up with Dr. Franklin in the making of really prime additions to electrical principles. He was always probing the unknown, ever on the verge of important discovery with others, and had a marvelous intuition backed by extraordinary gifts of exposition, as his useful books and splended educational work testify.

The reason is here disclosed. He was too much the Admirable Crichton of his times. The revelation presented of delightful hobbies and irrepressible enthusiasms reminds one of a story—not told in these vivid pages—of the visit paid to Morland by a famous American electrical inventor, to whom the buoyant, brilliant Thompson, in quick succession, showed his valuable library of early physical literature, his electrical experiments, his clever water colors, his floral hybrids, his caricatures, his instruments, his researches in sound and music, and other cherished possessions not a few. As the American left the home of the translator of Gilbert he turned to his entertainer, expressed keen pleasure over a delightful evening, and then, feeling keenly his own narrowness of interests, and putting a hand gently and regretfully on the shoulder of his host, said: "And now I know, Thompson, why you are not the great electrician you ought to be!"

The American references in these fascinating chapters might well be more numerous than they are, but we are glad to see so many, especially those to Elihu Thomson, Elisha Gray, Kennelly, Edison, Tesla and "Mr. Graham Bell," with whom the protagonist of Philipp Reis seems to have had a chummy good time after all. Nor may it be amiss to note mention of two former editors of the ELECTRICAL WORLD with whom Dr. Thompson had correspondence from time to time and with whom he was long on terms of personal intimacy.

This book is indeed welcome as one of the foremost biographies of the year, and the reviewer closes its perusal with the desire that it may be as widely read in America as in Europe. To which should be added hearty congratulations to the wife and daughter who, with such felicitous sense of proportion and unusual fitness of expression, have delineated this ideal but not idealized portrait of the noble "Brother Magnetizer," influential shaper to a notable degree of the modern electrical arts and sciences, so well described as historian by himself.

TESTING OF ELECTRICAL MACHINERY. By J. H. Morecroft and F. W. Hehre. New York: D. Van Nostrand Company. 220 pages, illustrated.

This book is being used by the authors at Columbia University for non-electrical students whose work along electrical lines has materially increased since the third edition was brought out. For this reason the present edition, the fourth, contains in addition certain experiments on batteries, illumination, measurement of electrical energy, etc., on which subjects a non-electrical engineer frequently has to pass judgment.

THE ELECTRIC FURNACE. By J. N. Pring. New York: Longmans, Green & Company. 483 pages, 426 illustrations.

In none of the fields of application of electricity, probably, has there been more development during the last few years than in the use of electric heat for electrochemical and metallurgical processes and for heat-treating. It is therefore with considerable satisfaction that we observe the publication of a résumé of this development. Although we should like to see a book by an American engineer on economic aspects of electric furnace operation in the United States, this contribution by an English engineer has its advantages because he is able to view at close range some of the European installations of note and is besides connected with the research department of the Royal Arsenal at Woolwich, which has devoted attention to the subject. The author's preface in itself gives in concise form an excellent statement of the present electric furnace situation. After sketching historically the development of electric furnaces and discussing the principles on which various furnaces operate, he devotes 265 pages to a consideration of industrial processes in which electric furnaces are used, such as synthesis of nitrogen compounds from air, smelting of iron ores, and non-ferrous metallurgy. Among other things of particular interest are the discussions on refractories, heat losses, temperature measurement, electrode dimensions and terminal design. The twenty-three-page bibliography on electric furnaces, processes involving them and related subjects constitutes a valuable appendix.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Demonstration of Shore-to-Ship Two-Way Radio Conversation

TWO-WAY radio-telephone conversation between the shore and ships at sea using the ordinary commercial telephone instrument was successfully demonstrated this week. President H. B. Thayer of the American Telephone & Telegraph Company was able to converse from his home at New Canaan, Conn., with the captain of the steamship America, 370 miles out at sea. Messages from the ship were received at the Deal Beach (N. J.) station of the telephone company, while messages to the ship were sent to the Elberon (N. J.) station and thence to the ship. In this way it was possible to carry on a two-way conversation. Similar tests have been going on for some time.

Harding Demands Coal Wage Conference by Operators and Miners

PRESIDENT HARDING injected a new note into the coal wage controversy this week when he insisted that the coal operators and miners abide by the terms of their last year's agreement and get together in conference before taking any drastic action. The union leaders have agreed to this provided there is a national conference. They are opposed, however, to state or district parleys. Internal dissension in the union, however, may break down the demand for a national conference.

The miners are voting this week on the question of calling a strike on April 1. Only early returns were in as this was written, but these, it is reported, are almost solidly in favor of going out.

Bad Faith by Hydro Commission Charged

IN PRESENTING his resignation to Premier Drury of the Province of Ontario, Dougall Carmichael, minister without portfolio in the Drury government and for two years a member of the Hydro-Electric Power Commission of Ontario, charged bad faith on the part of the commission with the provincial government. After making a statistical review of Chippawa expenditures in the Ontario Legislature on March 3, Colonel Carmichael announced the latest expectation of cost for units to be $69,000,000.

"I gave these figures last spring in good faith," he said, referring to the estimate of $55,000,000 he had brought forward in 1921. "When it came to my attention early last autumn that these figures were liable or sure to be exceeded, I brought it to the attention of the government, and I told the Prime Minister that my commission had either been inefficient or had been dishonest in dealing with the government in regard to this development."

Sir Adam Beck, who is ill, has not yet been heard from, and Premier Drury in a brief statement to the ouse on the matter indicated the determination of the government to find out what was wrong in connection with Chippawa estimates and expenditures. He deemed Mr. Carmichael's course to have been an honorable one, stating that the government had not as yet considered the resignation of the minister from the commission.

Rate Confusion Would Exist if Commission Were Abolished, Says McCardle

SHOULD the Indiana Public Service Commission be abolished, John W. McCardle, chairman of the commission, recently told the Indianapolis Republican Club, the rates of one or more utilities in at least 1,200 cities and towns would at once be the subject of controversy, while rates outside incorporated towns would be subject practically to no wish but that of the utilities themselves. He said that before the Legislature created the commission public utilities in nearly every town were the footballs of local politics and that there were great disparities in rates. He showed that no city or town is so well equipped to get at the facts of utility rates as is the commission, with its expert accounting, engineering and other divisions. He said that such service, if it were not for the state commission, could be obtained only at great cost by the cities or towns.

Would Create Commission to Settle Muscle Shoals Problem

CREATION of a Muscle Shoals commission empowered to straighten out government tangles as to existing contracts and enter into either a sale, a lease or a construction arrangement is favored by Chairman Kahn of the House military affairs committee. Such a commission would, as its first objects, insure the production of nitrates for war purposes and the production of fertilizers for the farmer in peace time, Mr. Kahn believes. In all probability the creation of such a commission will be one of the outstanding features of the report of the committee. This intimation was contained in an interview with a representative of the ELECTRICAL WORLD and afterward given to the daily papers through the Associated Press.

"Congress has four times refused," Mr. Kahn said, "to vote appropriations for Muscle Shoals, and the committee must take the attitude of Congress in that respect into consideration on Mr. Ford's offer, which requires that there shall be appropriations of from $45,000,000 to $50,000,000. Congress spent seven years in working out a fixed public policy in regard to the development of water powers and in fixing rules and regulations under which the rights of the people are to be safeguarded, and in Mr. Ford's offer for Muscle

Shoals he asks that he be exempted from the operation of the existing federal water-power act, so that the committee must also take that into consideration.

"Again, although the Alabama Power Company relieves the committee from the necessity of asking Congress to appropriate money, in that the power company undertakes to complete the Wilson Dam at its own expense, its investment being estimated at about $25,000,000 or $30,000,000, nevertheless the Alabama Power Company, although it proposes to furnish free power to the government for the manufacture of fertilizer, does not itself guarantee to make fertilizer, and our farming population is looking forward to such a guarantee in anything the committee recommends as a possible means of reducing the farmer's fertilizer bill and with the hope of reducing the cost of living.

"Finally, the Engstrum offer also requires heavy government expenditures and would require the committee to ask Congress for big appropriations.

"This Congress is avowedly an economy congress, and we have all undertaken to adhere sincerely to the administration policy of cutting out every possible appropriation.

Complication By Existing Contracts

"Aside from these points, we have to deal with the difficult situation that the Air Nitrates Corporation and the Alabama Power Company have contracts with the War Department, and we know from the statements of counsel of these companies before the committee that, whatever rights these companies have under these contracts, irrespective of the opinion of the Judge Advocate General's department of the army that they are non-enforceable, these contracts will certainly be taken into the courts, dragging their weary way through court after court, until some day the Supreme Court will settle the question of the rights involved either for or against the government. The committee must take this into consideration, and it would be most difficult for us to report to Congress that we have decided upon a course of procedure which would involve long litigation and thus defeat the very object desired, namely, the completion and operation speedily and with the least delay of the Muscle Shoals project.

"Contracts must be adjusted which are already in existence, and new contracts must be made, all of which is a subject of negotiation, and not at all a suitable piece of work for either a committee of Congress or the full membership of Congress in debate.

"In these circumstances general legislation giving the necessary authority to executive and administrative officers of the government might be the wisest policy for Congress to pursue. If Secretary Weeks had had this authority, especially the particular authority to sell real estate, the present difficulties of Congress in regard to Muscle Shoals might have been avoided.

"It would seem that the logical thing to do would be for Congress to create a Muscle Shoals commission, consisting of representatives of each of the three executive branches of the government which will be involved in the Muscle Shoals project in the future—namely, the War Department, because of the necessity of nitrates for explosives; the Department of Agriculture, because of the necessity of fertilizers for the farmer, and the Treasury Department, because of the large financial considerations involved. Such a commission ought to be clothed with full powers to adjust present contracts and enter into new ones so that the government and the people may get the utmost possible benefit of the largest water power in the South as one of the country's greatest natural resources. For the military affairs committee of the House to try to solve this problem in any other way might lead to nothing being done by Congress, because upon the two questions of an appropriation for Muscle Shoals and safeguarding the interests of the people under the present water-power act Congress has repeatedly expressed its attitude."

Industrial, Manufacturers' and Utility Engineers to Confer

TO AFFORD an opportunity for mutual discussion of practical problems jointly confronting electric service companies, the electrical manufacturers and the industrial consumers of electricity, the Pittsburgh Section of the American Institute of Electrical Engineers has arranged a meeting for March 15 at which a symposium will be presented on "Operation and Maintenance of Industrial Electrical Installations." The following papers will be presented: "Electricity in and Around a Coal Mine," by H. J. Nelms, general superintendent for the New Fields By-products Coal Company; "Electrical Problems in the Department Store," by E. R. Roberts, mechanical superintendent for Kaufmann's; "Factors Governing Maintenance Policies for Industrial Electrical Apparatus," by A. C. Cummins, electrical superintendent for the Duquesne Works, Carnegie Steel Company.

Each speaker is an expert in his line, having had intimate and practical experience with the operation of electrical apparatus. The papers will be followed by discussions from other operators, manufacturers and central-station men. The entire Pittsburgh district is being actively canvassed with a view to bringing this meeting before a large number of practical men.

The meeting will be held at 8 p.m. in the Chamber of Commerce auditorium, Pittsburgh. E. C. Stone, assistant to the general manager of the Duquesne Light Company, is secretary of the section.

Overhead Systems, Sales and Auditing Topics at Wisconsin Meeting

SPECIAL attention will be paid to overhead systems, electric sales and auditing at the annual convention of the Wisconsin Electrical Association to be held in Milwaukee at the Hotel Pfister, March 22 to 24. Group meetings will be devoted to discussion of these subjects during the afternoon of the first day and the morning of the second. There will be exhibits by manufacturers and jobbers. The afternoon of March 23 will be devoted to a joint session with the Wisconsin Gas Association on matters of regulation.

Overhead railway crossings, safety code, rural extension and general legislation are to be discussed at the last morning session, and at the afternoon session the following general program has been arranged: "More and Better Business," by Milan R. Bump, president National Electric Light Association; "Value and Cost of Rural Electric Service," by A. Meyers, University of Wisconsin; "Economy in Design of Rural Extensions," by Fred J. Singer, University of Wisconsin; "Trend in Indoor Lighting and Street Lighting," by Earl A. Anderson, National Lamp Works of General Electric Company.

Efficient Operation of Little Avail in Depreciated Plant

UNLESS the voters of the town of Wakefield, Mass., decide to put nearly $4 per capita of population into plant rehabilitation this year, the most efficient management will have but little effect upon finances, according to a recent exhaustive report by the municipal light board. It is estimated that $52,250 must be expended on the gas plant and on the gas and electric distributing systems to modernize them, and the board frankly states that if the town fails to make the necessary improvements, the commissioners "consider that continued municipal operation with antiquated machinery and inadequate distributing systems cannot be a success." The time has come for the town to provide the means of serving new customers, thus reducing the operating cost through quantity production, or to discard municipal ownership.

Wakefield's municipal lighting troubles have attracted much attention in public utility circles of late. In 1921, after the town had decided to retain public ownership another year, C. W. Whiting was engaged as manager of the lighting department. The commission's report gives Mr. Whiting credit for highly efficient work in the face of obstacles. Depreciated plant, however, is a severe handicap. The town purchases energy from the Edison Electric Illuminating Company of Boston, last year's delivery being 1,104,508 kw.-hr. at a total operating cost of 3.577 cents per kw.-hr., and the town sold to consumers 882,646 kw.-hr. at a total cost delivered of 8.32 cents per unit. The net price of electricity throughout the year was 13 cents per kw.-hr.

More Than 1,500 Stockholders Attend Commonwealth Edison Meeting

AT THE annual meeting of the stockholders of the Commonwealth Edison Company on Feb. 27 more than 1,500 were present, the largest number of stockholders ever assembled at Customers' Hall. The interest shown was thought to augur well for the customer-ownership movement. The board of directors was authorized to increase the capital stock from $60,000,000 to $80,000,000.

The annual report of the company shows that in 1921 62,200 new customers were added to the company's lines, bringing the total number served at the end of the year up to 536,982. While unsatisfactory conditions prevailed throughout the year in many lines of business, the increase was greater than in any other year of the company's existence. The electrical load also showed an increase, since the maximum carried was 525,640 kw. as against 478,820 kw. for 1920. Operating revenue in 1921 was $37,139,830, as compared with $35,317,134 in 1920.

With this increase in business and some reductions in operating expenses, a net earning of $5,366,785 was obtained, equal to a return of 9.89 per cent on an average capital stock of $53,839,075. This compares with 9.52 per cent earned in 1920 and 9.84 in 1919. This rate of return was obtained with an operating expense in 1921 of $24,396,155, as against a similar cost of $24,697,000 in 1920. State taxes increased $600,000 during the year. Because of the issuance of new capital in four installments, the company had the use of its full capital of $55,465,000 less than two months of the year. The working capital at the end of 1921 was $1,889,363, compared with $3,266,206 at the end of 1920. During the year the company reduced its loans and notes payable to the extent of $1,200,000.

President Asks for $50,000 More for Enforcement of Radio Laws

THE Senate has received from President Harding a request for a supplemental appropriation of $50,000 to deal with an emergency caused by rapid increase in radio broadcasting. The appropriation, in addition to the $80,000 already authorized, would be for enforcement of the wireless communication laws. Accompanying the President's request was a letter from Secretary Hoover stating that the Department of Commerce's force was entirely insufficient to cope with the emergency of radio broadcasting. A conference called by Secretary Hoover is now considering remedial measures.

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LEGISLATORS AND TECHNICIANS AT RADIO CONFERENCE

(Left to right, front row)—Secretary of Commerce Hoover, Postmaster-General Will Hays, General George O. Squier, Congressman W. H. White of Maine, former Congressman Shirley. (Back row)—Dr. Louis Cohen, consulting engineer for the War Department; Prof. C. M. Jansky, Jr., Edwin H. Armstrong, Columbia University; Harry F. Breckel, Dr. Alfred Goldsmith, New York City.

Conference Held on Overhead-Wire Crossing Specifications

A LARGE and representative conference met in New York on March 2 to consider the question of uniform specifications for crossing of overhead wires and to dispose, if possible, of certain differences of opinion in regard to Part 2 of the National Electrical Safety Code, which deals with overhead lines. The conference was called by the American Engineering Standards Committee at the request of the American Electric Railway Association.

The conclusions of the conference are expressed in the following resolution, which was passed unanimously:

Resolved, That it is the opinion of this conference that:

(1) The remaining differences of opinion on Part 2 of the National Electrical Safety Code are small, and the different interests are approaching agreement, and that it is therefore advisable:

(2) That the National Electrical Safety Code should be approved by the American Engineering Standards Committee with the understanding that:

(3) There should immediately be organized a thoroughly representative sectional committee under the procedure of the American Engineering Standards Committee to con-

sider any revisions of Part 2 of the code which may be deemed necessary by any of the interested parties, and

(4) That there should be a set of national specifications for crossings between overhead electric wire lines and railways and between different wire lines, because there is disagreement among existing specifications, and that

(5) Such specifications should be prepared by thoroughly representative sub-committees so as to make them in agreement with the code, with such revisions as may be made under the provisions of paragraph 3 above.

Wide Diversity of Interests Represented

The American Electric Railway Association presented a statement outlining the considerations which had led it to request the conference and stating in general terms its position on the various items of the agenda. This was followed by a statement by W. A. Durgin in regard to the general work of the Department of Commerce in promoting simplification in industry and industrial standardization along national lines. Dr. M. G. Lloyd, on behalf of the Bureau of Standards, then outlined the development of the National Electrical Safety Code and its present position before regulatory bodies and utility companies and associations.

The following representatives of state commissions briefly outlined the points of view of their respective bodies: A. E. Knowlton, Connecticut Public Utilities Commission; A. B. Campbell, Iowa Board of Railroad Commissioners; D. F. Jurgensen, Minnesota Railroad and Warehouse Commission; W. C. Whiston and F. G. Daniell, New York Transit Commission; C. R. Vanneman, New York Public Service Commission, and W. C. Bliss, Rhode Island Public Utilities Commission.

John Murphy, electrical engineer on the Board of Railway Commissioners, Ottawa, Canada, representing his commission and the Canadian Engineering Standards Association, outlined the status of crossing specifications in Canada.

More than fifty representatives were present at the conference, all the principal interests sending delegations. In addition to the state commissions and the Canadian bodies already mentioned the following bodies were officially represented: American Electric Railway Association, American Institute of Electrical Engineers, American Railway Association, American Telephone & Telegraph Company, Bureau of Standards, Electrical Manufacturers' Council, Federal Power Commission, Hydro-Electric Power Commission of Ontario, National Bureau of Casualty and Surety Underwriters, National Electric Light Association, National Safety Council, Postal Telegraph-Cable Company, United States Department of Commerce, United States Department of Labor, United States Independent Telephone Association, Western Association of Electrical Inspectors and Western Union Telegraph Company.

Radio Show Draws Crowd

TO WHAT extent the public interest in wireless has grown in the past year was plainly evidenced on Tuesday night when the annual Radio Show opened at the Hotel Pennsylvania, New York. Thousands stormed the doors, and more people were turned away the first night than attended during the entire week last year. In previous years the Radio Show has been of interest almost entirely to amateur radio operators.

A great many new devices were displayed by the manufacturers and numerous interesting radio applications were demonstrated.

Recommends New York to Build Power Plant to Supply Municipal Needs

THERE was placed before the New York City Board of Estimate last week by the Commissioner of Plant and Structures a recommendation that the city erect a 12,000-kw. municipal electric plant on Staten Island to supply energy for municipal ferries, street cars and piers. The estimated cost is $1,235,000. At the office of the commissioner it was stated that the city was forced to take this step because the local power company, the Richmond Light & Railroad Company, did not have sufficient capacity to meet the city's requirements.

Electrical Power the Best for Oil-Well Operations

THAT the electric motor is better than the steam engine in pumping oil wells because of its greater flexibility of control and higher hoisting speeds, and is far better than the oil or gas engine, was asserted by W. F. Barnes in discussing the adaptation of electrical apparatus to the oil industry before the engineering congress on the petroleum industry held at Kansas City this week under the auspices of the Engineers' Club of Kansas City and the local section of the American Society of Mechanical Engineers. Lower upkeep cost, longer life and greater reliability under all weather conditions are important factors in the superiority of electrical over other types of power equipment, Mr. Barnes said.

Even in the fields that have a plentiful gas supply it is cheaper to use the gas to generate electricity to supply motors for the individual pumps than to apply the gas engine directly to the pumping equipment. Individual motor-driven jacks employing 3-hp. to 5-hp. motors are used for wells up to 1,500 ft. in depth, and Mr. Barnes said that there was no doubt that this method would extend to deeper wells. The application to deep wells is more complicated because during 95 per cent of the time there must be efficient operation at a constant speed and for 5 per cent of the time the motor must handle a very severe hoisting load in pulling tools, rods and casing and perhaps in swabbing and drilling. While the steam engine is ideal from the operator's standpoint, from the producer's viewpoint it is not economical because of the necessity of supplying a boiler plant for each six wells and because of the attendance and the cost of frozen steam lines in the winter.

In discussing the subject of drilling, R. M. Stuntz estimated a saving of from $2,100 to $6,000 per well by the use of electric power. Constancy of the power supply and the elimination of expensive measures to obtain the proper water supply for use in boilers were to him the two most important factors.

In the discussion of Mr. Barnes' paper it was stated that data from 2,000 to 3,000 wells operated by electric power showed an increase in production over other methods of 15 per cent. On 2,500-ft. wells 10 kw.-hr. to 12 kw.-hr. per foot will be required in drilling operations, and it was asserted that the electrical equipment could be scrapped after the drilling of the first well and a profit could still be shown. In one case of seventy-two wells a saving of $1.12 per day over steam pumping was effected.

Plans Being Made to Increase Carolina Power & Light Capacity

THE Carolina Power & Light Company interests have organized the Carolina Power Company for the purpose of financing extensions to property so as to be able to supply adequately the territory served. Just how this is to be accomplished has not been determined. There is the possibility that a plant may be built on the Pee Dee River, along which the parent company is known to own power sites. Tne site is at Swift Island, and in all likelihood if any hydro-electric work were undertaken the plant here would be the first to be built. A 100-ft. dam at this site, it is understood, would give a plant capacity of 35,000 hp. This site was secured by the company in 1916, a survey made and riparian rights obtained. It is understood that the war prevented development at that time.

New Jersey Distribution System Being Converted to Three-Phase, Four-Wire

THE Public Service Electric Company of New Jersey is undertaking the conversion of its state-wide distribution system to three-phase, four-wire, T-connected, 4,000 volts between phases. At present the distribution is chiefly two-phase, four-wire, although some single-phase, two-wire circuits are included. Sixty-five substations will be involved in the change. By the conversion it is expected to benefit in the following manner: More power can be conducted for a given weight of copper, line losses at the increased load will be reduced, voltage regulation will be better, and the area of economical service will be extended.

Conversion to three-phase operation will be made gradually during periods of no load. One feeder will be changed at a time. At present T-connected transformers are used in the substations. Each of these banks will be duplexed and connected in delta-star with two other units. Four-pole switches now used on the two-phase circuits will be used for the three-phase, four-wire system. The single-phase circuits will be connected in pairs to give four-wire, three-phase circuits. New stations will have only three-pole circuit breakers per circuit.

Portland (Me.) Company Seeks to End Direct-Current Service

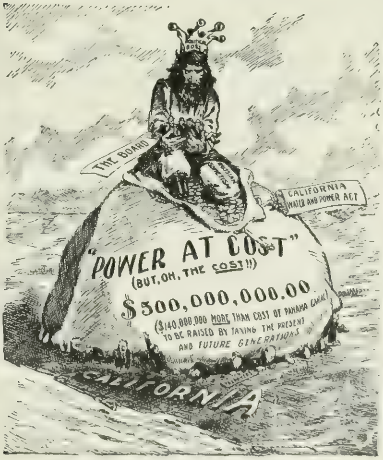
PERMISSION gradually to do away with direct-current distribution in the city of Portland, Me., is sought by the Cumberland County Power & Light Company in a recent communication to the Maine Public Utilities Commission. Such service covers only a limited area from the old Plum Street generating plant, now a substation only, and three fully loaded 500-kw. motor-generator sets without reserve for breakdown are handling the business. A separate set of 125-250-volt, three-wire direct-current feeders is required in this section despite its being adequately covered in the main by alternating-current lines. These low-tension feeders are also heavily loaded and voltage conditions are unsatisfactory.

In a letter to the commission Fred D. Gordon, general manager, states that it is the company's intention to furnish no more direct-current service except for railway operation after 1931, and that on and after March 15, 1922, no new direct-current customers will be accepted. Direct-current service to old customers is being discontinued, with temporary exceptions, in the present direct-current district. The company proposes to pay certain costs of changing to alternating-current service. These include bringing alternating-current service wires to the customer and the following compensation for changed equipment, based on its present value:

The company will pay the present value of the direct-current equipment changed by taking its cost new (estimated or agreed upon in the absence of actual record) and deducting therefrom the salvage value, to derive the service value. The number of years of the equipment's service will then be ascertained and its future useful life estimated. The per cent condition will be the ratio of the remaining years of useful life to the total (past plus estimated future) life of the equipment. To the scrap value will be added the service value multiplied by the per cent condition, in order to derive the present value. The customer will make the necessary wiring and equipment changes at his own expense. In case of equipment where the cost of exchange would be prohibitive the company may at its option furnish to the customer a suitable motor-generator set to operate that portion of the direct-current load on which the change-over costs would be prohibitive. This motor-generator set will become the customer's property and is to be installed, wired and operated at his expense.

War in Earnest Over Proposed California Water-Power Act

CALIFORNIA IN BONDAGE


BOSS
THE BOARD
RUSSIAN SOVIETISM
CALIFORNIA WATER AND POWER ACT
"POWER AT COST"
(BUT, OH, THE COST!!)
$500,000,000.00
($140,000,000 MORE THAN COST OF PANAMA CANAL)
TO BE RAISED BY TAXING THE PRESENT AND FUTURE GENERATIONS
CALIFORNIA

Water and (Political) Power Act

SUPPORTERS of private operation of public utilities have taken the fight on the proposed California water and power act to the people. A pamphlet entitled "California in Bondage" and containing a brief digest of all the important facts has been mailed to every voter. The proposed act is really an amendment to the state constitution and will be submitted to the voters at the November election. The amendment is aimed to secure to the state control, operation and development of all water powers.

Mansfield and Ashland Utilities Purchased by Ohio Public Service Company

AUTHORITY for the Ohio Public Service Company, a Henry L. Doherty holding company, to purchase the properties of the Richland Public Service Company of Mansfield, Ohio, and the Ashland Gas & Electric Company of Ashland, Ohio, was granted by the Ohio Public Utilities Commission on Feb. 15. The Ohio Public Service Company received permission to issue $1,991,000 in common stock, $2,350,000 in bonds to be sold at not less than 83, and $3,037,000 in bonds to retire bonds of the companies acquired.

Permission had been sought by the Ohio company to issue its securities on a basis of $9,087,000 valuation, but the commission recognized the present value of $6,986,500 and permitted securities to be issued on this basis. The Ohio company had also asked authority to issue $3,200,000 common stock and $500,000 preferred stock, but the commission rejected the preferred-stock request and reduced the amount of common stock.

Electric Utilities Paid $5,800,000 Federal Taxes in 1919

OF THE 1,603 electric light and power companies making income-tax returns for 1919, 454 had no net income whatever, according to figures just compiled by the Bureau of Internal Revenue. Among 1,046 light and power companies it was found that the net income was 6.53 per cent of the invested capital. The total net income of 1,149 such utilities in 1919 was $49,515,624, on which an income tax of $4,639,440 was paid, in addition to war-profits taxes and excess-profits taxes of $1,164,563. The deficit reported by the 454 companies which reported no net income was $4,360,909.

According to the bureau's figures, the net income of all transportation and other public utilities is shown to have been 6.38 of the invested capital. For the steam railroads the figure was 4.78 per cent, for electric railroads 4.11 per cent, for ocean lines 23.46 per cent, for gas companies 6.07 per cent, and for telephone and telegraph companies 7.01 per cent.

Federal taxes of $5,804,003 on electric light and power companies in 1919 compare with $1,214,980 on gas companies, $8,787,106 on telephone and telegraph companies and $873,440 on waterworks.

There were 242 electric railways which reported a total net income of $28,387,311. Their total tax was $3,126,002. There were 196 electric railroads which had no net income. Their deficit is shown as $10,860,272.

Illinois Utility Properties Reorganized

THE heating and electric properties in De Kalb and Sycamore Counties in Illinois formerly operated under the name of the DeKalb-Sycamore Electric Company, including the power stations formerly owned by the DeKalb-Sycamore & Interurban Traction Company and leased to and operated by the De-Kalb-Sycamore Electric Company, the Springfield Gas & Electric Company and the Springfield Consolidated Railway Company, have been acquired by purchase and merger by the recently incorporated Illinois Power Company, a Springfield concern. The obligations of the old companies, including securities and other indebtedness, have been paid off and a new first mortgage has been issued on the Illinois Power Company that is flexible as to amount and maturity and which obviates the difficulties in financing previously experienced.

Extensive improvements will be commenced this year with the putting underground of all light and power wires in the business district of Springfield and the rehabilitation of street-car lines, heating mains and the gas mains in this district incident to the entire repaving of the business section. Expenditures of $1,250,000 are estimated for this work. This reorganization represents the final outcome of the long controversy at Springfield which ended last year with the failure of the city to carry out an agreement to buy the properties and operate them with the existing municipal plant. Franchises to replace those that had expired or were about to expire were given to the company.

Annual Johns Hopkins Lectures Upon Engineering Practice

LECTURES on engineering practice are being given this month at Johns Hopkins University, Baltimore, in accordance with the yearly plan of that institution. The series this year numbers four, of which one concerned with civil engineering has already been given. On Wednesday of next week the electrical engineering field will be represented on the rostrum by C. E. Skinner, manager of the research department of the Westinghouse Electric & Manufacturing Company, whose topic is to be "Some Results of the War on Engineering Research." Mechanical engineering will furnish the subject for the following week, and chemical engineering the subject for the week after that.

New York Court of Appeals Sustains the Legality of Service Charge

THE legality of a monthly service charge by a public utility, which has been before the New York State courts for some months and has led to a conflict of judicial opinion, has been settled so far as that state is concerned by the Court of Appeals, the highest state tribunal, which on Feb. 28 handed down an opinion in the suit of the People against the Rochester Gas & Electric Corporation sustaining the right of the company to make such a charge. This decision is of far-reaching effect and probably means that electric as well as gas companies will be permitted to make a service charge in New York State and that rebates will be discontinued.

The Rochester corporation obtained permission from the old Public Service Commission, Second District, to make the service charge of 40 cents per month to each consumer, in addition to the rate of $1.30 per 1,000 cu.ft. of gas, by orders granted July 1 and Oct. 14, 1920. The legality of the orders of the commission was presented to the Appellate Division, Third Department, as a submitted controversy, and the court ruled that the charge was in effect a rental charge for a gas meter, which is prohibited by law, and that a charge for "service" was the imposition of a higher rate for gas.

The Court of Appeals has now reversed the Appellate Division's ruling and directed judgment for the gas company in refusing an injunction to restrain collection of the service charge.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

New Orleans' New Power Plant.—The Citizens' Light & Power Company has been organized with a capital of $2,000,000 to erect a new electric light and power plant in New Orleans, and it has been announced that the first unit will be ready within four months.

Municipal Plants in Utah Subject to Commission Control.—The Attorney-General of Utah has advised the city attorney of Logan, in response to a query, that a municipal corporation operating its own electric plant is a public utility subject to the jurisdiction of the state commission.

American Welding Society Issues "Proceedings."—Vol. 1, No. 1, of the *Proceedings* of the American Welding Society is out, bearing date of January, 1922. It contains forty-four pages, containing information and news concerning the society in addition to technical papers and reports. W. S. Sparagen is the editor.

Hydro-Electric Plant May Be Built in Camden County, Mo.—Plans are being discussed for the construction of a 30,000-hp. or 40,000-hp. hydro-electric plant near Linn Creek, Camden County, Mo., by the Osage Power Development Company, at a cost of several million dollars, according to a special dispatch from the correspondent of the *Manufacturers' Record* at Lamar, Mo.

Wireless Between France and Argentina.—A French engineering company has been granted a concession by the Argentine government for the erection and working of a wireless station for direct communication with France. The concession is for a period of thirty years, and the company is allowed three years for preparation before commercial service is demanded. By the terms of the agreement the company's wireless messages will be forwarded over the state telegraph lines and the rates of messages will be fixed by the national government.

San Antonio Ceases to Rely on the Moon.—Like nearly all the other larger cities in the country, San Antonio, Tex., has ceased to rely upon the moon to help cut its lighting bills. Until March 1 the city's illumination was provided under the moonlight schedule; that is, when the moon was at the full the lights were cut off. Now the city has planned to substitute one electric arc lamp in place of two gas lamps and also to substitute arc lamps for other electric units and hopes thus to be able to maintain artificial lighting every night regardless of the moon and the weather. The rate per arc lamp per month will, if the proposed new contract is ratified, be increased by the San Antonio Public Service Company from $4 to $4.50. More than 800 arc lamps will be used.

A "Fused Wire" Did It Again!—A great fire recently took place at Hartlepool, England, and the newspapers hastened to explain that it had its origin in "the fusing of an electric wire." Competent men have investigated the fire and found no basis whatever for such an assertion. Yet, says the *Electrical Times*, it would be quite futile to try to correct this reportorial verdict. The incriminatory phrase is "burned into the reporter's brain."

New Oklahoma Power Plant Opened.—The new 10,000-kw. plant of the Oklahoma Power Company, near Tulsa, was formally opened on Feb. 17. It is connected with the power plant of the Public Service Company in Tulsa by a conduit laid under the river and also by overhead cables. A transmission line carrying 13,200 volts leads south from the plant, which is stepped up to 66,000 volts and connected with transmission lines of the Oklahoma Gas & Electric company, furnishing energy for Sapulpa, Broken Arrow, Drumright, Kiefer, Mounds, Beggs and Muskogee. The plant is also connected with the power plants of the Okmulgee Ice & Light Company and the Henryetta Electric Light Company.

Scottish Highland Water-Power Projects Up Again.—The Grampian and Loch Doon hydro-electric plans, which failed of authorization last year, are to come up again, with modifications, at the present session of the British Parliament. The Grampian scheme is of especial interest, according to the London *Electrician*, because it would be the first British hydro-electric development to rely exclusively upon water power for the generation of electricity for bulk supply to authorized distributers. The Loch Doon proposals are of a more modest character, being concerned with the supply of power to Ayr. The salmon fishing proprietors and riparian owners are the chief opponents of the hydro-electric development of Highland waters.

Europe's Largest Power House.—What will be, it is said, the largest power house in Europe is under way at Gennevilliers, Paris, where the Union d'Electricité has its new central station. There are to be eight turbo-generator units rated at 40,000 kw. each, the first of which is now in operation, while work is proceeding on four others. Current is generated at 6,000 volts and transmitted at 66,000 volts. The switchgear is of the open-air type, though a light roof has been erected to exclude dust. Three different firms, two French and one Swiss, have, says the *Electrical Times*, built the machines, which are noteworthy for their great compactness. The whole electrical load of Paris will eventually be handled from three central stations, of which the one at Gennevilliers will be the chief.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

O. E. L. A. to Meet at Cedar Point in July.—The executive committee of the Ohio Electric Light Association has fixed upon July 11-14 as the date for the annual convention at the Breakers Hotel, Cedar Point. The committee has decided to have an exhibit at this convention.

Association of Iron and Steel Electrical Engineers.—The New Auditorium at Cleveland has been selected for the 1922 convention of this association, which will take place on Sept. 11 to 15. The auditorium, which has 35,000 sq.ft. of floor space, equipped with power, offers an opportunity to exhibitors to display machinery in operation.

To Discuss Safety Rules at Utilities Convention.—A course of instruction on the best and safest standards of construction for telephone, telegraph, electric light and power lines will be conducted in connection with the fourth annual convention of the Oklahoma Utilities Association, at Oklahoma City, March 14, 15 and 16, by Dr. M. G. Lloyd, electrical engineer of the United States Bureau of Standards. Dr. Lloyd will explain to the utility operators the application of Corporation Commission Order No. 1946, dealing with that subject. He will also give a history of the National Electrical Safety Code, and a representative from each of the telegraph, telephone and electrical industries will also discuss the subject.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Cleveland, March 13; Chicago, March 15; Pittsburgh, March 18; Youngstown, March 25; Birmingham, March 25.

A. I. E. E. Section Meetings—New York, March 15; Pittsburgh, March 15; Schenectady, March 17.

Associated Manufacturers of Electrical Supplies—New York, March 13-17. (For program see issue of March 4, page 447.)

Oklahoma Utilities Association—Oklahoma City, March 14-16.

Illinois State Electric Association—Chicago, March 15-16.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of Jan. 14, page 96.)

A. S. M. E. Spring Meeting—Atlanta, April 8-11.

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.

American Physical Society—Washington, April 22.

American Electrochemical Society—Baltimore, April 27-29.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Surcharge Continued.—The Northern Indiana Gas & Electric Company has been authorized by the Public Service Commission to continue to make a surcharge of 20 per cent on all bills for electricity in Lake County over $100. The order will stay in effect until June 27, 1923.

Declining Prices of Material in Their Relation to Rates.—Upon a showing that the cost of copper-wire base, electrolytic copper and scrap copper had materially decreased since the filing of a petition by the Prairie Electric Company for increased electric rates, the Illinois Commerce Commission refused to approve the application until an affirmative procedure should show that existing rates are unjust, unreasonable and insufficient for future operation.

How Special Conditions Affect Depreciation.—In granting increased rates to the Gays Mills Electric Company the Wisconsin Railroad Commission dwelt on two circumstances which necessitated a higher allowance for depreciation than would ordinarily be the case in a plant of the same character as the one concerned. One of these circumstances was that the company did not own the dam and could not benefit by the low rate of depreciation usually characteristic of such structures, and the other was that the company had an oil-power auxiliary and that the life of oil-engine units is generally quite short, though in the case in question they were to be used for such short periods in the year that the depreciation should be less than the normal.

Reductions in Milwaukee Rates.—The Wisconsin Railroad Commission, investigating the electric rates of the Milwaukee Electric Railway & Light Company and the Wells Power Company to see if a reduction from those fixed in December, 1921, could be made, found that coal costs had decreased, that during the first eleven months of 1921 there was available about $236,000 in excess of a full return on utility capital for the department, that the cost of power will be reduced somewhat below the average for that eleven-month period, and that the labor costs will be reduced, and therefore prescribed revised schedules providing for decreases in rates, which, together with a revised municipal rate schedule, the commission estimated would bring about the following reductions in annual revenue: Commercial lighting, $168,000; residence lighting, $137,500; municipal lighting, $118,500; increment power, $140,000. Replying to criticism made of the reduction in the municipal schedule on the ground that if this reduction were made there would be a material discrimination against customers supplied on other schedules, the commission said: "It should be remembered, however, that in this rate the cost of energy is a much more important component than in the rates for small residence and store-lighting use. In these schedules the other expenses of furnishing the service are relatively much greater so that a change of a given amount in the cost of energy would not have the same relative effect upon the schedule as it would have upon a schedule for large power or street-lighting use. Our conclusions, however, from our study of this case are that if there were to be no modification of the rates for small retail use of energy there would be a discrimination inasmuch as such rates have been based on a cost of coal not now existing and which is not now applicable in the charge for energy to the larger customers. With the modifications, however, which will be made by the order in this case we find that there is no unreasonable discrimination remaining."

Discrimination Between Localities.—Protestants against the rates of the Dixie Power Company contended before the Utah Public Utilities Commission that the company's rates were in excess of those imposed in some other parts of the state. Admitting this, the commission said: "Rates must be based upon the cost of service. Cost of service in turn depends upon the investment necessary to render said service. Investment varies with location, and particularly so with hydro-electric properties. Thus, before a comparison of rates may be made or relied upon, it is necessary to ascertain first whether the conditions and costs of rendering service are similar, and, unless the conditions are analogous, the fact that other companies in other localities charge rates higher or lower than those complained of would shed no light on the reasonableness of the rates under consideration. Further, it would be necessary to determine, first, whether or not the rate selected for comparative purposes in some other locality was a compensatory rate as applied to its own utility. For example, we have found the present rates of applicant to be confiscatory. If these same rates were used for comparative purposes, without a knowledge of their confiscatory character, it would lead to an absurd conclusion if applied to similar property. A comparison of rates may give information in a very general way, but for reasons heretofore outlined cannot be controlling. In this particular case we have a sparsely inhabited territory over which the company has extended its service, and it must be apparent to even the casual observer that the cost of service to the consumer must necessarily be higher than in sections where conditions are more favorable."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Municipality Cannot Compel Free Service.—In United Fuel Gas Company vs. Public Utilities Commission, the Ohio Supreme Court, while sustaining the commission and the city of Ironton in the contention that the city had the right to establish gas rates by ordinance for the remainder of a franchise term, declared that a provision requiring the company to furnish service free for certain municipal purposes was beyond the powers of the City Council. (132 N. E. 845.)*

Arizona Statute Regulating Transmission Lines Invalid.—In Pacific Gas & Electric Company vs. State, the Arizona Supreme Court has held void a statute of the 1915 Legislature relating to the erection and maintenance of telephone, telegraph, signal, trolley and electric light and power lines, in view of the fact that the Corporation Commission had previously exercised the power granted it by the constitution, and issued a general order concerning this matter. (201 Pac. 632.)

Commission's Decision in Specific Case Where Discrimination Was Charged Did Not Involve Reasonableness of Rate Schedule.—In Utah Copper Company vs. Public Utilities Commission of Utah, in which the Supreme Court of Utah sustained the commission in its abolition of contract rates held to be discriminatory (see issue of Dec. 31, 1921, page 1338), it was adjudged that in a proceeding before the commission involving the issue as to whether rates at which a company was furnishing power to a particular consumer were discriminatory, this proceeding being held concurrently with a proceeding on the company's application to increase rates, the commission properly refused in the first-named proceeding to pass upon the reasonableness of the rates charged or sought to be charged by the power company. The commission, on finding the contract rate to be discriminatory, before making its order as to a reasonable rate in the other proceeding, had power to fix as a temporary rate (pending its decision in the other proceeding) the regular schedule rate at which power was being furnished to other consumers, without passing on the reasonableness of such temporary rate, with the proviso that if such temporary rate should be ultimately found excessive, the power company should make reparation. (203 Pac. 627.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

T. O. Kennedy, general superintendent of the Denver Gas & Electric Light Company, has been promoted to be general manager of the Ohio Public Service Company, a consolidation of all the Henry L. Doherty holdings in Ohio except those in Toledo. Mr. Kennedy, who has been a member of the Doherty staff in several capacities since his graduation from the University of Missouri in 1907, is one of the youngest men upon whom these interests have devolved such a heavy responsibility. He has been in charge of various Eastern and Southern electrical and power enterprises owned by the Doherty company, and for a time he was head of the New York construction department. In July, 1917, Mr. Kennedy was appointed general superintendent of the Denver Gas & Electric Light Company, from which position he has just been promoted. He is a past-chairman of the electric bureau of the Civic and Commercial Association of Denver and was active in organizing the Electric Co-operative League of that city. Of this league he was president. Mr. Kennedy was also chairman of the newly organized Rocky Mountain Committee on Public Utility Information, composed of virtually all the utilities in Colorado, Wyoming and New Mexico.

T. O. KENNEDY

James H. Manning has been appointed engineering manager for Stone & Webster at their Boston headquarters, succeeding Col. Peter Junkersfeld, who recently resigned to enter private practice.

Ivar Herlitz, fellow of the American-Scandinavian Foundation and formerly with the Southern Sierras Power Company, Riverside, Cal., who has won a research scholarship from the Swedish Academy of Engineering Science, is studying high-voltage transmission problems in California.

E. B. Merriam, formerly director of industrial relations, has been appointed executive engineer of the switchboard department of the General Electric Company. As executive engineer Mr. Merriam will direct and co-ordinate the engineering activities of the switchboard department at Schenectady, Philadelphia and Baltimore. Mr. Merriam is an engineer of broad experience and has been identified with important developments in the particular field he is now entering. He holds a number of patents on circuit-interrupting and switchboard devices and was one of the pioneers in the development of outdoor substation and outdoor switching equipment, for which a model and diploma for meritorious design were awarded to him at the Panama-Pacific International Exposition. He entered the employ of the General Electric Company in 1900 as a student in the testing department. In 1903 as a member of the switchboard engineering department he was engaged in testing fuses and lightning arresters and in the investigation of short-circuit phenomena. In 1905 he entered the designing section of the switchboard department and two years later was assistant engineer in charge of design. About 1917, becoming interested in employment problems, he was appointed employment manager and director of industrial relations. During the war Mr. Merriam served on various personnel classification committees and was industrial representative in military camps.

E. B. MERRIAM

F. B. Frost, superintendent of motive power for the New Orleans Railway & Light Company, has had the added duties of superintendent of the electrical department of the company placed upon him, with a new title of general superintendent. He will now have charge of the generating, transmission and meter department of the New Orleans company.

George E. Lewis has been appointed executive manager of the Rocky Mountain Committee on Public Utility Information, serving the States of Colorado, New Mexico and Wyoming. Mr. Lewis made an enviable record during the war period, when as director of publicity for the Mountain division of the American Red Cross he did much toward standardizing that organization's publications and furthering its financial and other campaigns. He is a newspaper man and in that profession has had several years of executive experience and has been a successful feature writer. Mr. Lewis has made a special study of utilities with respect to public relations. He will make his headquarters at Denver.

G. E. LEWIS

E. G. MacDonald, formerly associated for ten years with the Great Western Power Company as superintendent of the steam-plant department at Oakland, Cal., has been appointed assistant superintendent of electric generation for the Los Angeles Gas & Electric Company. For the last three years he had supervision of the best and trial work for the Los Angeles Shipbuilding Company.

H. S. Cooper, formerly secretary of the Southwestern Electrical and Gas Association, has opened offices in Dallas, Tex., as an advisory engineer to electric light and power, electric railway, gas and water companies. Mr. Cooper made a reputation during his nine years as secretary of the Southwestern association and in the consulting engineering work that he carried on during a part of that time. He resumes active work after a rest taken when he resigned as secretary of the Southwestern Electrical and Gas Association last summer.

Reginald M. Campbell, well known in the electric light, power and railway and steam-railroad fields, and who has for the last eight years been identified with the Habirshaw Electric Cable Company, has resigned from that company to accept the position of special representative of the American Copper Products Company with headquarters at 200 Broadway, New York City. In his new connection Mr. Campbell will continue his activities in the fields he has specialized in for eighteen years and in which he enjoys so wide an acquaintanceship. Prior to his connection with the Habirshaw company, Mr. Campbell was associated with the Ohio Brass Company. The American Copper Products Company, whose organization he has now joined, is one of the largest producers of copper products in the country. Mr. Campbell is a member of the New England Street Railway Club and the Railroad Club and Engineers' Club of New York.

R. M. CAMPBELL

V. A. Zehr, consulting engineer, Pekin, Ill., who recently went to Europe to investigate certain construction work in Bohemia, has established an office in Brandys Labe, Czechoslovakia, for the practice of engineering. Mr. Zehr was born in Brandys Labe and came to this country in 1915. In the following five years he was with the General Electric Company, Stone & Webster, the Westinghouse Electric & Manufacturing Company and the E. T. Perkins Engineering Company.

A. B. Holcomb has been appointed district manager of the Pittsburgh office of the Corliss Carbon Company, Bradford, Pa. Mr. Holcomb was graduated from Worcester Polytechnic Institute in 1908, and after a year's experience with the West Penn Power Company at Connellsville, Pa., he spent seven years teaching electrical engineering at Cornell University and the Carnegie Institute of Technology, using the summer vacations for training and experience with the West Penn Power Company and the Westinghouse Electric & Manufacturing Company. In 1916 he left academic work to accept the position of electrical superintendent with the Standard Tin Plate Company at Canonsburg, Pa. Since 1919 he has been following consulting and sales engineering work in the Pittsburgh and Youngstown districts.

K. S. Edwards has been transferred from the Pacific Coast sales department of the Gilbert & Barker Manufacturing Company to the home office in Springfield, Mass., and will assume supervision of all retail sales activities of the company.

Louis C. Eitzen, well known in the electrical industry as a sales engineer, has established an organization with headquarters at 280 Broadway, New York, for sales promotion work. Mr. Eitzen obtained a degree of B.E.E. at Cooper Union, New York, and began his professional experience as an apprentice with the Lambert Schmidt Telephone Company, Weehawken, N. J. Later he entered the shops of the James Reilly Repair & Supply Company, New York. In 1904 he entered the employ of the William H. Bristol Pyrometer Company, being placed in charge of the manufacturing and calibrating departments. There he remained until 1907, when he became associated with the Electrical Testing Laboratories of New York, where his studies culminated in his engineering degree. From 1911 to 1917 he was a sales and electrical engineer with the Standard Underground Cable Company. During the following two years he held the position of general manager of the August Mietz Corporation, manufacturer of semi-Diesel oil-burning engines. He became vice-president and general sales manager of the oil-engine division of the Pittsburgh Filter & Engineering Corporation, with offices in New York, in 1919 and resigned that position in 1920 to become president of the Elsee Products Corporation, New York. Mr. Eitzen is an associate member of the A.I.E.E. and a member of the American Society of Testing Materials and of the Export Managers' Club.

L. C. EITZEN

Obituary

Francis J. Hovey, for fifteen years in charge of personnel matters for Stone & Webster and long in touch with the development of that organization at Boston and elsewhere, died at Hingham, Mass., recently. Mr. Hovey, who was about sixty-nine years of age, was known throughout the public utilities managed by Stone & Webster for his guidance and supervision of young men entering the organization after preliminary training outside. He exerted a far-reaching influence upon their development and progress toward posts of executive responsibility. Ill health compelled him to relinquish many of his responsibilities in the last two or three years, but he retained his active interest in the organization to the end, and during the recent convention at Boston of Stone & Webster managers telephonic arrangements were made by which he was able from his bedside to follow many of the proceedings. Mr. Hovey was an uncle by marriage of E. S. Webster of the original firm, now Stone & Webster, Inc. In earlier life he was associated with the American Bell Telephone organization.

F. J. HOVEY

J. Leake Carraway, formerly local director of public relations for the Virginia Railway & Power Company, died on Feb. 10 at his home in Norfolk, Va., after a lingering illness. Mr. Carraway was widely known by public utility men throughout the country. He was born in 1873 in Wadesboro, N. C. After several years in newspaper work he became executive secretary of the Charlotte Chamber of Commerce, which position he resigned in 1919 to become director of publicity of the Southern Utilities Company. Mr. Carraway had served as chairman of the publicity committee of the Southern Gas Association and also as a member of the managing committee of its advertising section.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Keener Competition on Control Devices

COMPETITION is keen among manufacturers of electric controlling devices in an attempt to secure what business is on the market, according to an inquiry just made by the ELECTRICAL WORLD. Prices were reduced generally several months ago, and there is no expectation of another such decrease soon, but there is a tendency to go after business on a price basis, and it is reported that special prices have been made in special cases.

In spite of this competition, or owing perhaps to the hard work it engenders, one company records a greater volume of sales for a greater cash value this last month than was the case six months ago. Deliveries of the apparatus are approximately normal. Manufacturers are optimistic regarding the future, feeling as they do that they have successfully passed the worst period and will go steadily ahead from now on.

Good Foreign Demand for Farm-Light Plants

COMPACT and simply operated electric lighting sets for household, estate or club installation, according to *Commerce Reports*, find a good sale in such countries as India, Ceylon, Mexico, parts of Central and South America, Java, the Malay States, South Africa, East Africa, and to some extent Indo-China and China. Small electric lighting sets, as would be naturally expected, find their most ready markets where central station service is least developed and where there are large plantations and estates. At the present time the inactivity in such products as rubber, jute, tea, coffee and sugar has affected the buying power of the better fields for small lighting plants, but manufacturers will find it well worth while to arrange now for the necessary selling connections.

Switchboard Manufacturers Hold Their Own in Last Half Year

SALES of switchboards and panelboards during the last six months have held just about even, according to several prominent manufacturers. Conditions in the northern part of the country seem to have been slightly better than in the South, producers in the former section stating that sales have run somewhat ahead of those last September. In the South there has been a decrease in orders estimated at from 15 to 20 per cent. A manufacturer in the Middle West states that any increase in sales will be based on the belief of the public that prices are low, on the fact that many developments have been held up so long that further postponement is impossible, and on the small stocks very generally being carried.

There is a hint of brightness on the horizon, says this producer, for it seems impossible for construction to go forward this summer and not cause the sales curve of the switchboard industry to go up with it. Jobbers' stocks and those of dealers and contractors are about liquidated, so that when any demand does show up it cannot fail to improve the manufacturer's business at once. There is a fear on the part of some in the industry that dealers will let their stocks sink so low that the first indication of a business revival will bring a rush to buy and eventually a secondary condition of inflation.

Prices have been declining for the past year, and it is not evident yet that they have reached a stable level. However, there is some complaint that they have fallen too low and it would not be surprising to see a reaction upward whenever a sufficiently strong demand affords a reasonable excuse.

Heater Season Subnormal, but Ends with Small Carry-Over

SALES of air heaters during the past winter have been disappointing in most parts of the country, owing partly to general business conditions and partly to the mild winter which has prevailed in nearly all sections. Fortunately, however, jobbers and dealers were very cautious about building up stocks last fall, and the majority will go into the summer months with a negligible number of heaters left on their shelves. A general average of heater sales for the country as a whole, it is estimated, will run from 20 to 25 per cent under the previous season and from 40 to 50 per cent under the 1919-1920 season.

In the eastern part of the country sales were restricted considerably by the generally mild winter, and jobbers state that the volume for the season is about 30 per cent under last year. The prospect for the manufacturer next year is bright, nevertheless, for stocks have been whittled down almost to the vanishing point.

SALES IN NEW ENGLAND HELD UP

Jobbers in New England have another story to tell, for probably 10 to 15 per cent more heaters have been sold this season there than a year ago. Two seasons back may have witnessed 80 per cent of the current season's sales. Carry-overs now amount to little because of hand-to-mouth buying. Price considerations affect sales inconsiderably. Electric radiators are staple products, standing fifth in the list of most popular appliances merchandised by one of the largest dealers. Some dealers sold fewer heaters this season than last, but, by and large, the demand is increasing annually in response to vigorous sales efforts.

The Middle Western 1921 heater market, taken as a whole, was not quite so good as that of 1920. While some dealers and jobbers have sold as high as 30 per cent more heaters than in 1920, a general average for 1921 business has been 85 per cent of that done in 1920. The 1921 carry-over was fairly large, but this season nearly all dealers report that their carry-over was very small. With the advent of the cheaper grades of appliances, the public is looking for bargains on the regular standard lines, and this problem must be worked out. The mild winter season has also acted to reduce sales of air heaters.

MILD WINTER RESTRICTS SOUTHWESTERN SEASON

A mild winter restricted the sale of air heaters in the St. Louis territory in the season about to close. The demand was especially quiet until the middle of January, but the subsequent cold weather has increased sales, and it is estimated that the total movement for the season will be about half of that in the season of 1920-1921 and possibly one-fourth of that in 1919-1920. The weather is considered to have been the controlling factor in the demand this year, and it is felt that price considerations had very little effect. The carry-over from the 1919-1920 season was very small, because of the big business and the difficulty in getting shipments, but that from 1920-1921 was heavy because of the sudden decrease in buying generally. Jobbers and dealers alike bought only as needed this season, consequently the carry-over will be very low.

This season has been a very disappointing one from the standpoint of air-heater sales in the Southeast. Jobbers report that sales in 1921 were only 50 per cent of those for 1920 and probably not over 33 per cent of those for 1919. Strenuous efforts to move stocks failed to bring results, even sharp price reductions being of little or no avail. As a result of this there is going to be quite a heavy carry-over by nearly all the jobbers in this section.

In the Intermountain region the carry-over is not so heavy this year as it was last, although total sales have been less. Jobbers and dealers did not stock so heavily during the past year, basing their judgment on the disappointing experience of the years 1919 and 1920. It is the general opinion that heater sales would have reached a much better volume in 1921 if the price schedule had been lower. Certain old-type heaters did not move well because of the arrival on the market of improved new types. Special price reductions are necessary to move them at all. Recent price reductions did not come soon enough to enable jobbers and dealers to clean up their stocks. The radiant-type heater in 600-watt to 1,000-watt sizes is in best demand in this territory. The fact that they can be connected to any socket gives them preference.

PACIFIC COAST SEASON SPOTTY

The past season in California was wonderfully assisted by an unusual spell of cold weather both for severity and duration. The result was that practically all surplus stocks on jobbers' and dealers' hands were sold during January and February and reorders actually placed at a time when the season is considered at an end. It is estimated that close to 20,000 radiators of all types and makes were sold in California during the past season, which is about 20 per cent over the sales of last year and very close to the sales of two seasons ago. A surplus of about 3,000 radiators was carried forward last year and almost as many the season before, but this year not more than a few hundred still remain. One manufacturer claims to be nearly six months ahead of his last year's showing. The reduced prices were expected by the public and cannot be said to have increased the sales to any appreciable extent. A noticeable California feature has been the sale of the large and stationary type to apartment houses. Many of the new apartment houses are being so equipped, and it is the local opinion that greater sales effort would have provided an even better showing. The experience gained this past year will be found very profitable next season.

Jobbers and dealers on the Northwest Pacific coast agree that the 1921-22 heater sales have been rather poor. The volume of business done was less than in 1920-21 and very much less than for 1919-20. While there are no exact figures available, it is safe to say that last season was 25 per cent under the 1920-21 season and from 50 to 60 per cent less than the 1919-20 season. The carry-over this season is universally small. The carry-over for 1920-21 with comparatively small orders was practically sufficient to handle the trade for the 1921-22 season. Business depression may have had a slight effect on sales, but the unusually long cold winter has had a counterbalancing effect. High prices decreased the demand for the better type of heaters and encouraged the cheap type handled by every class of store.

Prices Drop on Some Lines of Motors

SEVERAL large manufacturers of motors have announced decreases of from 5 to 14 and 15 per cent on alternating-current polyphase motors, the drop taking effect in the case of two manufacturers just before March 1. The reduction is on all sizes of the alternating-current polyphase motors, but does not apply to the single-phase or to the direct-current. One manufacturer gives the decrease as 10 per cent on induction motors, 7½ per cent on wound-ring motors under 10 hp. and 10 per cent on those above that figure.

The move was not generally expected and is taken as an indication of a desire on the part of manufacturers to get sales started if at all possible. Costs have been coming down steadily for the last year, but one producer of both large and small motors stated to a representative of the ELECTRICAL WORLD that this price cut added to those in 1921 anticipated still lower material and labor costs. There was very little profit in motor business today, he said, and not much business either. How much further prices of raw material can drop is a question, he continued, for the copper market is evidently at almost its lowest point and probably will react soon, electrical sheet is firm and the market for castings is steady. Another reason for the drop is ascribed by another manufacturer, who says that it is the first move in getting the "war-baby" and second-hand market cleaned out and new stock moving from the factory.

Whatever the reason, there is little increased demand yet as a result of the cut, and the quiet market of the last two months still continues. Here and there there is a sale to an industrial, but as a whole stocks are moving very slowly.

Strong German Competition in China

THE terms offered by German manufacturers of electrical goods are becoming a strong factor in China, according to Julean Arnold, commercial attaché at Peking. This is particularly true in the line of industrial machinery and plant equipment. Very recently the Siemens-Schuckert Electrical Company formed an alliance with Chinese interests for the development of a large electrical manufacturing plant at Saochan. The same company has arranged to erect a meter factory in Japan in conjunction with the Furukawa Electro-Industrial. In this connection the Department of Commerce advises that the investment of American capital and co-operation with Chinese financial interests are important means for taking fullest advantage of opportunities offered by the Chinese market.

Metal Market Situation

THE copper market seems to have reached another turning point at 12½ cents per pound, and there are signs that the firmer feeling noted at the beginning of the week will continue to increase. There has been somewhat of an improvement as far as buying orders are concerned, though no move has been made to start the price up again. Large producing companies seem determined to let quotations go no lower than 12½ cents, and the consumers have taken this as a sign that it would be wise to stock up on future deliveries at that price.

Offerings by second hands have been reduced in volume. Competition for brass and copper products developed lower prices during the last week end, and copper wire declined to 14 cents, rods to 13½ cents and other products in proportion. England, France and Germany purchased fair-sized tonnages of the red metal during the previous week, and there is more activity in the export market than has been noticed for several weeks. It is reported that during the dullest period the Copper Export Association sold as low as 12⅞ cents, c.i.f. European ports, but at present is actually booking orders at 13 cents and higher.

Part of this improvement in the market may be laid to the fact that the producers and large selling agencies are not competing so actively among themselves for the business. As long as sellers continued to force copper on the market at any price for the sake of an occasional sale consumers were frightened off and the market continued to sink lower.

NEW YORK METAL MARKET PRICES

	Feb. 28, 1922	March 7, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot.	58 15 0	60 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00-13.25
Electrolytic	12.75	12.87½
Casting	12.50	12.62½
Wire, base	14.00-14.25	14.00
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.25	4.20
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.90	4.97½
Tin, straits	30.00	29.00
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	Feb. 28, 1922	March 7, 1922
Heavy copper and wire	10.50-11.25	11.00 -11.25
Brass, heavy	4.75- 5.00	5.00 - 5.25
Brass, light	4.25- 4.50	4.37½- 4.62
Lead, heavy	3.50- 3.75	3.75 - 3.87
Zinc, old scrap	2.00- 2.12½	2.25 - 2.50

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A SOMEWHAT dull and unsettled market prevailed all last week in the electrical supply field. Sales of even the "bread-and-butter" materials remained light and unsteady, but here and there there were compensations in the shape of sales of line material, central-station apparatus or other important items. Chicago jobbers have made good sales of poles, wire, cross-arms and other line materials to those central stations that lost lines in the Michigan and Wisconsin sleet storm. Central stations in the Southwest are buying more weatherproof wire, and railroads there are still heavy purchasers of dry cells. Sales of underground cable have picked up in Boston, and so also has street-railway buying. A washing-machine campaign is going ahead successfully in the Intermountain section, and there is a good agricultural demand for small motors. A heavy demand for schedule material is reported from San Francisco. Electrical permits in Portland for February show an increase of about 7 per cent over January.

Price changes reported during the week included a 5 per cent decrease on pole-line hardware and 10 to 15 per cent decrease in Atlanta, and a 10 to 20 per cent decrease on switches and plug cut-outs, a slight drop on weatherproof and a 30 per cent cut on porcelain in Portland.

NEW YORK

Activity in the electrical trade remains at virtually the same level as reported last week. Jobbers state that there is a steady flow of small and moderate-sized orders for wiring material from contractors. There is, however, no tendency on the part of the contractors and dealers to increase stocks, and hand-to-mouth buying is still pretty much the rule. Building activity continues to increase and is responsible for most of the demand for wiring supplies.

Motor manufacturers have announced additional discounts of from 5 to 15 per cent on polyphase motors. Otherwise there were no price changes reported. Close buying on wiring supplies is apparent, and some price competition is evident in a few quarters.

Jobbers are busy closing up contracts for fans and expect to make shipments during the latter part of this month. Generally, the dealers' and jobbers' stocks were fairly well cleaned up last year, and prospects for the coming season are very good. The demand for heating appliances is sluggish. Radio apparatus continues to be in as great demand as ever, with but little improvement in shipments from manufacturers.

Rigid Conduit.—Prices on rigid conduit remain unchanged, and jobbers report only a very moderate demand. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in., $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft

Rubber-Covered Wire.—No change in conditions in the wire market was noted. No. 14 rubber-covered is quoted at $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—The demand for this material remains fairly steady, with ample stocks in jobbers' hands. No. 14, two-wire, single-strip, is quoted at $43 to $45 per 1,000 ft., and double-strip is $45 to $47 per 1,000 ft. in that quantity.

Metal Molding.—With a very light demand the quotation for metal molding is still $5.60 per 100 ft.

Dry Cells.—A fair demand is reported with ample stocks on hand. In barrel lots of 125, igniters are quoted at $30 per 100.

Lamp Cord.—Some changes in price of lamp cord have been reported. No. 18, cotton twisted, is quoted at from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft.

Washers.—A little more activity is seen in the demand for washing machines. Jobbers report that the smaller sizes are moving best.

Radio Equipment.—There has been no let-up in the demand for wireless apparatus, and deliveries are little, if any, better. One jobber reports receiving a small shipment of thirty "Tungar" rectifiers, while his orders on hand called for more than three times that number.

CHICAGO

Building permits issued in the city of Chicago for the month of February were 634, with a valuation of $13,493,000. This shows an increase in apartment-house building of 58 per cent over January. The permits for industrial construction increased from 82 in January to 116 in February, an increase of 42 per cent. This increase in activity during a dull month has been taken as a good sign for coming spring business by most dealers.

During the week plans were announced for building a 3,000-room hotel, to cost between $12,000,000 and $15,000,000. The building will be twenty-five stories in height. Construction plans are nearly finished, and work will begin as soon as uninterrupted construction is assured.

Activity in the electrical supply field has continued to be steady and fair, but with few large sales of any materials. Keen competition on conduit exists, and it is available in any amount at good prices. Poles are moving northward to replace fallen transmission lines in Wisconsin and Michigan. There is a shortage of radio vacuum tubes with deliveries averaging several weeks.

Wire.—With No. 14 rubber-covered wire selling between $6.25 and $6.40 per 1,000 ft. in 5,000-ft. lots, a fair demand has been reported by the majority of jobbers and dealers. The weatherproof and base wire market is also fair but with few large sales. Prices have not changed and stocks are ample.

Rigid Conduit.—Keen competition has lowered prices, and the ½-in. black pipe is available in 5,000-ft. lots at $40 to $42.50 per 1,000 ft. Stocks are in good condition.

Flexible Armored Conductor.—A moderate but steady business has been noted. The No. 14 two-wire, single-strip, is selling between $43 and $45 per 1,000 ft. in 5,000-ft. lots.

High-Tension Equipment.—A complete 66,000-volt 15,000-kva. outdoor substation was shipped to Scandinavia by one manufacturer during the week. This company also sold two 22,000-volt, 900-kva. substations to a firm in Pennsylvania. Another company is quoting on twenty-five 33,000-volt substations for a utility in southern Illinois.

Poles.—The storm damage to the transmission lines in Wisconsin and Michigan has aided the market for poles and pole-line equipment. Nearly all dealers tell of immediate shipments to these areas and state that their stocks are in good condition to supply this demand. No price changes have been noted and the 7-in., 30-ft. Northern white cedar sells for $8.40 f.o.b. Chicago.

Lamp Cord.—A spotty market exists, a few dealers reporting poor business, while others say that the silk cord is moving well. The No. 18 cotton parallel sells for $16 per 1,000 ft., and the silk parallel is quoted at $26 to $27 in lots of the same quantity.

Radio.—Popularity of this line is continuing, but stocks are in no better condition than they were a few weeks ago. All dealers have orders booked ahead and deliveries are in most cases two or three weeks. Crystal detectors are available, but very few vacuum tubes are on dealers' shelves. Stocks of head phones are not large, but are being improved daily.

Heating Appliances.—Activity on ironers, toasters and open-air heaters has been moderate. No pronounced demand for any one line has been noticed, and dealers report their stocks in fair condition.

Washers and Cleaners.—The majority of dealers report that sales on washing machines for the last two months have been good. Stocks are ample. Vacuum cleaners have sold fairly well, but not so steadily as the washers. Stocks are in fair condition.

BOSTON

Business is spotty in New England this week, but in the electrical field the tone is better than in February. The textile strike is hampering general business somewhat, but electrical jobbers and manufacturers have not been affected seriously as yet by curtailment of the small replacement business being handled of late. Moderate improvement is evident in the metal-working field and in the building industry. Prices are a little uneven, rubber-covered wire showing weakness under close competition. No shortages of supplies are apparent. A 20,000-kw. turbine was ordered last week for a new electric railway generating plant to be built at Providence, R. I., and some central-station buying of underground cable was also put through. Retail trade is improving over February figures.

Motors.—"Pick-up" business dominates the market, but inquiries are showing considerable activity. Stocks are ample for current requirements.

Wire.—Moderate sales are reported. Rubber-covered wire prices are uneasy, No. 14 selling from $6 to $5.50 or lower, according to competition, in 5,000-ft. lots. Weatherproof wire is moving slowly around 15⅛ cents base, and small sales of bare copper are reported at 14½ cents to 14¾ cents for No. 00, in 5,000-ft. lots. Some street-railway replacement work is under way, though of small volume.

Porcelain.—Light sales are being carried through, with good supplies for current needs. "Nail-it" knobs are selling around $15.50 per 1,000 in barrel lots, $\frac{5}{16}$-in. by 3-in. tubes at $4.50, and 6-in. tubes at $9.

Vacuum Cleaners.—A dull market is evident, with light sales in response to vigorous canvassing. Prices are firm.

Washers.—A better tone in washers is evident, sales having picked up somewhat last week in retail circles. Price variations are still proving troublesome to distributers. Stocks are plentiful.

Loom.—Fair sales are reported on some days and light orders on others. Building operations tend to absorb more of this material than in the past few weeks.

Lamps.—A slight recession in lamp demand is apparent, following unusually active post-holiday sales, which were protracted far into the winter. Portables are still moving freely in retail circles under sharp competition.

Meters.—A better movement is expected to develop shortly as building operations increase.

ATLANTA

General business conditions in this section might be characterized as spotty with an air of dullness throughout the entire line. This is a somewhat natural condition for the latter part of February, and, all things considered, it might be safely stated that conditions have a brighter aspect with a slow but irregular improvement to be noted. Unfortunately, there has been some increase in non employment during the month of February, New Orleans showing an increase of 2.3 per cent and Atlanta a fraction over 1 per cent. but this is offset by decreases in Chattanooga and Birmingham, most of the decreases being shown in the railroad repair shops, building-material lines and iron and steel products. This is probably due largely to very unfavorable weather conditions, which have held up all outdoor construction work, but with the advent of spring employment conditions should materially improve, especially in the building-trade line.

February building permits in Atlanta are the heaviest on record, residential permits alone totaling 390, with the valuation of all permits at $1,045,000. This compares well with February, 1921, when the permits were valued at $533,000. An indication of the general improvement is to be noted in the Sixth Federal Reserve Bank report, which shows a reserve ratio of 69.2 per cent as against 42.1 per cent a year ago, while local clearings show an increase of approximately $1,000,000 per day.

Portable Lamps.—Little activity has been reported either in the mahogany stand and silk shade or the metal type since the holidays, and some price cutting is to be noted. Local stocks are reported good to heavy.

Industrial Motors.—Sales of the popular sizes, while not up to anticipations, are showing a slight improvement, particularly in sizes of 50 hp. and under in 220 volts. The larger sizes, except in isolated instances, are reported very sluggish. Stocks have been allowed to shrink somewhat, but are still equal to the demand.

X-Ray Outfits.—Extreme activity is to be noted, there being a largely increased demand for the more reliable and expensive types, with the smaller sets continuing quite popular. Local stocks have become very spotty, with deliveries on the former type of equipment as long as ninety days.

Oil Switches.—Little movement of this item is reported, as most industrials are at present holding off on installation of equipment requiring this control apparatus. Stocks as a whole are somewhat low.

Pole-Line Hardware.—A drop in price of 5 per cent became effective on Feb. 22. Spring activity is not to be noted as yet, but local stocks are being put into good shape in the anticipation of activity in the near future.

Schedule Material.—Weather conditions holding up construction work are reflected in the movement of schedule material, which is quite slow throughout. Local stocks are in good shape, and price reductions of from 10 per cent to 15 per cent are reported as effective last week.

Electric Elevator Equipment.—A steady demand is reported for the smaller commercial types, with an encouraging number of inquiries for the high-speed office-building equipment being received. Shipments of the smaller types are from stock, with the larger and higher-speed equipment on approximately a ninety-day basis.

ST. LOUIS

Building permits issued in St. Louis during February for new work, additions and alterations amounted to $1,285,735, as compared with $1,119,530 in January and with $714,845 in February of last year. Of this amount new factories comprised but $20,500 for three structures, the majority of the permits being for residential building. The volume of the latter form of work is being steadily maintained, and an active real-estate market indicates there will be quite a bit of such work this spring. In furtherance of construction some of the trades have agreed upon reduced wage scales, and the indications are more promising that the other trades will be falling in line.

The residential construction work results in a fairly steady demand for the "bread-and-butter" materials, but jobbers report that buying to any great exent by the industrials has not yet materialized. A few large orders for power-plant equipment are being placed, the state university being one of the buyers last week. In the last monthly report of the Eighth District of the Federal Reserve Bank it is said that buyers are in a hesitating mood and the movement of general commodities is disappointing despite the stable prices, the rise in important farm products and the strong financial position of the nation. While the grain-producing districts were assisted by a sharp rise in the price of corn, wheat and oats, many of the producers had already marketed their stocks. Reports from the manufacturers were discouraging, the report said. Cheap and medium-priced goods were called for. Railroads reported an improvement in the volume of freight traffic.

Dry Cells.—Demand has been steady and exceptionally good for several months. The railroads continue to buy in liberal amounts. Stocks are usually in good shape but at times run low. The igniter is priced at 32 cents and the regular at 31 cents, both for barrel lots.

Storage Batteries.—The increased use of wireless outfits is creating an additional field for jobbers handling storage batteries, and sales have been very good. The demand for automobile purposes has also been active. Stocks are in excellent condition.

Wire.—Movement continues on about the same basis, No. 14 rubber-covered being the only class to sell in large quantities. Central stations are buying weatherproof to a slightly greater degree, and there have been a few good sales of bare wire for high-voltage line work. Typical quotations are: No. 14 rubber-covered, $6.25 per 1,000 ft. in 10,000-ft. lots; base on weatherproof, 16 cents per pound; base on bare, 16 cents per pound.

Pliers.—All linemen's tools are selling very slowly, and the stocks are well up. The 6-in. side-cutting Klein plier is priced at $2.80 and the same in the 8-in. size at $3.75.

Poles and Cross-Arms.—Though there is a good deal of line work under contemplation, actual sales continue to be slow. In St. Louis and the immediately surrounding territory a fairly large amount of extension work will be started shortly. Northern white cedar poles, with 7-in. tops, in carload lots f.o.b. St. Louis, are quoted as follows: 30-ft., $8.90; 35-ft., $14.60; 40-ft., $18.65; 45-ft., $21.75. Fir arms, 3¼-in. by 4¼-in., are priced per 100, f.o.b. St. Louis, as follows: 3-ft., $51.38; 4-ft., $68,31; 6 ft., $102.77; 8-ft., $137.03; 10-ft., $152.25. Excellent deliveries of both poles and cross-arms can be given.

SALT LAKE CITY—DENVER

Weather conditions were unfavorable to business during the past week, the Intermountain sections being caught in the great storm wave that swept the country. Milder weather prevails now, and merchants are confidently looking forward to the opening of spring. It is expected that building will then begin and mark the opening of an era of better business generally. Electrical contractor-dealers are making preparations for handling a good volume of work, stocking to a degree that has not been known in the past year. Jobbers are well prepared to handle all orders for materials, but little call is being made on manufacturers to furnish new stocks. Until construction gets well under way it will not be necessary for jobbing houses to replenish their stocks. One of the most encouraging signs since the slump in metal prices a year ago is the announcement by the International Smelting Company that it will resume operations within sixty or ninety days. The time from now to the date of blowing in the furnaces will be used to build up stock piles as storage against emergency. Besides being a highly significant event to the mining industry, the immediate effect will be the re-employment of 300 to 400 men. The outlook for the copper industry is still unsettled, production on a partial scale going on in several centers.

Washing Machines.—The big spring drive on washers has been launched, and during the month hundreds of contracts with home owners will be closed. Terms are usually easy, as little as $1 down being required with $5 a month on the balance. The low price of copper is making the copper tub practicable from the point of view of price. Several important improvements in models are being demonstrated.

Motors.—Pending irrigation projects are stimulating interest in large-size motors for pumping. Small-size motors are also in fair demand by farmers and orchardists who are planning private installations.

PORTLAND—SEATTLE

Business continues reasonably good, although it appears to be materially influenced by weather conditions. Long-continued bad weather has held back the starting of many projects, and immediate prospects for a pick-up have been postponed somewhat on this account. The February volume probably will not show a very bad total, even though it may not quite reach previous expectations.

Building is increasing throughout the Northwest. Building permits for Portland for February, 1922, exceeded those for February, 1921, by 5 per cent in number, and those for January, 1922, by about 7 per cent, with a corresponding increase in valuation. The value of building permits for February in Seattle was $611,635, or about $33,000 more than for February, 1921. Seattle's water-borne commerce for January, 1922, showed an increase of nearly 52 per cent over January, 1921. Electrical permits in Portland for February, 1922, showed an increase of about 7 per cent over January, 1922. Lumber production for the week ended Feb. 25 was only 12 per cent below normal.

Electrical business, while only moderately good, shows some improvement over the preceding week. Sales are highly diversified and orders are largely for small lots. Several price changes are reported for the past week. Switches and plug cut-outs show a drop of 10 to 20 per cent.

Rigid Conduit.—Quotations are now: ½-in., black, $6.25, and galvanized, $6.80 per 100 ft. in less than car-load quantities; ¾-in., black, $8.05, and galvanized, $8.85 per 100 ft.

Wire.—Weatherproof wire, triple-braid, sizes No. 4/0 to No. 6, also shows a slight drop. It is now quoted at $20.75 per 100 lb. No. 14 is now quoted at $7.55 per 1,000 ft. in coil lots and $6.70 per 1,000 ft. in 5,000-ft. quantities.

Porcelain.—Porcelain shows a very appreciable drop, $\frac{5}{16}$-in. x 3-in. tubes being now quoted at $5.85 per 1,000 in unit-package quantities of 500. These were formerly $9.05 per 1,000. "Nail-it" knobs are now quoted at $23.75 per 1,000 in unit-package quantites of 500, and No. 5½ solid knobs are now quoted at $11 in similar lots. These were formerly $21 per 1,000.

Switches.—Tumble safety-entry switches dropped about 7 per cent on March 1. Motor-starting switches in small sizes also show a drop of about 30 per cent. Schedule adjustments have been made on sockets of all kinds so that dealers may buy assorted orders of 500 at discounts formerly applying on 1,000-unit quotations. This amounts to a drop in socket prices.

SAN FRANCISCO

Although there was a decrease in the value of February building permits as compared with last February that was slight in Los Angeles and more appreciable in San Francisco, yet construction continued at a high level because February, 1921, was a high month. The figures for February, 1922, are as follows: Los Angeles, $3,131,670; San Francisco, $2,830,991; Oakland, $1,424,772; San Diego, $490,357. The corresponding figures for February, 1921, were: Los Angeles, $3,254,131; San Francisco, $3,126,581; Oakland, $966,203; San Diego, $900,075.

Counter business is poor, but as crop prices are increasing and the season promises excellent crops there should be a return to normal conditions in appliances about the middle of the year. Export business has been signalized by several spectacular failures, but export conditions themselves are improving and the increasing value of foreign currency will help to stabilize the field. There is much non-employment of unskilled labor and many of the department stores have released scores of employees, but the trades unions are all busy. Relations with labor are in a healthy state.

Rubber-Covered Wire.—New price of No. 14, single-braid, solid, in 5,000-ft. lots is $6.75 per 1,000 ft. This is about the market. Stocks are good and the demand for all sizes and styles is steady.

Rigid Conduit.—The ½-in. black conduit in less than carload lots is quoted at about $5.60 per 100 ft., while galvanized and sherardized sells at $6.10 per 100 ft. The demand is good. Local stocks have been good. Freight shipments have been arriving in quick time from the East, averaging about three weeks, and this service has been maintained all during the winter, aided by the relatively small amount of goods in transit.

Schedule Material.—Just at present sockets, switches and cut-outs of all kinds are showing the best movements of all electrical materials. This condition is general along the coast, but particularly marked in southern California. There have even been shortages of such essentials as ¼-in. cap brass key sockets, push switches and fuse plugs, but such shortages have not continued more than a few days. Fuse plugs have been showing an especially good movement.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Hurley Buys Superior Machine Company

The Superior Machine Company, De Kalb, Ill., owner of the Cooling swinging wringer patents and manufacturer of the "Superior" oscillating-type and dolly-type washing machines, has recently been purchased by the Hurley Machine Company, Chicago. The Superior company will continue to manufacture and merchandise its products as formerly.

New Electrical Factory for Portland

The Wonder Electric Manufacturing Company has established a plant at Twenty-fourth and York Streets, Portland, Ore., which is fully equipped with machinery suitable for turning out electrical appliances of all kinds. The officers and stockholders of the company are all Portland men. The company is already turning out a commercial and a domestic type of waffle iron. Offices are maintained in the Chamber of Commerce Building. John W. Henry is president of the company.

Lamp Manufacturer Announces Change of Name

The plant formerly operated by Alfred Hofman, 150-52 Hudson Avenue, Union, N. J., has been taken over by Alfred Hofman & Company, the change extending to the company name only. The manufacturing and distributing policies and the general management of the business will remain the same. Alfred Hofman is president, Victor Anderson is vice-president, and Fritz Seifart is secretary and treasurer. The company manufactures electric lamp and other special machinery. Business in this line is slightly slower at the present moment than two years ago, according to Mr. Seifart, but there is enough activity to keep the plant working, owing to the demand for machinery for making tipless lamp bulbs.

Air-Way Cleaners Shipped to Far East and Europe

Shipments of the vacuum cleaners manufactured by the Air-Way Electric Appliance Corporation, Toledo, Ohio, have been made recently to Japan, Italy and Switzerland, according to C. A. Ward, sales promotion manager, and within the near future several shipments of both the standard and "Junior" cleaners made by the company are expected to go to Australia, Ecuador and several other foreign countries. In addition to this, Mr. Ward stated, the company has considerably widened the zone of its domestic distribution and has taken on a considerable number of new dealers.

Current sales of cleaners for several months past have shown an increase, Mr. Ward stated, due mainly to improved conditions generally and to good dealer co-operation. The outlook for the coming months, he said, is brighter than might have been expected before the beginning of the year as both old and new dealers are being welded into a more compact and effective selling organization than ever before and the realization is growing that the demand curve in the appliance industry will rise in direct ratio to the amount of sales energy expended.

Must Lower Production and Sales Cost, Says Trumbull

With about a 10 per cent reduction in wage scale, by improved methods and through increased earnestness in the staff of employees, the Trumbull Electric Manufacturing Company, Plainville, Conn., is making a greater profit today on a switch selling for $1 than was formerly reaped at a price of $1.40, says the company's house organ, the *Trumbull Cheer*, in the current issue. Lower retail prices must accompany the efforts of manufacturers to reduce costs, the company points out.

"Many elecrical retailers have 'come to,'" says the article, "but statistics clearly show that the last to leave the sinking ship of high prices is the retailer, and we have no reason to believe that *all* electrical retailers are exceptions to the rule." The claim is advanced that, on the whole, electrical manufacturers have done the trade a great service by seeing the need early in 1921 and by taking great losses in high-priced stock and overheads voluntarily. Those who do not improve in manufacturing and reselling processes, the article declares, will be hard pressed by those who do.

Radio Corporation Distribution Policy

Atlantic Division Jobbers Told Wireless Apparatus Will Be Marketed Principally Through Established Electrical Supply Houses

Considerable interest was aroused at the recent meeting of the Atlantic Division of the Electrical Supply Jobbers' Association, held Feb. 28 in New York, by the discussion of radio sales and manufacturing conditions by David Sarnoff, general manager of the Radio Corporation of America. The meeting lasted only one day, and Mr. Sarnoff's talk and the discussion following it occupied the entire afternoon session. The morning was given over to matters concerning salesmanship.

"The situation in the manufacture of sets and parts is such that manufacturers cannot possibly produce more than enough to furnish each distributer with a small portion of his demands," said Mr. Sarnoff, after explaining how the Radio Corporation had been formed and had become sole selling agent for the radio apparatus manufactured by the General Electric Company and the Westinghouse Electric & Manufacturing Company. "The General Electric and Westinghouse factories are going at top speed turning out the radio devices ordered by the Radio Corporation, running into many millions of dollars, and normal production is expected to commence in April of this year. It is hoped that during March there will be produced 75,000 vacuum tubes, and that beginning in April the production will be brought up to 100,000 tubes monthly. It is expected that within the next three to six months factory production can be built up to meet all reasonable demands. In the meantime the Radio Corporation will undertake to allocate fairly to each distributer an equitable portion of his orders.

"It is the opinion of those who have had opportunity to gain an insight into this business that it may easily develop in volume into something as great as or even greater than the phonograph industry, which is credited with an annual business of $400,000,000. The opening of broadcasting stations, from which popular programs are daily sent out, has unexpectedly created an opportunity for the merchandising of radio-telephone sets. The Radio Corporation realizes both the great possibility of failure, if improperly handled, and that for success, if properly handled, and feels morally responsible to guide every one who undertakes to sell its product.

"No jobber or distributer should undertake to handle this line unless he has technical knowledge of the subject or can get some one who has. The corporation is willing to consider the advisability of offering a course of instruction which would fit salesmen to handle this particular line of material—possibly in conjunction with the school which it now operates for the training of radio operators. For the present, however, it will be necessary to make use of the services of radio amateurs qualified to assist in the organization of special radio departments. The distributer or dealer who undertakes to handle this line must be equipped to render service. In the natural distribution of the apparatus it will be the dealer who will be called upon for this service, but it will be necessary for the jobber and distributer to see that the dealer is equipped to furnish service on the apparatus, and that he does it.

"The Radio Corporation intends to market principally through established electrical supply jobbers. It will endeavor to encourage the purchase of its product by dealers through the jobber. It plans to appoint as jobbers those electrical supply jobbers throughout the United States who are prepared to function properly and do a real distributing job. At the present time the Radio Corporation has about seventy-five jobbers. Within a short time it will have 150. It is expected that some of these may not perform the services which will be expected by the Radio Corporation, and as a result the number of jobbers will probably be reduced to somewhere between seventy-five and a hundred. It is the policy of the Radio Corporation to grant an exclusive agency or exclusive territory to no one. It is kindly disposed toward the phonograph people and is studying their system of distribution."

As to the future plans for the establishment of broadcasting stations, Mr. Sarnoff stated that these plans will be subject to conferences now being held with the authorities in Washington. It is the intention to erect a sending station in the heart of New York City; also one each at Washington, San Francisco and Boston, and eventually, if proper conditions can be worked out and the business warrants, to cover the United States with broadcasting stations suitably located.

Buffalo Company Established to Represent Manufacturers

The J. Leo Scanlon Company has been established at 950 Ellicott Square, Buffalo, N. Y., to act as district sales representative for a number of well-known manufacturers in the electrical field. The company is headed by J. Leo Scanlon, formerly general sales manager for the Moloney Electric Company, St. Louis. The manufacturers represented include the Moloney Electric Company, Page & Hill Company, Schweitzer & Conrad, Inc., and the Ideal Electric & Manufacturing Company.

Philadelphia Jobber Reports Better Sales

Business is rapidly improving, according to George H. Carnall, sales manager of the Frank H. Stewart Company, 37-39 North Seventh Street, Philadelphia, electrical supply jobber. The past few months have shown an improvement in electrical activities, he recently declared to a representative of the Electrical World, and it can be safely expected that March and April will be much better. At present the company is selling much seasonable merchandise for the coming summer and winter months. Much material that would ordinarily be sold later in the year is being pushed now. This method, he stated, has brought an increase in business by adding future sales to present.

Western Electric Sees 1922 Business Same as 1921

The outlook for business in 1922, according to a statement issued by Charles G. Dubois, president Western Electric Company, is that its volume will be substantially the same as in 1921. Sales of the Western Electric Company for 1921, he stated, had been eclipsed only by those of 1920 in all the time the company had been in business.

The statement was as follows: "The sales of the Western Electric Company for 1921 were approximately $185,000,000, which is a greater amount than in any previous year except 1920, when they were $206,000,000. The books have not yet been closed for the year, but it is estimated that some margin was earned above the regular dividends of $10 per share on the common stock. The company's floating debt was reduced during the year by $14,000,000 and its cash on hand increased by over $5,000,000, a total improvement of more than $19,000,000 in its financial position. The outlook for 1922 is that the volume of business will be substantially the same as in 1921."

In the annual report of the American Telephone & Telegraph Company, which holds a controlling interest in the Western Electric Company, the sales of the subsidiary company are given as $189,800,000, of which $135,600,000 were to the Bell companies and $54,200,000 to other customers. This was an increase over the previous year of 19 per cent to the Bell companies and a decrease of 41 per cent to other customers, indicating the activity of the telephone companies and the severe depression that characterized the electrical jobbing business during 1921. Unfilled orders of the Western Electric Company on Dec. 31, 1921, were given as approximately $76,000,000, as compared with $83,000,000 on the previous Dec. 31.

Incandescent Supply Opens St. Louis Branch

The Incandescent Supply Company of New York, with branch houses in Pittsburgh, Chicago and San Francisco, has established a new jobbing house at 1,118 Olive Street, St. Louis. A very general line of lighting fixtures, glassware, lamps, appliances and other electrical supplies will be carried. This branch is intended to cover the Southwest territory. Horace F. Kite will be the local manager.

Mueller Electric Plans New Building

A new factory, the first contracts for which were recently let, is planned by the Mueller Electric Company, 2135-43 Fairmount Road, Cleveland, manufacturer of storage-battery accessories. The new building, which is to be two stories in height will be erected on East Thirty-first Street between Payne and Superior Avenues and will be of the most modern construction. The new move brings the company closer to the business section of the town and assures better freight and express service to customers. The building will afford the company about 10,000 sq.ft. of floor space for manufacturing purposes.

According to R. S. Mueller, one of the officials of the company, current sales are holding up very satisfactorily. The year 1921, he said, was the second best year in the history of the business, having been exceeded in volume only by the extraordinary period of 1920. Sales of test and battery clips are back to normal, although sales of attachment plugs have continued rather quiet.

The American Wiremold Company, Hartford, Conn., manufacturer of apparatus for bending wire work, recently secured a three years' lease on offices at No. 252 Asylum Street, that city.

Cote Brothers Manufacturing Company, 1425 First National Bank Building, Chicago, manufacturer of refillable fuses, has announced the establishment of branch offices in New York, Philadelphia, Boston, Cleveland, Tampa, Denver and San Francisco.

The George J. Hagan Company, Pittsburgh, furnace and combustion engineers, has recently established offices in Detroit and Chicago. The Detroit office is at 515 Murphy Building and is under the management of J. Sandberg, formerly with the General Electric Company. The Chicago office is at 20 East Jackson Boulevard and is under the management of V. A. Hain, formerly with General Electric Company.

The Acme Electric & Manufacturing Company, 1,444 Hamilton Avenue, Cleveland, announces the appointment of new sales representatives for the "Acme" motor-generator equipment as follows: The E. & M. Products Company, 50 State Street, Boston; Wilson, Ensign & O'Hara, Real Estate Trust Building, Philadelphia; Corte Engineering Company, 3414 Woolworth Building, New York City; E. L. Bailey, Ford Building, Detroit, and the McDowell Machinery Company, 343 South Dearborn Street, Chicago.

The John Hugo Manufacturing Company, New Haven, Conn., manufacturer of electrical specialties, has filed a certificate with the Secretary of State of Connecticut to increase the capital stock from $50,000 to $150,000.

The Chicago Bridge & Iron Works, 30 Church Street, New York, has received a contract from the Brooklyn Edison Company for furnishing and erecting two steel stacks, 15 in. in diameter and 250 ft. high, for the new power plant of the Edison company at the foot of Sixth-sixth Street, Brooklyn.

I. P. Frink, Inc., New York, has appointed R. M. Booth as representative in southwestern Ohio, southeastern Indiana, eastern Kentucky and western West Virginia, with headquarters at 17 Greenwood Building, Cincinnati. Mr. Booth was formerly with Johns-Manville, Inc., which up to this time has had the agency in that territory for Frink products.

Foreign Trade Notes

PROPOSAL TO FORM A COMPANY TO MARKET ELECTRICAL EQUIPMENT IN ITALY.—A proposition to organize an Italian company which would handle the marketing of American electrical equipment in Italy has been submitted to Assistant Commercial Attache Osborne by an electrical expert in Rome for submission to American manufacturers. It is his idea that specialties such as washing machines, heaters, etc., would sell better in Italy at the present time than heavy electrical machinery, and the proposed company would give its attention to small equipment and appliances. A translation of the proposal as submitted, together with the address of the Italian expert, may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, by referring to exhibit No. 1348.

FREE IMPORTATION OF MATERIAL FOR THE BRAZILIAN CENTENNIAL EXPOSITION.—The essential provisions of the special Brazilian revenue law to facilitate the entry into Brazil of material to be used in connection with the National Centennial Exposition, according to *Commerce Reports*, are as follows: Exemption from customs duties and internal revenue taxes is accorded to articles to be exhibited as well as to all materials to be used for the pavilions; at the close of the exhibition all articles not re-exported within the period fixed by the directing committee of the exposition will be subject to the payment of duties recorded by the customs officials upon the entry of these articles; exemption from customs duties is granted to articles presented to public institutions, or which as advertisements merely are distributed gratuitously to visitors, and to construction materials for pavilions acquired by the government; consular invoices accompanying articles for use in the exposition will be free of charges. All volumes must be marked "Exposicao Brasileira," with another mark indicating the importer or the recipient in Rio Janeiro.

PROPOSED INDUSTRIAL PLANTS.—Plans are being formed by C. C. Nieh, Lu Er-kia and other Shanghai merchants, *Electrical Industries* states, to organize the Yeh Chung Machine Manufacturing & Engineering Company in Shanghai. The company is capitalized at $300,000 and will manufacture electric fans, electric lamps, generators, motors, etc. The Ta Tung Company, Ltd., has recently been organized by Chang Chien, Jr., and others with a capital stock of $1,000,000 at Garden Row, Tungchow, and will specialize in engineering and electricity.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Manufacturers' agent in Canada (No. 970) desires to secure an agency for the sale of tools for electricians, small machinery and equipment, electrical fittings and attachments, etc.

An engineer in the Azores (No. 974) desires to be placed in communication with exporters of electrical apparatus.

A mercantile firm in Norway desires to secure an agency for the sale of electrical supplies, insulating materials of all kinds, backing joints and gaskets, armatures, etc.

New Apparatus and Publications

STOVE.—The Acme Electric & Manufacturing Company, 1448 Hamilton Avenue, Cleveland, has recently placed on the market the "Acme" electric utility stove.

PLUG.—The Bryant Electric Company, Bridgeport, Conn., has developed a new appliance switch plug, known as Bryant No. 651, which it will soon place on the market.

LIGHTNING ARRESTERS.—The Electric Service Supplies Company, Philadelphia, has issued bulletin No 183, describing the "Keystone" expulsion type and the "Garton-Daniels" lightning arresters for central-station, line, transformer, railway and mine protection.

WIRE.—The Electrical Alloy Company, Morristown, N. J., is distributing two leaflets, one describing its "Calido" resistance wire for pressing irons, toasters and cord-attached electrical devices, and the other calling attention to its various types of electrical wires and alloys.

METER SWITCHES.—Circular No. 1184, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, describes the Westinghouse meter-service switches.

WATER HEATER.—The Automatic Electric Heater Company, Warren, Pa., announces a new 1,000-watt "Sepco" automatic-circulation-type water heater as the final number in its complete line.

LIGHTING PLANT. — Day & Zimmermann, Inc., 611 Chestnut Street, Philadelphia, engineers, are distributing a booklet, entitled "The Front Street Plant of the Erie Lighting Company," in which it describes and illustrates the results and actual performance of this station, which was designed by and built under the supervision of the company.

WAGON LOADER. — The George Haiss Manufacturing Company, 141st Street and Rider Avenue, New York City, manufacturer of hoisting machinery and clamshell buckets, is distributing booklet 521, describing its new "Hais" creeper, "Path Digging" loader, coal-handling machinery, elevators, conveyors, screens, gates, buckets, etc.

OIL CIRCUIT BREAKERS. — The Condit Electrical Manufacturing Company, 60 High Street, Boston 9, has brought out a new oil circuit breaker, known as type D-22, designed to open circuits of high amperage.

IRONER. — An open-end electric ironer ("Horton") has been placed on the market by the Horton Manufacturing Company, Fort Wayne, Ind.

FIRELESS COOKER. — An automatic electric fireless cooker has been placed on the market by the William Campbell Company, Detroit.

CLOTHES DRYER. — An electrically-heated cabinet for drying clothes indoors is manufactured by the Scientific Heater Company, Cleveland.

TUNING UNIT.—The Ship Owners' Radio Service, Inc., 80 Washington Street, New York City, has placed on the market a new tuning unit, known as "Tunit."

EXTENSION DISTRIBUTER. — A new four-way extension distributer has been developed by the Diamond Electric Specialties Corporation, 101 South Orange Avenue, Newark, N. J.

FIRELESS COOKER.—The Cook Electric Heating Company, 717 Frankfort Avenue, Cleveland, has developed an electric fireless cooker.

WATER HEATER. — The Warnerlite Company, 745-769 South Raymond Avenue, Pasadena, Cal., has placed on the market an electric water heater.

FAN.—The Bayley Manufacturing Company, Milwaukee, is marketing a new variable-speed disk fan.

GLUE POT. — The Charles E. Francis Company, Rushville, Ind., has placed on the market a portable electric glue pot.

New Incorporations

THE CYR ELECTRIC COMPANY, Van Buren, Me., has been organized with a capital stock of $10,000 to generate and distribute electricity for lamps and motors in the plantation of Cyr. The officers are Elzear Lapointe, president; Napoleon Lapierre, treasurer, and Neil J. Lapierre, clerk, all of Cyr Plantation.

THE MORRIS (IND.) LIGHT & POWER COMPANY has been incorporated by Aleys Bischoff, Anthony Haskamp and John Nordmeyer. The company is capitalized at $10,000 and proposes to supply electricity for lamps and motors.

THE FREEDOM TOWNSHIP ELECTRIC COMPANY, Claysburg, Pa., has been incorporated by Fred S. Dunlap and F. L. Greene, both of Claysburg, and Thomas N. Kurtz, Hollidaysburg. The company is capitalized at $5,000 and proposes to furnish electricity for lamps, motors and heaters.

THE MUTUAL ELECTRIC LIGHTING COMPANY, Greenfield, Ind., has been incorporated with a capital stock of $2,625. The directors are Claude White, Lawrence E. Streng, Peri C. Devore, Carl Weber and Ernest W. Jacobi.

THE KEYSTONE POWER COMPANY, Ridgway, Pa., has been granted a charter, with a capital stock of $1,250,000, to take over a number of electric companies operating in Elk and adjoining counties. The incorporators are Carl F. W. Kealer, Rochester, N. Y.; H. S. Clader, Philadelphia, and N. M. Seabrease, Chestnut Hill

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 14, 1922)

1,406,576. THERMOELECTRIC TRANSFORMER; Howard J. Murray, Brooklyn, N. Y. App. filed April 11, 1918. Electric generator in which heat is applied or withdrawn from its field, producing an electric current.

1,406,624. METHOD OF AND APPARATUS FOR EXTRACTING BROMINE; Herbert H. Dow, Midland, Mich. App. filed June 7, 1916. Electrolytic cell for liberating chlorine and bromine.

1,406,645. INCANDESCENT ELECTRIC LAMP; John A. Heany, New York, N. Y. App. filed July 29, 1916. Short large-diameter filament element.

1,406,668. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie, New York, N. Y. App. filed Aug. 7, 1919. Pertains to step-by-step numerical selector switch.

1,406,672. VIBRATION DETECTOR; Joseph P. Maxfield, Millburn, N. J. App. filed June 24, 1919. For detecting vibrations propagated through water.

1,406,674. TARGET APPARATUS; Arnold Michoud, Yverdon, Switzerland. App. filed June 10, 1919. Automatically operated indicator locating hits near marksman.

1,406,678. TELEPHONE SYSTEM; Louis A. Mortimer, New York, N. Y. App. filed March 2, 1920. Machine switching.

1,406,681. PROTECTIVE DEVICE; Robert E. Ottman, East Orange, N. J. App. field Oct. 29, 1920. Protector blocks used in open space cut-outs.

1,406,696. SELF-COOLING STRAIN INSULATOR; Louis Steinberger, Brooklyn, N. Y. App. filed Oct. 12, 1918.

1,406,697. SELF-COOLING STRAIN INSULATOR; Louis Steinberger, Brooklyn, N. Y. App. filed Dec. 10, 1918 Means for flashing over during abnormal conditions.

1,406,698. STRAIN INSULATOR; Louis Steinberger, Brooklyn, N. Y. App. filed Dec. 10, 1918. Means for flashing over during abnormal conditions.

1,406,726. MEANS FOR ADDRESSING AN AUDIENCE; William Dobson, Rockford, Ill. App. filed Oct. 7, 1919. Assistant telephones address to speaker, who repeats it.

1,406,731. SYSTEM OF ELECTRIC CIRCUIT CONTROL; James B. Heard, San Antonio, Tex. App. filed Aug. 16, 1918. For small power-plant operation.

1,406,738. MEDICAL APPLIANCE; Charles B. Hughes, New Orleans, La. App. filed April 2, 1921. Curative device without using induction coil.

1,406,741. ELECTRODE HOLDER; Robert M. Keeney and Philip J. Lonergan, Jr., Denver, Colo. App. filed Jan. 20, 1920. For electric smelting furnaces.

1,406,760. ELECTRICALLY HEATED PRESSER FOOT; Hettie E. Rudolph, Bisbee, Ariz. App. filed June 28, 1921. On sewing machines to press seams, hems, etc., as they are stitched.

1,406,776. ELECTRICAL HEATING APPLIANCE; Leonard Sykes, Fort Wayne, Ind. App. filed Jan. 31, 1920. Means for removing element.

1,406,812. TROLLEY-WHEEL HARP; Edward Baczenski, Hamtramck, Mich. App. filed Sept. 15, 1921. Self-returning trolley wheel.

1,406,833. DEVICE FOR TRANSLATING THE EFFECTS OF SOUND VIBRATIONS INTO VARIATIONS IN AN ELECTRICAL CIRCUIT; Charles A. Finley, Brooklyn, N. Y. App. filed April 15, 1918. Telephone transmitter.

1,406,850. ELECTRIC STOVE OR HEATER; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 31, 1915. Comprises gas emitter, a tubular resistor, and adapted to receive steam.

1,406,851. ELECTRIC STOVE OR FURNACE; William S. Hadaway, New Rochelle, N. Y. App. filed March 4, 1916. Plurality of heating chambers.

1,406,857. WIRELESS SIGNALING; Raymond A. Heising, East Orange, N. J. App. filed Oct. 26, 1916. Means for disconnecting receiving apparatus when sending and vice versa.

1,406,865. SIGNAL TRANSMITTER; Richard M. Hopkins, Rutherford, N. J. App. filed Oct. 10, 1919. Relates to "McCulloh" type.

1,406,900. HEATER. John L. R. Robinson, Reno, Nev. App. filed June 18, 1920. Heating pads for warming and curative purposes.

1,406,912. ELECTRIC HEATER; Nicholas Theofilos, Chicago, Ill. App. filed Oct. 13, 1920. Attachment for electric fans.

1,406,918. TESTING SYSTEM; William G. Blauvelt, New York, N. Y. App. filed Jan. 8, 1919. For determining conditions on telephone circuits.

1,406,953. STRAIN INSULATOR; Walter T. Goddard, Hamilton, Ontario, Can. App. filed April 4, 1916.

(Issued Feb. 21, 1922)

1,406,994. ELECTRIC WATER HEATER; Frederick W. Moffat, Weston, Ontario, Canada. App. filed April 27, 1921. Double spiral element.

1,406,996. ELECTRIC WAVE-RANGING SYSTEM; Joseph B. Morrill, St. Louis, Mo. App. filed Sept. 30, 1920. For determining position of airplanes or ships.

1,406,998. SIGNALING SYSTEM; Harold S. Osborne, New York, N. Y. App. filed June 21, 1918. Retaining wave form on long communication line by inductances.

1,407,010. CURRENT COLLECTOR; John L. Whittaker, Winthrop, Mass. App. filed July 11, 1917. Sliding trolley shoe.

1,407,028. TRANSMISSION-EQUALIZATION ARRANGEMENT; Alfred U. Harper, Evanston, Ill. App. filed Oct. 2, 1919. Constant-current flow in telephone lines.

1,407,033. FIELD-WINDING MACHINE; George C. Huggins, Lynn, Mass. App. filed May 3, 1917. Directly wound in internal slots of field frames.

1,407,035. ELECTRIC BATTERY; Alton K. Huntley, Clyde, Ohio. App. filed April 13, 1920. Dry cell of deferred-action type.

1,407,042. TELEGRAPH SYSTEM; Paul M. Rainey, West Hoboken, N. J. App. filed July 19, 1917. Automatic transfer of messages of branch circuits to main lines.

1,407,046. TELEPHONE APPARATUS; John F. Toomey, New York, N. Y. App. filed May 16, 1919. Amplifying apparatus for subscribers.

1,407,061. LIGHTNING ARRESTER; George F. Gray, Pittsburgh, Pa. App. filed Jan. 11, 1919. For low-voltage circuits.

1,407,069. METHOD OF AND APPARATUS FOR INSULATION TESTING; Charles L. Kasson, Mattapan, and Thomas H. Haines Dorchester, Mass. App. filed Feb. 17, 1920. Detects defective units of suspension-type insulators in service.

1,407,078. AUTOMATIC ELECTRIC WEIGHT-MEASURING DEVICE FOR MOVABLE CARRIERS; Howard J. Murray, Brooklyn, N. Y. App. filed Oct. 11, 1918. Integral with truck or wagon frame.

1,407,103. RECEIVING SYSTEM FOR RADIO TELEGRAPHY AND TELEPHONY; FREDERICK K. VREELAND, Montclair, N. J. App. filed Feb. 17, 1917. Baffle circuit affording passage to signal impulses, but obstructing foreign impulses.

1,407,119. ELECTRIC MINING APPARATUS; Harvey C. Berkey, Claremont, N. H. App. filed June 18, 1921. For protecting operator from shocks.

1,407,120. MINING APPARATUS; Charles W. Wyman, Claremont, N. H. App. filed June 18, 1921. System for grounding machine.

1,407,147. THERMAL AMMETER; William N. Goodwin, Jr., Newark, N. J. App. filed July 27, 1916. For high-frequency current measurement.

1,407,151. MAGNETIC PULLEY; John P. Bethke and Roswell H. Stearns, Milwaukee, Wis. App. filed Jan. 22, 1920.

1,407,205. RADIO RECEIVING SYSTEM; Robert H. Marriott, Bremerton, Wash. App. filed Dec. 26, 1916. Neutralizing stray currents.

1,407,207. ELECTRIC BRAKE; Arthur W. McAuly, Oakmont, Pa. App. filed Jan. 26, 1920. Acts against opposite sides of brake drum.

1,407,245. AMPLIFYING DEVICE FOR USE IN WIRELESS TELEGRAPHY; John B. Bolitho, Eltham, England. App. filed Sept. 18, 1920. Using three tubes.

1,407,307. CONDUIT CAP FOR ELECTRIC INSTALLATION; Wheeler H. Vibber, New London, Conn. App. filed Oct. 13, 1919. In form of bracket and screwed to support.

1,407,308. SWIVEL CONDUIT CAP FOR ELECTRIC INSTALLATION; Wheeler H. Vibber, New London, Conn. App. filed Nov. 1, 1919. Turns in direction of strains upon the wires.

Construction News

Projects, Plans, Bids and Contracts
Contemplated or Under Way

New England States

AUGUSTA, ME. — The Public Utilities Commission has granted the Central Maine Power Company permission to issue $827,900 in bonds. Part of the proceeds will be used for extensions and improvements to its system.

RUMFORD, ME.—The property of the Rumford Falls Power Company has been acquired by the Oxford Paper Company. It includes a 31,000-hp. hydro-electric plant. The purchasing company has arranged for a bond issue of $5,000,000 to provide for the purchase and for proposed extensions and improvements. James A. Harris is general manager.

MANCHESTER, N. H.—The construction of a hydro-electric power plant on the Pemigewasset River, in the vicinity of Manchester, is under consideration by Herbert B. Rust, Meredith, and associates. The plans include a transmission system to supply electricity at Ashland, Wolfeboro, Plymouth, Bristol and vicinity.

MONSON, MASS.—Ricketts & Shaw have commissioned Reeds & Thorpe, 60 Prospect Street, Hartford, Conn., engineers, to prepare estimates of cost for the installation of additional equipment at the power plant at their woolen mill.

WAKEFIELD, MASS.—Improvements are contemplated in the municipal electric power plant, including the installation of new equipment to cost $50,000.

PROVIDENCE, R. I.—The Board of Education will soon call for bids for the construction of a central power house on Pond Street for service at the group of high-school buildings, estimated to cost $160,000.

HAMDEN, CONN. — Electric equipment will be installed in the one-story plant, 70 ft. x 200 ft., to be erected at Hamden by the National Filter Cloth & Weaving Company, 57 Hope Street, Brooklyn, N. Y., manufacturer of wire cloth, etc.

NEW HAVEN, CONN.—The Velvet Textile Corporation, P. O. Box, New Haven, contemplates the construction of a one-story power house in connection with a new factory to be erected at Allingtown, to cost about $100,000.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company will install a distributing system for street lighting at East Pembroke, N. Y.

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until March 15 for electric wiring in the East Building and West Building and laundry equipment and drying tumbler at the Binghamton (N. Y.) State Hospital.

BROOKLYN, N. Y.—The Brooklyn Edison Company, 360 Pearl Street, has awarded a contract for two steel stacks for its generating plant to be erected at the foot of Sixty-sixth Street. Other material and equipment contracts will be awarded at an early date.

CANANDAIGUA, N. Y.—The Rochester Gas & Electric Company will begin work at once on a one-story substation on Gorham Street.

GLEN FALLS, N. Y.—Plans are under way by the Adirondack Power & Light Corporation, it is reported, for a large hydro-electric project, which includes the construction of four dams, two on the Schroon River north of Warrensburg, one on the Hudson at Luzerne and the large water-storage project on Sacandaga River.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, has filed plans for improvements to its substation at 208-10 Elizabeth Street, estimated to cost $20,000.

NEW YORK, N. Y.—The State Hospital Commission, Albany, will receive bids until March 22 for electric work and equipment for a new assembly hall and bakery building at the Manhattan State Hospital, Ward's Island. Lewis F. Pilcher, Capitol Building, Albany, is architect.

NEW YORK, N. Y.—Electric power plant, Diesel engine electric drive, complete refrigerating plants, electrically operated freight-handling machinery and other electrical equipment will be installed in the fifteen freight vessels to be constructed by the Central Steamship & Commerce Corporation of New York, to cost about $5,000,000. Theodore D. Wells, 11 Broadway, naval architect, has been commissioned to prepare plans.

NEW YORK, N. Y.—The New York Edison Company will erect a substation at Park Avenue and 188th Street, to cost $75,000. Ground will be broken at an early date for a substation at Yonkers, N. Y., to cost $250,000. William Whitehill, Buckley-Newhall Building, Forty-first Street and Sixth Avenue, is architect.

NEW YORK, N. Y.—The Department of Plants and Structures has made application to the Board of Estimate for an appropriation of $1,235,000 for the construction of a municipal power plant on the site of the former garbage reduction works, Staten Island, with capacity of 12,000 kw. to supply electricity for the municipal traction line, ferries and piers. An appropriation of $95,000 also has been asked for an automatic electric substation between Richmond and Tottenville, S. I., for electrical machinery and for new trackless trolley cars and equipment for the municipal traction lines.

TOTTENVILLE, N. Y.—The Staten Island Rapid Transit Railroad has surveys under way for the electrification of its system, to include power house, transmission system, etc. T. A. Davis, electrical engineer, is in charge.

TROY, N. Y.—The Ford Motor Company, Detroit, Mich., will soon commence the installation of machinery at its hydro-electric plant at Green Island. It will have a capacity of 3,600 hp. and will cost about $2,000,000. It will supply electricity for the proposed tractor and automobile plant to be erected at a cost of about $1,500,000. Stone & Webster, 147 Milk Street, Boston, Mass., are engineers.

JERSEY CITY, N. J.—Electrical equipment will be installed in the proposed junior high school building to be erected in the Greenville section, to cost $1,560,000.

NEWARK, N. J.—The City Commission has rejected a proposition to construct an electric power plant at the new Center Market, at a cost of $117,000, and will use central-station service.

PHILADELPHIA, PA.—A power house will be erected at the dyeing and finishing plant, comprising a group of fourteen buildings at Wyoming and G Streets, for Walter E. Knipe & Sons, Hancock Street, near Berks Street, to cost $257,000. W. E. S. Dyer, Land Title Building, is architect and engineer.

PHILADELPHIA, PA. — The Braun & Stuart Company, Commercial Trust Building, will build a substation at its factory at State Road and Bleigh Street.

PHILADELPHIA, PA.—The Bureau of Transit is arranging to install electrical equipment for connection between the municipal elevated railway and the system of the Philadelphia Electric Company. The Council is preparing a contract for securing power from the Philadelphia company.

SECURITY, MD.—The Security Cement & Lime Company, Baltimore, will dismantle the power plant at its local mills and will obtain electricity from the Hagerstown & Frederick Railway Company, for which a contract has been signed, effective July 1.

CHARLESTON, W. VA. — The Libbey-Owens Sheet Glass Company will erect an addition to its power house in connection with other extensions to its plant at Kanawha City, to cost including equipment about $200,000.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company, 30 Church Street, New York, plans the construction of a transmission line, about 65 miles, to Sprigg, W. Va., Betsy Layne, Ky., and other points in this district, with the erection of a number of substations in the different centers.

CLIFTON FORGE, VA. — The Virginia Western Power Company has disposed of a bond issue of $850,000, of which more than one-half will be used for extensions to its system.

MANASSAS, VA. — Arrangements are being made for extensions to the municipal electric light plant in the near future, including the installation of a Corliss type engine and a 225-kva generator. Frank Gue, Jr., is superintendent.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has completed plans for the following and will call for bids at an early date. Electric substation and dry dock, South Boston Navy Yard (Specification 4,550); one turbo-alternator, for use at Pearl Harbor, H. T. (Specification 4,548); reciprocating air compressor, New York (Specification 4,555); two 300-ft. radio towers, Kutuila, Samoa (Specification 4,600), and lighting fixtures for naval hospital, San Diego, Cal. (Specification 4,595).

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia until March 31 for annual supplies, including electrical supplies, etc. Information may be obtained from the purchasing officer, Room 320, District Building.

North Central States

DETROIT, MICH.—The Ford Motor Company is planning for extensions in its electric generating system to provide power for all of its factories in this district, including the Lincoln Motors Company. The steam plant at River Rouge will be supplemented by a hydro-electric generating plant in the vicinity of Flat Rock, Mich. The cost is estimated at about $400,000.

GRAND RAPIDS, MICH.—The Père Marquette Railroad Company, Detroit, will erect a power house at its proposed car shops at the Wyoming yards, to cost about $1,000,000. The different departments will be equipped with motor-driven machinery. A. L. Grandy is chief engineer.

MUSKEGON, MICH.—The Ravenna-Conklin Electric Light & Power Company will begin work soon on the power station in connection with its new hydro-electric plant.

AKRON, OHIO—The County Commissioners are planning to install an ornamental lighting system on the North Hill viaduct.

CINCINNATI, OHIO.—Plans have been prepared for a new street-lighting system which provides for abandoning 4,000 gas lamps and substituting electric lamps in various parts of the city and suburbs. It is also proposed to extend the ornamental lighting system zone to the suburbs and to replace the arc lamps now in use with nitrogen lamps. Under the new specifications it is estimated that 14,458 lamps will be required.

CLEVELAND, OHIO.—Separate bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 11 for hard-drawn, bare stranded copper wire, paper-insulated, lead-covered cable, and outdoor-type oil switches and accessories.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company contemplates extensions to its plant, including the installation of boilers, turbines and ash-handling equipment.

VAN WERT, OHIO.—The Van Wert Light & Power Company is planning the construction of a distributing system, to cost about $30,000.

WARREN, OHIO.—The Ohio Public Service Company has issued $4,000,000 in bonds, part of the proceeds to be used for extensions, etc.

GOSHEN, IND.—The Midwest Utilities Company, a subsidiary of the Commonwealth Edison Company, Chicago, has acquired the properties of the Hawks Electric Company, Goshen, and the Winona Light & Water Company, Warsaw. The companies will be merged with the system of the Interstate Public Service Company, affiliated with the Midwest company, adding about thirty-five cities and towns in northern Indiana to the lines. Transmission lines will be constructed to connect the systems and other improvements made.

CENTRALIA, ILL.—Work will begin at once on the proposed municipal electric light plant, to cost about $85,000.

CHICAGO, ILL.—The Chicago Union Station Company, it is reported, will soon ask for bids for a power plant to be erected at Harrison and Canal Streets, Chicago.

JOLIET, ILL.—The Public Service Company of Northern Illinois contemplates construction of a 12,000-volt transmission line, to cost about $50,000.

MATTOON, ILL.—The Central Illinois Public Service Company has purchased 180 acres of land, 2 miles from Grand Tower, on which it will erect a power plant, at a cost of about $2,000,000.

PESHTIGO, WIS.—The Wisconsin Public Service Company, Green Bay, has awarded a general contract to J. R. McDonald, Black River Falls, Wis., for the construction of a two-unit hydro-electric power plant on the Peshtigo River, Johnson Falls, to cost $500,000. Mead & Seastone, Madison, Wis., are consulting engineers.

SHEBOYGAN, WIS.—Bids, it is reported, will be opened about March 15 by the H. C. Prange Company for the erection of a power and heating plant, to cost about $60,000. W. C. Weeks is architect.

CLARINDA, IOWA.—An electric power department will be installed in the high school to be erected by the Board of Education, estimated to cost close to $200,000.

WATERLOO, IOWA.—The Council is considering the installation of a new street-lighting system in the northern section of the business district.

JEFFERSON CITY, MO.—A power house will be installed in the new plant to be erected by the Automatic Water Pump Manufacturing Company at a cost of about $150,000. Benjamin F. Schuetz is president.

KANSAS CITY, MO.—The Kansas City Power & Light Company contemplates the construction of a one-story-and-basement power house, 50 ft. x 140 ft., at 1100-12 Baltimore Avenue. H. C. Blackwell is general manager.

ST. CHARLES, MO.—Plans are being prepared for improvements to the municipal waterworks system and electric light plant, to cost about $250,000. Benham & Mullergren, Firestone Building, Kansas City, are engineers.

ST. LOUIS, MO.—The Board of Water Commissioners is planning to build a steam-driven power plant in connection with extensions to the municipal waterworks. The equipment will include electric generator, exciter, boiler and auxiliary apparatus.

ST. LOUIS, MO.—The St. Louis & San Francisco Railroad Company has appropriated $205,000 for new power plants at its shops during the present year.

AMHERST, NEB.—The Council is planning the construction of a transmission line for municipal power supply. The Electrical Development Company, Omaha, Neb., is consulting engineer.

GURLEY, NEB.—The Council is considering the construction of a transmission line for municipal electric supply. The Hengson Engineering Company, Omaha, Neb., is engineer.

LINCOLN, NEB.—A special election will be held in April to vote on a bond issue of $200,000 for extensions and improvements to the municipal electric system. George W. Bates is engineer.

ABILENE, KAN.—The Riverside Light, Power & Gas Company will construct a dam, 200 ft. long, to cost about $80,000.

RANSOM, KAN.—The Council has called a special election March 17 to vote bonds for $30,000 for the construction of a transmission line from McCracken to the city limits. The Ruckel Engineering Company, Hutchinson, Kan., is engineer.

Southern States

RALEIGH, N. C.—Surveys are being made by the Carolina Power & Light Company for a railway, 6 miles long, from a point on the Southern Railroad, probably between Norwood and Albermarle, to a point on Yadkin River near Swift Island. The cost is estimated at $100,000. H. B. Cartwright is engineer.

STANTONSBURG, N. C.—The Council is planning an issue of $25,000 in bonds for the construction of a transmission line to Wilson.

ATLANTA, GA.—The White Provision Company will build a power house at its packing plant in connection with other extensions. W. H. White, Jr., is president.

JACKSONVILLE, FLA.—The advisory park committee of the City Commission has asked for an appropriation of $50,000 in the budget next year to place all electric lighting wires underground.

MIAMI, FLA.—The plant of the Miami Electric Light & Power Company was badly damaged by fire recently. Two 2,000-kw. generators, it is understood, will have to be replaced. M. H. Hyman is manager.

ORLANDO, FLA.—Bonds to the amount of $607,000 have been voted for the purchase of the water and light plants of the Orlando Water & Light Company; also $368,000 additional to be used for rehabilitating and extensions to the two plants.

LEBANON, TENN.—The Cumberland County Power Company plans the construction of a transmission line to the Wilson Farms section, a distance of about 12 miles.

NASHVILLE, TENN.—The Council is planning for the rebuilding of the municipal light and power plant, recently destroyed by fire, causing a loss of about $100,000.

DOTHAN, ALA.—The Ludlow Engineering Company, Hartford, Ala., has surveys under way for the construction of a dam and hydro-electric plant on the Choctawhatchie River.

NEW ORLEANS, LA.—Separate bids will be received by the Sewerage and Water Board, 526 Carondelet Street, New Orleans, until March 20 for the following: (A) 1,500-1,800-hp. boilers; (b) centrifugal pumps; (c) electric machinery. George G. Earl is general superintendent.

CARTER, OKLA.—The Council has appropriated $25,000 for the construction of a transmission line to Sayre, Okla., to obtain electricity for local service. Bids will be asked at an early date.

HUGO, OKLA.—The Hugo Ice & Light Company is planning to erect an electric transmission line from Hugo to Fort Towson, a distance of 16 miles, to cost about $30,000.

PAWHUSKA, OKLA.—The Sand Springs (Okla.) Railway Company has obtained a local light and power franchise and will construct a transmission line for service about 35 miles long.

PONCA CITY, OKLA.—The municipal lighting department is considering erecting a high-tension transmission line to Bliss, Red Bank and other nearby towns.

WEWOKA, OKLA.—Improvements are contemplated to the municipal electric light and waterworks.

WOODWARD, OKLA.—Bids will be received by J. D. Barry, city clerk, March 16 for construction of a municipal power plant. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are engineers.

SEYMOUR, TEX.—The Seymour Power & Ice Company is planning extensions and improvements to its system.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Power & Light Company is planning extensions to its transmission system.

SEATTLE, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 22 for an operating and power building, etc. at Tatoosh Island. Specification 4574.

EUGENE, ORE.—Rights-of-way, franchises, etc., are being secured by the California-Oregon Power Company for the proposed 120-mile transmission line to extend from the hydro-electric plant on the Rogue River to Eugene, where connection will be made with the system of the Mountain States Company.

CANBY, ORE.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric light plant in Canby.

BERKELEY, CAL.—The University of California will soon break ground for a new power plant to cost about $35,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will construct a 110-ft. high dam in the San Joaquin River for its proposed Kerckhoff development, application for which has been made to the Federal Power Commission. The equipment will include three 15,000-hp. waterwheels in each station, with 110 miles of 110,000-volt transmission lines.

PASADENA, CAL.—Plans are being prepared for the construction of a 1,000,000-volt transformer and electrical laboratory at the California Institute of Technology, to be used for experimental work.

SAN FRANCISCO, CAL.—Motors and other electrical equipment will be installed in the plant to be erected at Second and Brannan Streets, San Francisco, by the Los Angeles Soap Company, Los Angeles, to cost $150,000.

SAN FRANCISCO, CAL.—The Great Western Power Company, 14 Sansom Street, has completed plans for the erection of an addition to its power plant at Bush Street and Grant Avenue. The company will soon commence work on a new power plant at El Cerrito.

Canada

LONDON, ONT.—The Public Utilities Commission, London, is considering the extension of the hydro-electric system to Scarboro Bluffs.

RIDGETOWN, ONT.—Plans are being prepared for Howard Township for the erection of an electric transmission line from Ridgetown to Rondeau to secure service from the Hydro-Electric Commission. The cost is estimated at $35,000. E. R. Lawlor, Toronto, is engineer.

THEDFORD, ONT.—Plans are under consideration for the installation of an electric light and power distribution system in Bosanquet Township, to cost about $30,000. J. N. Wilson, 190 University Avenue, Toronto, is engineer.

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A Mortgage on America

EIGHT years ago it cost America in the aggregate about 12 per cent to market her goods. The consumer paid about 12 per cent more than the factory selling price, which, of course, was spent for distribution. Today it costs more than 24 per cent. The war has doubled up this overhead expense by charging up more taxes, higher wages and so on.

In a word, we have taken out another mortgage on America and shot the money up into the air. And now we have the mortgage on our hands, and to carry it we are compelled to add an interest charge of 12 per cent on everything we sell. And this is fixed and permanent. It is here for good. The mortgage stands. The interest never slackens.

MEN shut their eyes to facts like these. But it is more than theory—more than statistics, more than economics. It is an issue which is everybody's problem. In short, are we content to carry this double cost for evermore? Or will we save the interest money in some other way?

Out of the city of Cincinnati comes a graphic presentation of the only answer. In this conservative old town, where cheap natural gas has always held back electrical progress, in the last two years they have wired and taken on the central-station lines 25,000 homes. In these homes 25,000 normal, ordinary families have been convinced that now is the time to wire and equip electrically. They have been "sold" in spite of all the clamor of the pessimists who through the entire land are claiming that the times are bad and nothing can be done.

But that is not all that they are doing in Cincinnati. They have figured also that every consumer should be a market for $200 worth of appliances. This means that those who wired last year should buy $3,000,000 worth. And those that they expect to wire this year should buy $4,000,000 worth. And houses previously on the lines should spend $6,000,000 more. So they are going after this $13,000,000 in appliance business in the same way that they sold the wiring.

How have they done it? How will they do it? By adopting methods to conditions, that's all; by meeting hard times with easy terms. And they have proved again that *selling will sell* in any year, in any place, if it is just made possible for people to purchase what they naturally want.

THERE are two ways to carry a mortgage. One is to shoulder the burden and struggle on. The other is to make more money by better work with head and hands and gradually pay it off. They are lifting the war mortgage for electrical men in Cincinnati by facing the facts and tackling the job. It can be done in every other town.

Thomas Edward Murray

Who as consulting engineer, utility executive and inventor has greatly contributed to the upbuilding of the industry.

TO MOST men it is sufficient that they excel even in a single branch of the industry. In Thomas E. Murray, however, we find a consulting engineer and power-plant builder of outstanding prominence, a central-station executive of noteworthy achievement and an inventor whose creative ability has won for him one of the highest American scientific honors. Mr. Murray now gives most of his attention to the business of the consulting engineering firm of Thomas E. Murray, Inc., of which he is president. He is now completing one of the largest and in many ways one of the most exceptional steam plants in the country, namely the new Hell Gate station of the United Electric Light & Power Company of New York City. This plant has initially four 35,000-kw. units and is designed to have an ultimate rating of 280,000 kw. The results to be gained from phase isolation and the unusual method of using condensing water will be watched by the industry with considerable interest. Today there stand as monuments to his engineering skill the well-known Waterside No. 1 and No. 2 stations of the New York Edison Company, the Sherman Creek plant of the United company, steam plants in Albany, Troy, Rochester, Utica and Brooklyn, N. Y.; Dayton, Ohio, and other places, and the hydro-electric development on the Tennessee River at Chattanooga.

Mr. Murray was born at Albany, N. Y., Oct. 21, 1860. At an early age he entered an apprenticeship as a mechanic in Albany. He made rapid progress and his ability became generally recognized, so much so in fact that at the age of twenty-one he became engineer of the city waterworks. It was about six years later that the late Anthony N. Brady launched the Albany Electric Light Company and Mr. Murray was chosen chief engineer, advancing to superintendent and finally general manager. During this period he also acted for a number of years as consulting engineer for the Albany Street Railway Company and the railway and electric lighting properties in Troy.

Thus began another of those famous associations for which the electrical industry is noted. In 1898 Mr. Brady brought Mr. Murray to New York to effect the physical merger of the electric lighting systems in Brooklyn, and shortly afterward Mr. Brady also intrusted to him the task of consolidating the electric lighting properties in Manhattan into the New York Edison Company, of which property Mr. Murray became second vice-president and general manager.

In the midst of these activities Mr. Murray has found time to patent between three and four hundred inventions. More than two hundred of these are electric protective devices for the manufacture of which the Metropolitan Engineering Company was established sixteen years ago. In recognition of his work in this field the Longsworth medal was awarded to Mr. Murray in 1910 by the Franklin Institute, and in 1913 he received the gold medal of the American Museum of Safety. Credit is also due him for the invention of the individual reactance coil and several steam-power-plant devices which include a cinder catcher and a safe and economical container for stored coal. Of late years he has been giving considerable attention to electric welding and has obtained a large number of patents covering his work in this field.

Mr. Murray still retains his official connection with a number of light and power companies. He has found time to engage in electrical society activities and for two years was president of the Association of Edison Illuminating Companies. Among the many honors he has received none perhaps is held by him in higher esteem than the honorary degrees of doctor of science, conferred on him by Villa Nova College, and doctor of laws, by Brooklyn College.

Editorial Comment

Electrical World, March 18, 1922
Volume 79
Number 11

A Commission Should Decide the Fate of Muscle Shoals

ONE of the best suggestions which have emanated from Washington thus far with reference to the Muscle Shoals project of the government was made by Congressman Kahn, chairman of the House committee holding hearings on it. He recommends, and no doubt his suggestion will be carefully considered by the committee, that the whole matter be turned over to a commission comprising the Secretaries of the Treasury, War and Agriculture, with power to adjudicate the various claims and to lease, sell or operate the plant as it deems best. So long as the affair dangles before Congress, so long will it be used as a political catspaw, and the Muscle Shoals squabble should not be permitted to clutter up the calendar, especially at a time when the country is looking to Congress for much needed and pressing legislation. Congress has never appropriated one cent for the development of Muscle Shoals as such. Every bill offered with that purpose in view has been defeated on its merits. What now exists at Muscle Shoals was erected by President Wilson as an emergency war measure, and Congress has since refused to appropriate the necessary funds to complete what was started. The drawn-out hearings before the Congressional committee on the various offers made to the War Department have established the fact that much of the work is tied up by contracts which will cast a cloud over any title to the property. The suggestion, therefore, of placing the matter in the hands of the commission is to be commended, as it offers a way to handle the matter expeditiously and equitably.

The Real Problem of the Ex-Service Man

BEHIND the problem of the soldier bonus is another very vital consideration which may well be thought of while this subject is under such general discussion. What is the chief interest to America in the working out of this complicated heritage of the war? Unquestionably the end to be most desired is that the ex-service man may be physically, mentally, vocationally and financially rehabilitated, so that he may be returned and merged into the citizenry of the country to disappear as a class either political or social. For there is no safe place in a democracy for an ex-soldier class, either claiming or receiving special privilege or exerting influence that does not function as a natural factor in a self-governing community.

The men who formed our armed forces in the war came out of the heart and brawn of America. They *were* America and so they remain—not a class in contention with the American government or American industry on any point, but a great, enduring element in American life and character, honored, beloved and held in grateful memory for their heroic achievements and great sacrifice. Every disabled man and his dependents should be cared for. Health, disability and unemployment insurance should be provided for every veteran. But a cash bonus would neither represent the obligation of the nation nor provide any real measure of relief, for the small sums contemplated would last no time. Moreover, such a bonus would create a precedent for other bonuses that might logically follow, and, worst of all, perpetuate an unnatural ex-soldier class with no proper place in American democracy.

The world has come to be so closely knit and the nation such a unified community that men of science, industry, finance and business are compelled today to fabricate into their thinking influences not only economic but social, political and international as well. These under-aspects of such national questions, therefore, cannot be left to Washington alone. The strength of America rests in the minds of the people and the responsibility with the leaders of our thought.

The Inalienable Right of the State to Fix Rates

VIEWED from any angle, the decision of the United States Supreme Court handed down last week in the Consolidated Gas case is most interesting. For the edification of those for whom truth and fact are not necessarily established unless they are constantly reiterated or confirmed, the highest court again asserts that "rate making is no function of the courts and should not be attempted either directly or indirectly." We question whether any public service commission ever had any doubts on that matter, but inasmuch as the civic authorities of New York felt otherwise it is well to have the law reiterated. It is refreshing also to public utilities to have the highest court settle without quibble or qualification the right of a public utility to a rate for service which is not confiscatory. "Mere past success," the court says, "could not support a demand that it continue to operate indefinitely at a loss. The public has no such right in respect of private property although dedicated to public use. When it became clear that the prescribed rate had yielded no fair return for more than a year and that this condition would almost certainly continue for many months, the company was clearly entitled to relief."

Two well-merited rebukes were administered by the court—one to the Public Service Commission, which, possessing the power to fix rates, was too slow in asserting itself, and the other to the lawyers for the appellant, who, contrary to the rules of the court, presumed on its indulgence by dragging in 20,000 printed pages of evidence and thereby came preciously near having the case thrown out of court. Many clients feel that the fees paid to a lawyer bear some ratio to his loquacity, but the "gift of gab" is not always to be commended. Pope years ago said: "Words are like leaves, and where they most abound much fruit of sense beneath is rarely found." Very much the same sentiment was expressed by the Supreme Court, the learned judge who delivered the opinion saying that "the master talked too much and often unwisely." The same strictures might apply to many valuation experts. Real estate experts have no difficulty in determining very quickly the value of property, and it hardly seems unreasonable to expect that public utility property may some day be valued just as expeditiously and inexpensively for rate-making purposes.

Electric Smelting as a Means of Utilizing Low-Grade Iron Ore

ALTHOUGH the threatened exhaustion of high-grade native iron ore is not likely to occur in the next quarter of a century, as has been prophesied by some statisticians, it has nevertheless focused interest upon the possibilities of electric smelting of low-grade deposits as a solution of an American industrial problem that may become serious. Already twenty-seven large installations, with a total electrical equipment of 100,000 kw., are in operation or under construction in various parts of the world.

Unfortunately there may have been many failures in the effort to smelt low-grade ores electrically, but it appears that these failures have frequently been due to lack of expert metallurgical advice, the promotion of so-called "direct" and "secret" processes having misled investors. Sound technical advice appears imperatively necessary in the development and commercial exploitation of electric smelting of iron and the production of steel by the electric furnace. There is little doubt that by electric smelting iron ore superior in quality to that made in the ordinary blast furnace can be produced with marked savings in time per heat in steel production.

However, very careful studies of costs must be made before undertaking commercial work in the low-grade ore field.

One Interest of the Utility in the Railway Problem

TRANSPORTATION being a vital element in every business nowadays, the condition of the railways is a matter of particular concern to the electrical industry and of interest to each individual. Secretary Hoover's analysis of the existing situation as published in this issue merits some careful thought. One phase of it is especially pertinent to the public utility.

At the present time the railways of this country are behind in rolling stock by about 4,000 locomotives and 200,000 cars. Since 1917 they have laid down in trackage 10,000 miles less than our increasing population and economic development call for. Because of the existing industrial depression this equipment is carrying the load, but the time is clearly not far off when growing business will begin to place an overburden of demand upon the railways. Then when the peak of a crop movement is superimposed there will result a car shortage so stringent that industry and the public will pay a toll far heavier in added cost on coal and general commodities than would have provided the rolling stock and rails that then will be so badly needed. Such a transportation crisis will inevitably produce a storm of popular protest and a renewed unreasoning demand for government operation that in every direction will reflect new feeling on the whole broad subject of municipal, state and federal management of utilities.

In years gone by a great reserve capacity in rolling stock has been provided by the larger railway systems. Between crop periods these cars have waited on the sidings, carried against the coming season of maximum demand, when they have been thrown into the service of all lesser roads and all the people. But under the conditions of today the larger roads no longer can afford to finance and maintain this car and motive power reserve as a contribution to the seasonal needs of industry. And this question comes to mind: With rates and wages regulated by the government, can the few great roads longer be required or permitted to maintain this seasonal equipment? Or should the government, as a feature of its regulation, in the interest of the people, provide for the excess peak-load rolling stock made necessary by our present system of unbalanced transportation burden? It is a problem not for the railroads alone, but for all who are involved in the broader issue of protecting the national investment in utility properties and guiding the education of the people in this new responsibility which has come to them with the expanding growth and value of regulated utilities.

Debt to Pure Scientists Should Be Recognized

THE astonishingly rapid and extensive expansion of the field of electrical engineering is probably due in largest measure to the wide, and in fact almost universal, prevalence of electrical laws and processes in fundamental natural phenomena. The relations of electricity and magnetism with the underlying problems of physical science have been uncovered by physicists and other workers in the field of pure science in their constant attack upon the great problem of the ultimate nature of matter and the laws which control it. The names of Cavendish, Ampère, Faraday, Maxwell and Thompson spring first to mind, but the list may be extended to great length. The laws upon which all the applications of electricity in the modern field of engineering depend may be traced directly to the discoveries of these great investigators and their successors. Moreover, within the brief space of a hundred years or so the attraction and promise of exploration in this field has become so great as now to number its workers probably by thousands.

Hand in hand with discovery in the field of pure electrical science goes the expansion of the field of application of the laws uncovered. It is this fact more than any other which lends its charm and fascination to the profession of electrical engineering. Immediately back of the workaday problems of design and execution there is always open to the inquiring electrical engineer, as a resource replete with interest and promise, a field of experimental study, investigation and speculation.

As a consequence the debt of the electrical engineer to the pure scientist should always be appropriately recognized. We are in the habit of offering this recognition in some of the most notable instances. Last year, for example, the centenary of Oersted's discovery of the magnetic effect upon electrical currents was not only celebrated in his native country but electrical engineering societies throughout the world also took appropriate notice. We shall doubtless have even a greater celebration on the hundredth anniversary of the work of Faraday and Henry leading to the discovery of electromagnetic induction. Our debt, however, is so great that we should look even beyond these great outstanding discoveries for others which have also contributed to the foundations of the present great structure of applied electrical science and render due praise and homage whenever a date marking the original discovery of some great contribution is passed.

These thoughts are suggested by the twenty-fifth anniversary of a discovery which immediately antedates that of our youngest agent of such great promise, the electron, and which was so intimately related to it as almost to warrant its being considered a part of the discovery of the electron itself. In 1896 Zeeman discovered the influence of a magnetic field on a source of light, separating the lines of a spectrum and showing beyond doubt the presence and motion of electric particles smaller than the atom within the substance of the source. Faraday had already suggested the relation between light and magnetism by his discovery of the rotation of the plane of polarization by magnetic field, and it remained for J. J. Thomson to isolate the electron. It is well to bear in mind, however, that Zeeman's discovery, in addition to its creation of the modern field of magneto-optics, also stands out as an important link in the progress of investigation which has given us today the electron tube and its expanding field of usefulness.

Current Distribution in Busbars Becoming Serious Problem

UNTIL recently skin effect has rarely assumed serious proportions in the range of commercial power frequencies. However, with the increase in the capacities of modern plants, their feeders and distributing circuits, and with the reversion to 60 cycles, the reduced carrying capacity of large conductors due to the skin effect has become of serious moment.

Even in the simplest of all cases, that of a solid conductor of circular cross-section, the exact theoretical analysis is extremely involved. With conductors of cross-section other than circular, and with stranded cables of the usual type, it is quite impossible. The theoretical studies of all cases of skin effect therefore are usually approximations based on assumptions of symmetry known to be at variance with the actual conditions. As a consequence present knowledge of the magnitude of the skin effect is based rather on experimental observation, each new type of case being attacked as it arises. Within the past year several interesting papers in this field have appeared. In the article by C. F. Wagner in this issue another closely related problem is studied, that of the unequal distribution of current among the several parallel connected conductors of large station busbars. In this case, owing to the large total cross-section and the space separation of the several conductors, the inequalities are especially marked. In one common type the current density at the center of an inner bar was shown to be only 29 per cent of that near the edge, and its phase 129 deg., lagging. The simple but ingenious method of experiment used also brings out other interesting results. Aside from the inefficient use of conducting material, the distortion of current density is also objectionable as leading to local high temperatures.

Corrective measures consist in transposition and special forms of grouping, and for best results in the use of special reactances inserted in the outer conductors for shifting the current to the idle ones inside. The serious magnitude of the effect is indicated by the introduction of this added complication and expense.

A Machine Rating Should Express a Definite Limitation

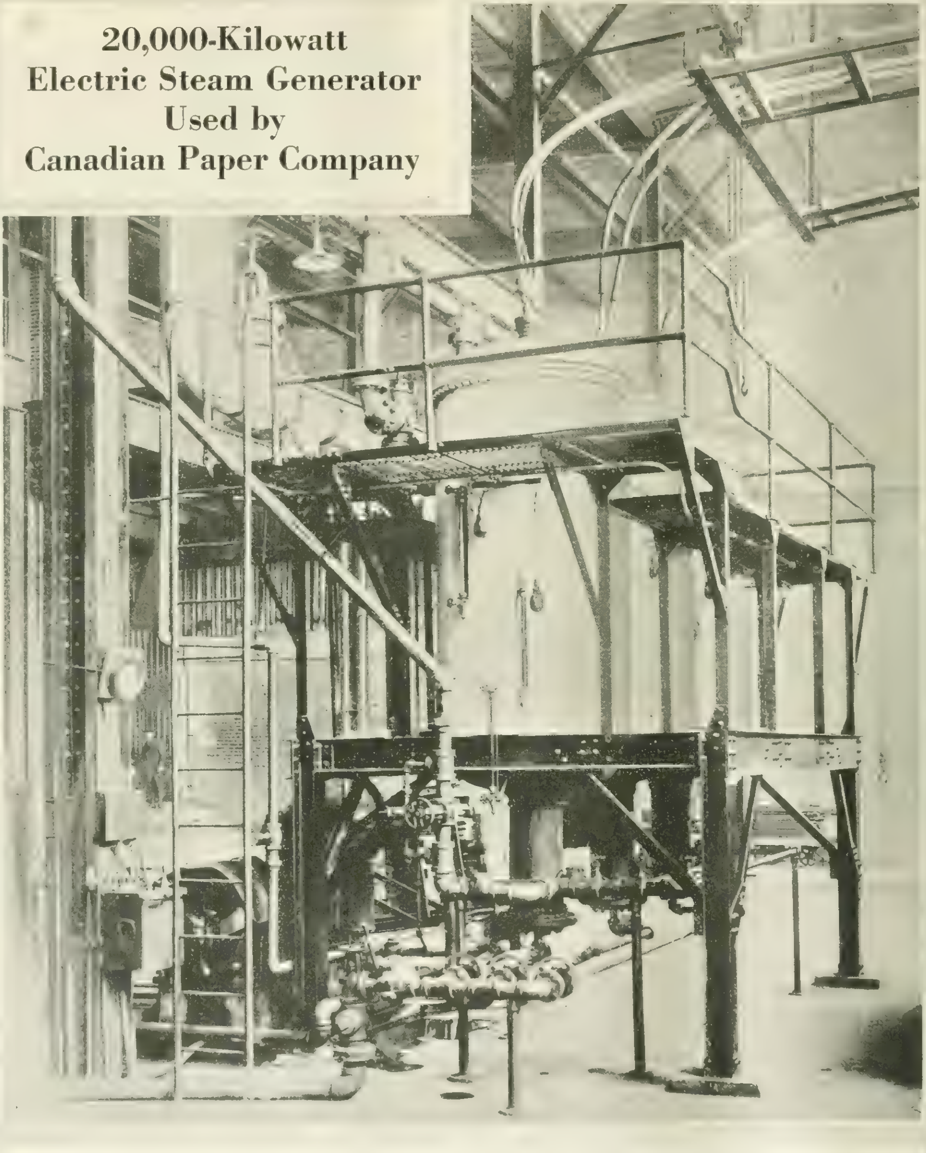
MOST of the advances in electrical design and construction which have been made by the slow process of standardization have encountered considerable opposition. Usually these advances have been put into effect by extremely small majorities. It is, therefore, not to be wondered at that the conception of a single rating of electric generators and motors has found many manufacturers and users strongly opposed to this modification. It is proper that due and careful consideration should be accorded to such opposition and that any possible argument that may be advanced against the use of the single rating should be considered thoughtfully in all possible aspects before its final rejection.

When the industry was in its early state of development and when the properties of insulating materials were hardly known or considered, when the designer groped in the dark as to the outcome of his designs, and when, last but not least, the amount of power required by machine tools or other appliances to be operated by electric motors was almost totally unknown, it appeared logical to place a rating on the machine which gave only a general idea of its capacity. This gave considerable latitude to the engineer who wished to apply it, so that if he made an error of 100 per cent in his calculations the machine was still able to do the work for which it was intended.

In the first place, a liberal estimate had to be made of the power required and, secondly, a motor was applied which was ample for its rating. These two allowances added together constituted a very large overestimate of the size of machine to be installed. With increased experience and judgment, with an increased understanding of the power required by the machines to be operated, it became essential to know the real, reasonable limit of capacity of a motor or generator; and now most engineers prefer to make their own allowances, knowing definitely what the electric machine is capable of doing, rather than to have the manufacturer's allowance added to their own, thus piling one margin of safety upon another. It would appear, therefore, that the rating of a machine should express the limit of its capacity, instead of an arbitrarily chosen designation of an equally arbitrarily chosen capacity.

The older conception in putting a rating of 40 degrees on an electric motor was to select arbitrarily one of the many ratings which could be put upon the machine, instead of giving the reasonable limit at which the machine could function indefinitely without injury. The 50-degree rating, which has received the indorsement of the Electric Power Club and is being favored by many engineers in this country and abroad, is a more definite conception of the limitation of the machine than the earlier rating of 40 degrees. For the same reasons that a standard of length is a given quantity and that a foot rule is meant to measure lengths within one foot and is not intended to be stretched, the ratings of electrical machines should not be stretched beyond the limits on which the rating is based. Any true conception of a "rating" must express a definite limitation. The most serious effect of a double rating for electrical machines is the obliteration of all conceptions of genuine standardization and the subordination of principles of accurate measurement to considerations of commercial expediency.

20,000-Kilowatt Electric Steam Generator Used by Canadian Paper Company



FOR nearly six months the Belgo-Canadian Pulp & Paper Company has been producing its process steam with a 20,000-kw. electric steam generator. Sixty thousand pounds of water are being evaporated per hour with a thermal efficiency of 98 per cent, including losses in 100 ft. of piping. According to reports, engineers of the paper company have estimated a saving of $4,000 per month with the new system. which saves 75 tons of coal a day. Installation costs—about $25,000—were 40 per cent less than the cost of the coal-burning plant replaced.

Three-phase, 6,600-volt power from the Shawinigan Water & Power Company, Montreal, is utilized directly in the tanks shown above, the resistance of the water converting the electric energy into heat for generating the steam. The amount of steam generated, the pressure and the amount of power used are governed by the depth of immersion of the electrodes in the tanks. The design was developed by F. T. Kaelin, chief engineer of the power company.

Already generators of this type with a total rating of 100,000 kw. have been installed or contracted for, according to F. Hodson, president of the Electric Furnace Construction Company, Philadelphia. He declares that the most important applications of the electric steam generators will probably be in industries situated within convenient transmission range of hydro-electric plants. Where savings in initial cost, space occupied and operating expense are very important, the electric steam generator will have many points in its favor.

Local Selling of Holding Company Stock

Organization of Securities Department and an Employees' Club to Promote Stock Sales Preparation of Prospect Lists -Advertising and Selling Methods Maintenance of Market for Resale of Stock

By H. E. WEEKS
General Manager Securities Department, United Light & Railways Company, Davenport, Iowa

IN A LITTLE less than a year the United Light & Railways Company, through employees, sold more than $1,000,000 of its 7 per cent prior preferred stock to 3,733 subscribers in the seventeen different communities served by its subsidiary companies. This stock was that of the holding company, not local company stock, and the method used for gaining confidence of prospective stockholders through the organization of an employees' club is interesting and unusual.

The United Light & Railways Company operates seventeen companies, eleven of which serve communities in Iowa, six serving communities in Illinois, Indiana, Michigan and Tennessee. Altogether 600,000 people are served in ninety-one cities and towns.

The stock was first offered on attractive terms to the employees of the company in Iowa and Illinois on Oct. 1, 1920. The response to the offer was very gratifying. Three of our companies subscribed 100 per cent, every employee taking stock; six companies showed percentages ranging from 91.5 per cent to 99.2 per cent; one street-railway company took 82 per cent. The employees of several companies have not yet had the opportunity to subscribe. The stock was then offered to the public through employees of the company only for cash at par or on the installment plan with a payment down of $10 and installments of $7.50 per month plus interest on the unpaid balance.

Team Organization

The employees of each of the large companies were then separately organized into teams of ten members to compete in the sale of the stock, and the cities were divided into districts to be assigned to the teams. Our first method was to select as many captains as we expected to have teams, allowing the captains to choose in rotation from a list of workers until they had filled their teams. This, however, was found to be a mistake as team workers were chosen who lived in different sections of the city, whereas by our plan a team was assigned to a certain district. The teams were, therefore, reorganized so that the members lived either in or adjacent to the district assigned to their team. This enabled an employee to work in the vicinity of his home, which on account of the limited time in the evening available for the work was important.

Schools of instruction were conducted for employees who had volunteered to sell the stock to familiarize them with stock selling, sales policies, organization and sales methods. The campaign for sales was then launched. Each salesman was furnished with a salesman's manual containing convenient answers for commonly asked questions. Competition was encouraged by special prizes. A special campaign was conducted for a few weeks to offset an attack on the company by the socialist administration in Davenport. The employees engaged in stock selling were released from their regular duties for one week to concentrate on stock sales. The results demonstrated the fact that it is often possible to convert a "knocker" into a "booster" by making him a stockholder.

After the team organizations had been maintained for about three months it was decided to organize a separate department of the company, to be known as the securities department, to which was given full charge of the sale of securities. The manager of each operating company was made responsible to the manager of the securities department for the sales by his company. Employees who had made the best records as salesmen were selected and put in the securities department.

"United Go-Getters' Club"

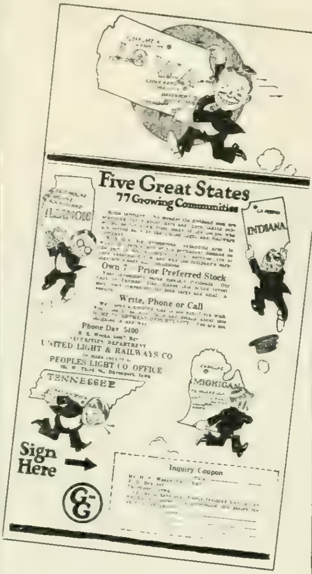
Approximately $500,000 of stock was sold in the manner outlined between the inauguration of the sale and Oct. 25, 1921, when a special campaign was put on to sell $500,000 of stock in six weeks. To co-ordinate the work and put on this sale the "United Go-Getters' Club" was formed. A local section of this club was organized in each company operating in Iowa and Illinois. It was the idea of the officers of the company in organizing this club to make it a permanent institution, and the articles of association provide:

"It shall be the purpose of this club to unite for service all its members in order to further their own and the interests of the United Light & Railways Company in every honorable manner, and whenever called upon, to do all in their power to promote, assist and encourage every legitimate enterprise, whether civic, charitable or otherwise, which will add to the welfare and prosperity of the communities in which the members of this club are residents."

The club is composed of the directors of United Light

Advertising that Sold Utility Securities

Typical Publicity Used in United Light & Railway Company's Stock Campaign



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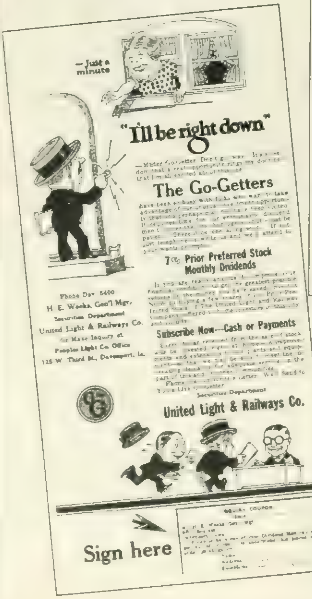

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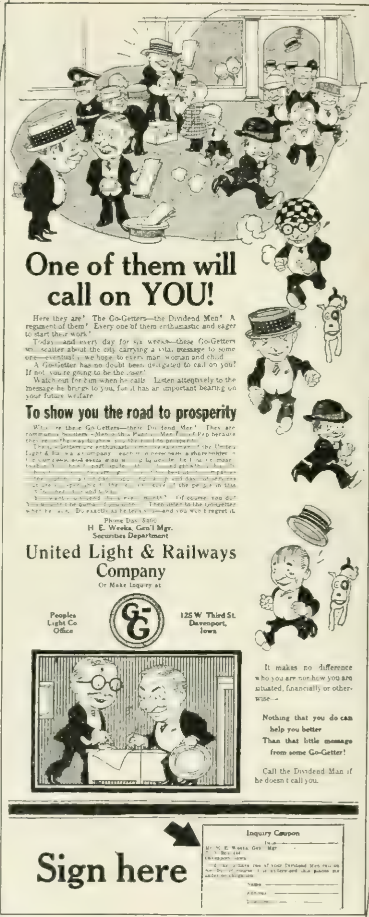

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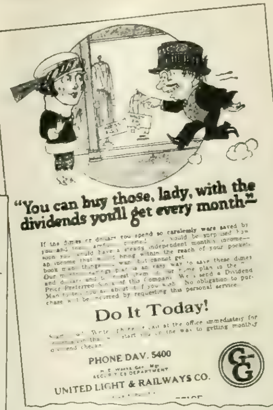
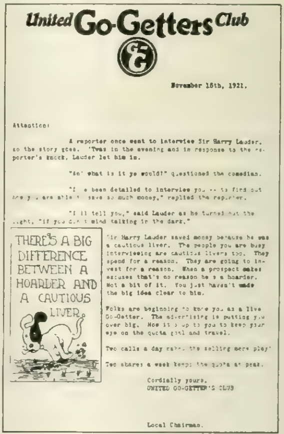


"You can buy those, lady, with the dividends you'll get every month"

Do It Today!

PHONE DAV. 5400
H. E. Weeks, Gen. Mgr.
SECURITIES DEPARTMENT
UNITED LIGHT & RAILWAYS CO.



United Go-Getters Club

November 15th, 1921.

Attention:

A reporter once went to interview Sir Harry Lauder, so the story goes. 'Twas in the evening and in response to the reporter's knock, Lauder let him in.

"An' what is it ye would?" questioned the comedian.

"I've been detailed to interview you — to find out how you are able to save so much money," replied the reporter.

"I'll tell you," said Lauder as he turned out the light, "if you don't mind talking in the dark."

THERE'S A BIG DIFFERENCE BETWEEN A HOARDER AND A CAUTIOUS LIVER.

Sir Harry Lauder saved money because he was a cautious liver. The people you are busy interviewing are cautious livers too. They spend for a reason. They are going to invest for a reason. When a prospect makes excuses that's no reason he's a hoarder. Not a bit of it. You just haven't made the big idea clear to him.

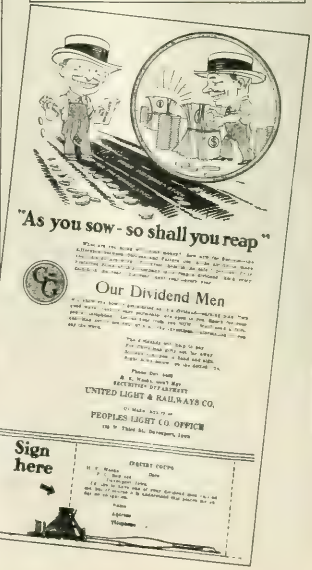
Folks are beginning to know you as a live Go-Getter. The advertising is putting you over big. Now it's up to you to keep your eye on the quota goal and travel.

Two calls a day make the selling more play!

Two shares a week keeps the quota at peak.

Cordially yours,
UNITED GO-GETTER'S CLUB

Local Chairman.



"As you sow - so shall you reap"

Our Dividend Men

UNITED LIGHT & RAILWAYS CO.
Or Make Inquiry at
PEOPLES LIGHT CO. OFFICE
125 W. Third St., Davenport, Iowa

Sign here

Inquiry Coupon

Name
Address
Telephone

THESE newspaper advertisements were prepared especially with the view to getting away from the conventional appearance of the usual financial announcement and the results of the campaign have demonstrated the value of this policy. One of the Go-Getters' Club "pep" letters is also reproduced, showing how employees' interest in stock selling was maintained.

& Railways Company and its subsidiary companies, the managers of properties, the officials of the securities department and such employees as had shown especial interest in the previous distribution of stock.

Bonus and Prize Offers for Stock Sales

Prizes aggregating $5,000 were offered, their distribution being contingent on the quota for the campaign being sold. A book of instructions to salesmen was printed, explaining these special prizes, together with a bonus for keeping up the quotas during the campaign, which was awarded on the following basis:

If a member sold his quota the first week and again the second week, he received a bonus of 10 cents per share on his total sales for the two weeks. If a member sold his quota during the third week, he received a bonus of 20 cents per share on his total sales for the three weeks and so on during the six weeks campaign. In other words, if a member made his quota for the six weeks of the campaign, he received a bonus of 50 cents per share on all stock sold by him during the period of the campaign.

In addition to the prizes which were annouced in the book of instructions, when the campaign was put over a special prize of $50 was given to six "Go-Getters" who had sold fifty shares or more of stock and were the second highest men in their locals. A special prize of $75 was also given to the "Go-Getter" who sold to the largest number of public subscribers, and the locals which exceeded their quota by more than 5 per cent were allowed $1.50 for each member, to be used in defraying the expense of a dinner to celebrate the success of the campaign.

Obtaining Prospect Lists

We endeavored to profit by our experience, which indicated clearly that the success of the sale would be dependent largely on the number of good "prospects" called upon. We arranged to have each manager appoint a committee consisting of the employees having the broadest acquaintance among the customers of the company to eliminate from the customers' list the names of those who in their opinion would not make good prospects. Out of the total customers' list of approximately 70,000 names, 32,000 prospect cards were made up. Our slogan for the campaign was, "Call on two people each day—sell at least two shares each week." With 460 active members in the "Go-Getters' Club," we figured that this would enable us to cover the prospect list of 32,000 names during the period of the campaign. Judging from our previous experience, we felt sure that we could sell to a minimum of one in eighteen of those canvassed, especially in view of the improved financial conditions on some of our properties and the fact that we had decided to accept Liberty bonds in payment for the stock, beginning with the opening of the campaign.

When planning for the campaign it was decided to employ the McJunkin Advertising Company of Chicago, which had done splendid publicity work for us when the sale of stock was first inaugurated. This company prepared for us a special series of advertisements different from any financial advertising we had previously seen. It also prepared a series of "pep" letters to be sent out weekly to the members of the "Go-Getters' Club." We thus had the benefit of the McJunkin company's experience in serving other public utilities.

The campaign was opened with a dinner at the Blackhawk Hotel in Davenport, at which there were present about 100 "Go-Getters" from the properties outside of the Tri-Cities and about 300 "Go-Getters" from the Tri-Cities. Frank T. Hulswit, the president of the United Light & Railways Company, explained in an address the objectives of the campaign.

In the second week of the campaign it was decided that an inspirational talk by some one experienced in salesmanship would be beneficial, and the services of a former instructor in salesmanship at Northwestern University, a man of wide experience, were engaged. He gave ten lectures to the "Go-Getters" at the different properties in Iowa and Illinois.

Too much credit cannot be given to the influence of the publicity of which we made use. Our situation was a particularly trying one owing to the fact that prior to the inauguration of the sale of stock no publicity whatever had been given to the United Light & Railways Company. In fact, it had been the policy to play up the local management of the subsidiary companies and avoid mentioning the name of the holding company. Wide publicity in the form of newspaper advertising, folders, stickers on bills, street-car display cards and personal letters was therefore necessary to pave the way for the salesmen.

Maintaining Market for the Stock

The maintenance of a market for securities sold only by the company is of greatest importance. A large proportion of the investors are of the savings-bank type, and unless the integrity of their investment is protected it cannot be expected that they will recommend the securities to their friends. If the stock is sold to them at par and they find they can get par in return, less a small commission for reselling, it will dispel their desire to sell.

We are selling a 7 per cent preferred stock at par only through our employees and special salesmen, who are instructed to inform the public that the stock will be sold in no other manner and that we expect to be able to maintain the market for the stock at par because of the fact that all stock will be offered to us for resale. We insist, however, that our salesmen inform people that we do not guarantee to resell the stock at par. Up to the present we have been able to resell all the stock that has been offered, which so far has amounted to only about 7 per cent of the total stock sold.

Before starting the sale in each community we interviewed the local bankers and informed them of what we intended to do. In many instances we have had their active co-operation, and in no case have we discovered that they were criticising our plan. Under the existing conditions we could not expect them to be enthusiastic about having the money taken out of their banks, and we have given our salesmen to understand that they will not encourage depositors to withdraw their money.

Value of Publicity

The effects of our publicity were clearly apparent in the reception which the members of the "Go-Getters' Club" received when they made their calls. When we first began to sell the stock many cases were reported where people had refused even to talk to the salesmen, but very few cases of this sort were reported during the campaign.

Prior to the opening of the campaign we had sold to 1,958 subscribers in ten months. During the period of the six weeks intensive campaign we sold to 1,775 subscribers more than $500,000 of stock. We have placed over $1,000,000 of the stock with 3,733 subscribers in approximately one year's time, an average holding of less than three shares per stockholder.

We have discouraged from investment in our stock those who expected to make use of their money in the near future for the purchase of a home or for other purposes and have explained to them that we wanted only permanent investors.

We have found that it was necessary in many cases to call frequently on a single "prospect" before closing the sale, and very often fifteen or twenty calls might be made on different persons before a sale was made. The class of investors is such that a great many of them can only be seen at night, when the employee must sacrifice his leisure time to see them. Our experience, and I believe it is approximately borne out by the experience of others, is that the average original sale is three shares.

It is difficult to estimate the value to the company of the better knowledge of its affairs gained by the employee who becomes a stockholder and salesman. This is true in like manner of the customer who becomes a stockholder.

Finally, too much emphasis cannot be placed on the fact that some companies in promoting customer ownership have overlooked the importance of protecting the customer in his investment and will pay many times over in the ill will toward them which has thus been created. Great care has to be exercised to prevent employees from using "high-pressure" methods and making promises which the company cannot keep. In their eagerness to sell they sometimes lose sight of the fact that the company does not want short-time depositors but investors who will be permanent, and that a permanent, satisfied customer-stockholder, even though he be a subscriber for only one share, is a valuable asset to the company.

The Economic Function of the Railroads*

Importance of Keeping Utilities Financially Strong and Unhampered by Public Prejudice or Governmental Bias — Private Initiative Is Essential

BY HERBERT HOOVER
Secretary of Commerce

IT MIGHT be profitable for our people to get a somewhat clearer perspective of our own and the world's troubles and problems. Even a superficial survey must bring us out of an atmosphere of gloomy introspection into an assuring realization that, great as our dislocations may seem to be, we relatively are in an enviable position. Our nation is unshaken and as a people we are getting our bearings in a world of perplexing economic adjustments. While there is unemployment and lack of profit taking, we are free of panic. We are comparatively more restless than injured.

The violence of our readjustment, however, is without parallel, and we sometimes tend to color our measures for the future by the depression we are in. The fact is that we must predicate all plans for the future on the ultimate return of the American people to a normal economic activity, with our annual progress in the expansion of our production, of our plant and equipment, of our skill and our efficiency. There can be no question that this return will take place, and no responsible body will approach our problems on any other basis. Not one of us would submit to the charge that we were not prepared to bet against any odds upon the future of the United States. Our problem is to expedite this recovery—to speed up employment of our workers, and thereby find a market for our farmers.

If we look at the national economic situation as a whole, the greatest impulse that can be given to recovery from any source whatever would be a reduction of rates on primary commodities combined with the immediate resumption of railway construction and equipment. The first depends upon reduction of operating costs, the second upon restoration of credit for our railways.

One thing is absolute. Our transportation facilities are below the needs of our country, and unless we have a quick resumption of construction, the whole community—agricultural, commercial and industrial—will be gasping from a strangulation caused by insufficient transportation the moment that our business activities are resumed.

Few people seem to realize the amount of expansion in our transportation machine necessary to keep pace with the growth of the country, and equally few seem to have any notion of the price we pay for not having it. Since we entered the war in 1917 we have constructed at least 10,000 miles of railways less than our increasing population and economic development called for, and we are behind in rolling stock by about 4,000 locomotives and 200,000 cars. I wish to emphasize that unless we can have an immediate resumption of construction and equipment our commercial community will pay treble the cost of the whole of them in their losses of a single season. There would be no difficulty whatever, basing such losses on the experiences we have already had, in calculating a loss to the American people of a billion dollars for each one of these periodic transportation shortages.

IMPORTANCE OF RESUMPTION OF RAILROAD ACTIVITY

Furthermore, there is nothing that is so irrecoverable a loss to the nation as idle shops and idle men. Today we have both. There is nothing that will so quickly start the springs of business and employment as an immediate resumption of construction and equipment of the railways. If we examine the fundamental reasons for failure to resume equipment we will find them in the loss of confidence in railways as an investment and the competition of tax-free securities. We have passed the period of credit strain in this depression. Surplus capital is pouring by hundreds of millions monthly into tax-free securities and foreign loans, and yet our railways are unable to finance the most moderate of construction programs. The confidence of the public in railway investments was at so low an ebb before the war that finance by the issue of common and preferred stocks had become impossible and railway expansion was living on bond issues. The confidence of an assurance and continuity in earning power to cover this burden of bonds has been even lowered since the war began, because of the uncertainties of both rising and falling prices, of rising and falling wages, of rising and falling rates preventing all regularity of earnings upon which an investor could be convinced, even if no other difficult factors entered into the problem. I see no occasion to go into the labyrinth of past railway finance, its propriety or lack of propriety, its foolishness or its skill. That generation is gone by. This commission approaches the financial problems of the railways upon their actual value, not upon their issues of securities, and I take it we are living for the future, not the past. We want transportation, and we want it with the values of private initiative and clean public service.

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*Abstract from statement by the Secretary of Commerce before the Interstate Commerce Commission.

ALTHOUGH the statement of Mr. Hoover before the Interstate Commerce Commission dealt entirely with the steam-railroad situation, it applies with equal force to every public utility in the country. The railroads are not alone in their dilemma. Other utilities have had to face financial woes as well, and the regulating authorities have been just as slow and just as remiss as the Interstate Commerce Commission in granting prompt relief. That the investing public has not taken kindly to the bonds and stocks of public utilities is as much a reflection on the commissions as it is an evidence of the short-sightedness of the public. A starved utility cannot function efficiently any more than a starved man, and it is the public that reaps the whirlwind eventually. Mr. Hoover has given a great deal of time and attention to the subject of transportation, and testimony from such a high source deserves careful study and consideration.

In these circumstances it seems to me vital that the railways as our greatest industry should propose a courageous program of broad-visioned betterments, and if necessary the government should consider giving the use of its superior credit. It would not cost the taxpayer a cent to give the government guarantee to equipment trusts upon the primary responsibility of the railways, the proceeds to be devoted entirely to improvement and equipment. This is no proposal to take money from the taxpayer. It is a proposal to save him from paying treble the amount of his guarantee in profiteering and losses. It will bring a reduction of rates earlier, for unless something is done the improvements will have to be paid over years out of increased rates. Nor would we lose a cent upon the guarantee, for if American railways cannot earn interest upon their borrowings let us throw up our hands and prepare for a second Russia.

We talk glibly of giving billions of credits to foreign countries to increase our farm exports. I wish to say, with all responsibility for the statement, that a billion dollars spent upon American railways will give more employment to our people, more advance to our industry, more assistance to our farmers, than twice that sum expended outside the frontiers of the United States—and there will be greater security for the investor.

Finally, I want to refer to the veritable witches' caldron being fed constantly with hates distilled from the misdeeds of railway promoters in the past, from the conflicts between the railways and the farmers, between the railways and their workmen. Because of all the confusion that arises we destroy our railways and destroy ourselves. With this commission on one hand assuring honesty in finance, justice to the shipper and the railway investor, with the Railway Labor Board assuring justice to workers, and, above all, with a great spirit of public service in our generation of railway managers, it is time to call off the witches and take some vision of our national situation if we are to pull ourselves out of this depression.

If we survey the results of the past year in the application of present costs and rates, we find many railways failing to earn interest upon their borrowed capital. We find some others, more fortunately situated, which have earned dividends on their share capital. In one or two exceptional cases of low bonded indebtedness railways did extraordinarily well on their share capital. If we survey the situation by districts, in order that single instances shall not mislead us, we shall find that the whole of the Class 1, Southern roads, barely covered bond interest, while the most fortunate group, the Western roads, show an earning of only 4 per cent in 1921 upon their tentative valuation. Moreover, it is obvious that maintenance has been held to a low level and that new equipment and extensions have been practically nil.

The present earnings, in their perilous closeness to bond obligations, seem to me to dispose of the question of immediate important rate relief, if we do not wish widespread receiverships and shocks to our whole commercial fabric.

A great deal has been said about the inefficiency of our railway system. I do not sympathize with these statements. Comparison with foreign railways of the fundamental criteria of per-ton-mile costs, train loading and so forth, in the light of our cost of living, will demonstrate that our railways are of higher standards, better in methods than others, and are growing in efficiency. The consolidation of our railways into larger systems has been contemplated in our legislatures for some years past as a gain in efficiency. Its value can be overestimated—it is not a remedy for all trouble. It does give hope, however, of economies in further efficiency from more complete utilization of rolling stocks and terminals, some small degree of saving in overhead, saving in current inventories; but probably its greatest saving would be decreased cost of proper finance, increased financial stability and fuller independence of the supply companies.

It is probably unnecessary to refer to the question of government ownership. No one with a week's observation of government railways abroad, or with government operation of industry in the United States, will contend that our railways could ever be operated as intelligently or as efficiently by the government as through the initiative of private individuals. Moreover, the welfare of their multitude of workers will be far worse under government operation.

We are struggling with the great problem of maintaining public control of monopoly, at the same time maintaining the initiative of private enterprise. I believe that we are steadily progressing to a solution.

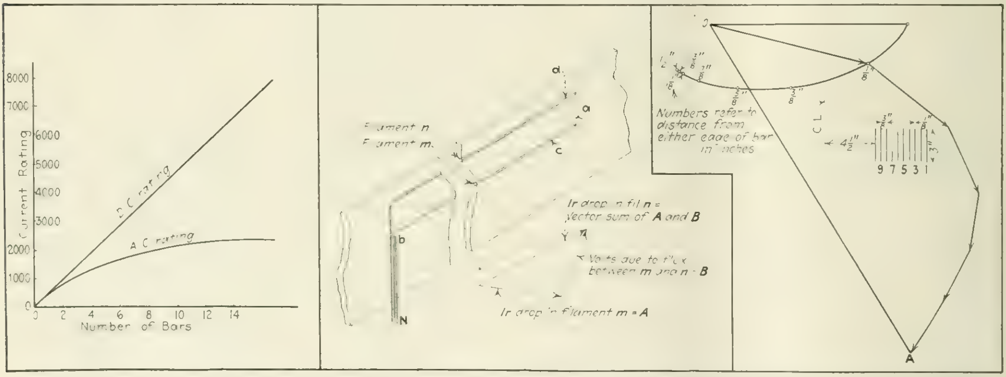
Great social and economic problems find their solution slowly and by a process of trial and error. We have tried unregulated monopoly and have tried government operation, and found the error in them. We still have much to solve if we are to maintain our transportation. Much of this solution depends upon the successful initiative of the railways themselves, and much of the shaping of these matters lies fortunately in your able hands.

Current Distribution in Multi-Conductor Single-Phase Buses

Study of the Phenomena Involved Is Necessary to Design Busbars for Generating and Distribution Systems of Large Capacity if Cost of Construction Is to Be Minimized—Simple Graphical Method Is Presented

By C. F. WAGNER
Material and Process Engineering Department,
Westinghouse Electric & Manufacturing Company

GENERATING and distributing systems are increasing in size so rapidly that it is becoming more and more important to determine methods of increasing bus capacity and reducing the cost of construction. This resolves itself into making the most economical use of copper. No longer may we double the number of bars and assume that the bus rating is doubled. Other means must be developed. A necessary preliminary to the solution involves the study of phenomena encountered in single-phase buses. A simple graphical method whereby the actual current distribution in multi-conductor buses may be ascertained is presented in this article. It points out the forces present tending to produce inequality of current distribution and discusses means of overcoming or annulling these forces. Though the article does not bear directly upon the three-phase problem, except as to the general nature of the phenomena encountered, it is very probable that the method described will be employed in all subsequent investigations of this nature. Therefore it should be of interest to both central-station and industrial engineers.



FIGS. 1, 2 AND 3—COMPARISON OF D.C. AND A.C. RATINGS OF MULTI-BAR BUS; METHOD OF STUDYING CURRENT DISTRIBUTION IN A.C. BUS, AND CONDITIONS OBSERVED IN A SPECIFIC CASE

Increasing number of bars does not increase rating to the same amount for alternating current and for direct current; insulated leads attached to busbar for studying current distribution; magnitudes and phase relations of currents in different portions of bar No. 6 in a ten-conductor bus. The curved line is the loci of vectors representing currents in different portions of the bar. As indicated, the current $1\frac{1}{2}$ in. from the edge is about 145 deg. out of phase with that at the edge.

As is well known, any conductor carrying alternating current has produced in it magnetic lines of force, which on rising and falling create back electromotive forces of self-inductance. These electromotive forces vary both in magnitude and phase from point to point through the cross-section of the conductor, being larger in the middle and smaller toward the periphery. The result is to produce a non-uniform distribution of current of such character as to crowd the current toward the conductor surface; hence the term "skin effect." A measure of this distortion is given by the "skin-effect ratio," which is the relation of the thermal energy generated by the flow of alternating current to the thermal energy formed by the passage of the same value of direct current.

The distortion of the current increases with the frequency for a given conductor, but, as H. B. Dwight[*] has pointed out, the skin-effect ratio is an increasing function of the ratio f/R, where f is the frequency and R is the resistance. The physical significance of this relation may be better grasped by considering the unbalance of current density as merely due to circulating or eddy currents superimposed upon a uniform power current. At certain points the circulating currents add to the power current and at other points deduct from it. The induced voltages producing these currents are directly proportional to the frequency and are balanced by the resistance drop of the circulating currents. Hence to maintain a given current distribution with increased frequency it is only necessary to increase the resistance drop in the same proportion. Dwight's relation is of no importance here except as it elucidates the phenomenon connecting the radio art and busbar work. It shows that the distribution may be just as bad with low resistances as with high frequencies.

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[*] *Transactions A.I.E.E.*, 1918, page 1399.

The presence of neighboring conductors distorts the current distribution further. A rigorous mathematical investigation of the distribution in complicated composite buses with returns is impossible, although a few of the more simple cases have been found susceptible of analysis. Distortion also increases as the resistance decreases; this is the condition met with in busbar practice and the one in which we are interested.

Method of Studying Current Distribution

In an experimental investigation of this phenomenon the writer used the following method with marked success:

> An insulated lead *c* was placed close to the bar under investigation and brought into electrical contact with it at *a* Fig. 2. With another tap *N* from *b* it was possible to form what is in effect a non-inductive shunt with filament *m*, that portion of the bar in immediate proximity to the lead. All lines of force which cut filament *m* likewise cut lead *c*, it being assumed that filament *m* and lead *c* are so close together that practically no lines of force may pass between them. The voltage across the terminals of *N* and *c* will then be affected only by and will be a measure of the resistance drop in filament *m*. Similarly, if another insulated lead *d* was secured along the bar, the voltage between it and the *N* lead will be proportional to the resistance drop in filament *n*.
>
> So far, only the scalar values of the vectors have been considered. There remains to determine their phase relation. The voltage between the terminals of *c* and *d* will be equal to the vector difference of the *ir* drops. These three values are sufficient to construct a triangle which determines the phase relations of the *ir* drops (see Fig. 2). However, this gives no physical conception of the quantities. The total drop along the bar between *b* and *a* consists of two components, namely, the resistance drop and the reactive drop. It is equal to the vector sum of the *ir* drop of any element and the reactive drop due to all the lines of force external to that element. Lines of force which do not cut the element do not contribute to the development of reactive drop. To be more specific, the total drop between *b* and *a* is equal to the vector sum of the *ir* drop in filament *m* and the reactive drop due to the flux external to *m* and is also equal to the vector sum of the *ir* drop in filament *n* and the reactive drop due to the flux external to *n*. By subtracting the reactive drop external to filament *n* from each of these equal sums, it becomes evident that the *ir* drop in filament *n* is equal to the vector sum of the *ir* drop in filament *m* and the voltage due to the flux between *m* and *n*. It will be noted that the two leads *c* and *d* with that portion of the bar at *a* form a complete rectangle or loop through which threads the flux between *m* and *n*. The voltage across the terminals of *c* and *d* will, therefore, be equal to the vector difference of the *ir* drops in filaments *m* and *n*.

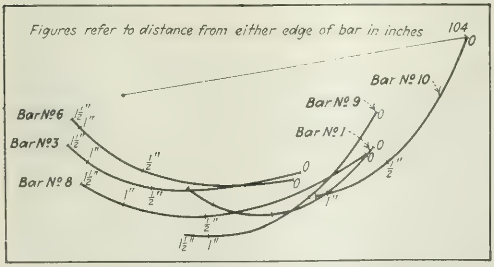


FIG. 4—LOCI OF VECTORS REPRESENTING CURRENTS IN BARS OF TEN-CONDUCTOR BUS

The current in the middle of bar No. 6 lags 160 deg. behind that at the edges of bar No. 10, which indicates that while the current in one part of the bus is flowing in one direction, that in another part is flowing in the opposite direction.

Using the preceding method the current distribution in a ten-conductor copper bus of the section indicated by Fig. 3 was investigated. A current of 4,200 amp., 60 cycles, was used. Fig. 3 also shows the current distribution in different portions of bar No. 6. The figures along the curved line indicate the termini of the vectors representing current in filaments or laminæ distant from either edge an amount equal to the figures shown. This diagram indicates that the current density at the middle of the bar is but 29 per cent of that at the edge, and that these currents are out of phase 124 deg., the current in the middle lagging behind that near the edges. By dividing the bar into quarter-inch elements and by assuming the current density at $\frac{1}{8}$ in., $\frac{3}{8}$ in., $\frac{5}{8}$ in. (3.1 mm., 9.5 mm., 15.8 mm.), etc., to be average densities for these elements, it is possible to obtain by the addition of the vectors the resultant *OA*, which is in phase with but equal in scalar value to six times average current density in the entire bar. Dividing by six and multiplying by the area, the total current in the bar is obtained. From a knowledge of the distribution it is but a simple step to determine the skin-effect ratio.

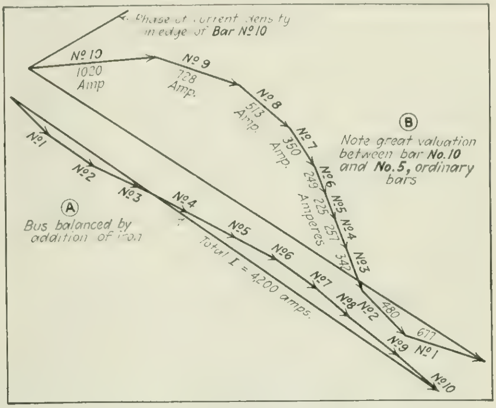


FIG. 5A AND B—CURRENT RELATIONS IN INDIVIDUAL BARS OF BALANCED AND UNBALANCED BUSES

Similar diagrams for bars Nos. 1, 3, 6, 8, 9 and 10 are shown in Fig. 4. The vector marked 104 is used as a reference vector and is in phase with the current density at the edge of bar No. 10. It may be noted that the current in the middle of bar No. 6 lags 160 deg. behind that at the edges of bar No. 10, which signifies that at any instant while current in one part of the bar is flowing in one direction that in another part is flowing in the opposite direction.

It may be noted further that the loci do not overlap one another and form one continuous curve as might be expected. If a solid conductor in which the magnetic lines of force constitute a system of concentric loops is assumed, all elements of the conductor through which pass the same lines of force are cut by an equal number of lines, viz., those external to that line. These elements will then all have equal reactive drops, and since all elements of the conductor must have the same total drop along the conductor, they must likewise have the same *ir* drop and current density. Any other element will have a different reactive and *ir* drop. It may therefore be concluded that the current density at any point in a conductor with a concentric magnetic field may be represented by a single locus. All points having equal reactive drops will likewise have equal current densities.

The foregoing argument fails, however, when the magnetic field is other than concentric. In the composite bus consisting of rectangular bars with air ducts between, each bar has linked about it magnetic lines of force which do not link other bars. Consequently, elements of the same magnitude of *ir* drop may be obtained, but they are not in phase. The best analogue is the leakage reactance of a transformer. This explains the necessity for a separate locus for every bar.

The relations between the total current in all the bars is shown in Fig. 5B, the smallest current value being 225 amp. and the largest 1,020 amp. Since these vectors have in no way been determined by the use of the ammeter readings, a comparison of the vector sum of these currents with the ammeter reading constitutes a check upon the method. This method indicated a total current of 4,380 amp., while the ammeter indicated 4,200 amp. Considering the magnitudes of the voltage drops involved and the instruments available, this appears to be a sufficient check upon the method.

Having determined the current distribution, it is interesting to consider how poor current distribution affects the rating of a bus. In the first place, there exists a maximum temperature of the bus above which it is unwise to run. Oxidation of the joints results, which increases their resistance. This in turn increases the thermal energy developed, thereby raising the temperature further. Above a certain temperature the effect is cumulative, so it is advisable to keep the maximum temperature below a certain safe working temperature. Non-uniform distribution within a bar increases its effective resistance and hence lowers the current rating for a given temperature rise. Unbalance of current between the bars not only increases the total energy formed but also increases the maximum local temperature. One bar may be working at the maximum allowable temperature while the other bars are cool. This results in poor economy and a very low rating for a given quantity of copper.

FOUR METHODS OF INCREASING BUS RATING

How may the rating be increased? Several schemes have been proposed.

1. For low-voltage work, such as electric furnace installations, "interlacing" has been found most satisfactory. Direct-current rating is thus virtually obtained. However, "interlacing" must be restricted to low voltages.

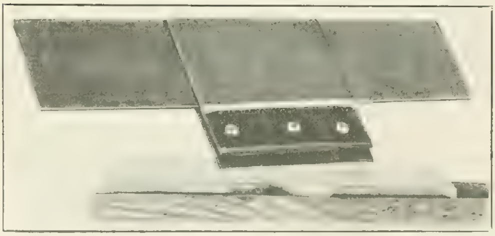


FIG. 6—SECTION OF A BUSBAR WITH BALANCER ATTACHED

2. The conductors may be regrouped in such a manner that the unbalance between bars and the distortion within the bars are decreased. One such arrangement is to form the bars in "hollow square," placing, say, four conductors, so that their centers coincide with the four corners of a square allowing space between.

3. The conductors may be transposed in a manner similar to the "transposition" used in transmission lines. This is possible in cases where a small number of conductors are involved or where long stretches of bus are employed.

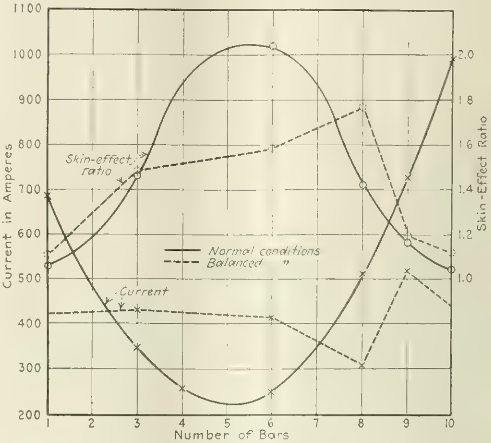


FIG. 7—CURRENT AND SKIN-EFFECT RATIO IN INDIVIDUAL BARS OF BALANCED AND UNBALANCED BUSES

4. Artificial inductance or balancers (Fig. 6) may be added to those bars carrying the greatest current. In this manner the current in all bars may be made equal.

Probably the most economical means is to regroup the conductors in a "hollow square" so as to reduce the skin-effect ratio of individual bars and then to correct for the unbalance between bars by means of artificial inductance. That it is possible to obtain absolute balance may be shown mathematically as follows:

Considering a pair of ten-conductor buses like the one shown in Fig. 3 with one constituting the return for the other, and assuming currents balanced in magnitude and phase, the voltage equation for bar No. 1 may be written:

$$e = ir + jwI(K_1 + M_{11} + M_{12} + M_{13} + M_{14} + M_{15} \\ - M_{16} - M_{17} - M_{18} - M_{19} - M_{110})$$

where

e = impressed emf. along the bars,
I = current in each bar for the balanced condition,
R = resistance of each bar,
M_{12} = mutual inductance between bars Nos. 2 and 1, etc.,
K_1 = added inductance to bar No. 1, etc.

Five bars per bus are used merely for simplicity.

Similar equations may be formed for all bars. The necessary and sufficient condition that the currents in all bars be equal and in phase is that the scalar quantity in parentheses be equal for all bars. These quantities may be made so by varying the values of K.

By adding balancers of the type shown in Fig. 6 to the bus considered in Figs. 3 and 4 until approximate temperature balance was attained, the current distribution shown in Fig. 5A was obtained. A comparison of this figure with Fig. 5B indicates the effect of the balancers. The currents per bar are not only made equal in magnitude but are also in phase. The same results are also shown in Fig. 7, the full lines referring to the normal condition and the dotted lines to the balanced bus. The improvement may be better appreciated if it is remembered that the temperature of the bars varies approximately as the square of the current. It is unfortunate that the ventilating conditions under which the test was made precluded the possibility of obtaining exact balance.

The skin-effect ratio of the individual bars is also shown in Fig. 7. The curve for the normal bus is symmetrical about a vertical axis, which indicates that the field due to the return has little influence upon the current distribution within individual bars. The principal effect of the return conductor is to augment the unbalance of current between the bars. With perfect balance it would be expected that the curve of skin-effect ratio would be symmetrical, but results do not bear this out. Bar No. 8 possesses the greater skin-effect ratio. This dissymmetry is probably due to the fact that bar No. 8 had too much iron, resulting in a small current. But the circulating currents would be altered very little, producing a greater distortion of the current and a greater skin-effect ratio. Assuming, then, a symmetrical curve, the maximum skin-effect ratio would be about 1.6. The balancers decreased the maximum skin-effect ratio from 2.04 to 1.6.

Similar investigations were made upon a single-phase bus consisting of four 4-in. x ¼-in. (10-cm. x 6.35-cm.) copper bars arranged in "hollow square." The bars were held in a horizontal position with the flat side vertical and separated 4 in. (10 cm.) horizontally and 2 in. (5 cm.) vertically. The distance between center line of buses was 16 in. (40 cm.).

The following table serves to compare a bus having ten 3-in. x ⅛-in. (75-mm. x 3.1-mm.) bars with a bus having four 4-in. (10-cm.) bars. The current rating for 30 deg. C. temperature rise is given below:

Conditions	Amperes for 30 Deg. C. Temperature Rise Ten 3-In. x ⅛-In. Bars Separated ⅛-In.	Four 4-In. x ¼-In. Bars in Hollow Square
60-cycle—normal	2,700	3,600
60-cycle—balanced	4,500	4,500
60-cycle—transposed (estimated)	....	4,800
Direct current	6,250	5,300

The improvement with the addition of the balancers is evident for both cases. While "transposition" produces a further improvement, the practice is not warranted because of the increased complexity of the bus. It will further be noted that while the heat dissipation qualities of the ten-conductor bus, as evidenced by the direct-current rating, are better than those of the four-conductor bus, still the skin-effect ratio of the individual bars and the unbalance of current between them are so much greater as to maintain the same rating for the two buses.

The skin-effect ratio of individual bars may be decreased by placing iron clips around the edges. The function of the clips is to increase the inductance of the edges, thus preventing the crowding of current to that part of the bar. They produce a more uniform distribution of current. In view of their structural disadvantages, the resulting increases in current rating do not warrant their use in practice.

While the information given in this article is directly applicable to single-phase installations, it has a broader usefulness in the development of a knowledge of current distribution, and therefore circuit design and rating, in three-phase systems.

Economy of Electric Trucks for Delivery Use

Large Brooklyn Department Store Has Found Them to Be Cheaper per Unit Hauled than Any Other Vehicle

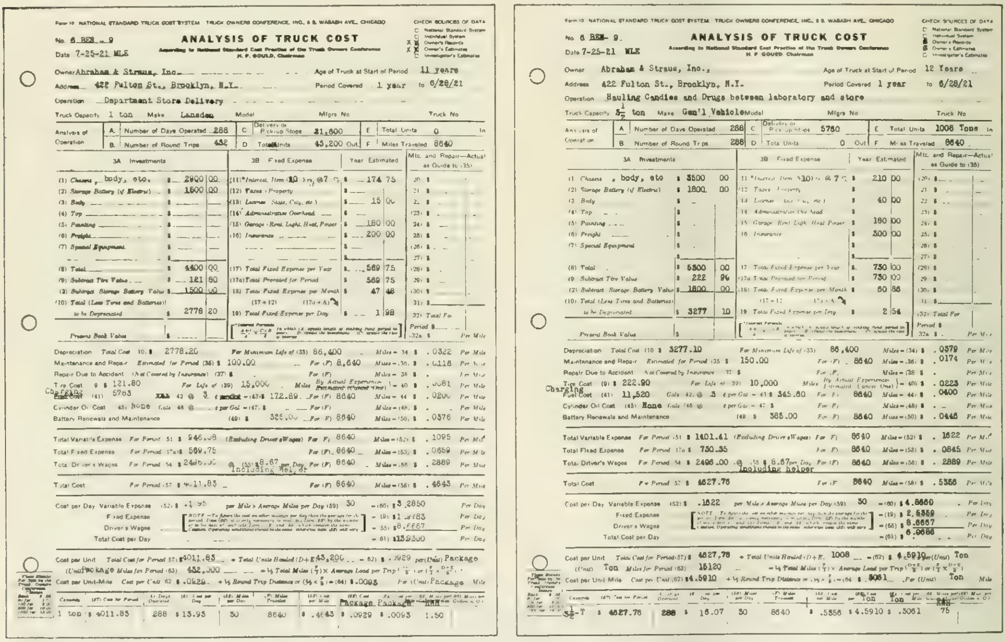
"THIRTEEN years experience with electric trucks has satisfied us that for certain classes of work they are cheaper per unit hauled than any other type of vehicle," say Abraham & Straus, Inc., 422 Fulton Street, Brooklyn, N. Y., owners of one of the largest department stores in that borough. "For making deliveries we use electric trucks, gasoline trucks and horses, employing each type of vehicle in the zone of operation where we have found it the most economical. Our horses are used on trips requiring a mileage of less than 10, electric trucks are used for a daily mileage between 10 and 40, and gas trucks on a mileage between 40 and 130. "Our electric fleet consists of one 3½-ton truck purchased in 1908 and twenty 1-ton trucks of a different make, of which ten were bought in 1910 and ten in 1911. We operate in addition a number of horse routes and ninety-one gas trucks of ¾-ton, 2-ton, 3-ton and 5-ton capacity. We have been using gasoline trucks since

SIXTEEN OF THE TWENTY-ONE ELECTRIC TRUCKS COMPOSING FLEET OF LARGE BROOKLYN DEPARTMENT STORE

Of the vehicles shown, nine were purchased in 1910 and seven in 1911. Four of the trucks not pictured are like those shown, being rated at 2,000 lb. each. The remaining one is a 3½-ton truck, purchased in 1908. All of the trucks have been operated daily since they were purchased and have been found particularly economical for trips of 10 to 40 miles daily.

1913. The 1-ton 'electrics' deliver department-store merchandise of all kinds. They cover practically all of Brooklyn and in New York run uptown as far as Columbus Circle at Fifty-ninth Street. Their average daily mileage is 25, and they make between one and two trips. On the average each truck handles 150 packages a day. Since at some stops more than one package is delivered, the total number of delivery stops does not exceed eighty-five per day. The average load weighs about 1,500 lb.

"While we have actually had these trucks eleven and twelve years, we figure on a ten-year depreciation. Repairs and maintenance are very low, averaging only $100 a year per truck. We use almost no oil—simply pack the main bearings with grease once a year. We figure on operating a truck all but three weeks in the year, which gives us 288 operating days. Each truck carries a driver and a helper, the driver getting $30 a week and the helper $18. Figured on the National Standard Truck Cost System, one of these 1-ton electrics costs $13.93 a day, 9.29 cents per package and 0.93 cents per package-mile. The cost per delivery stop is 18.57 cents.



Form 10 NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE, INC., 5 S. WABASH AVE., CHICAGO

CHECK SOURCES OF DATA
☐ National Standard System
☐ Individual System
☒ Owner's Records
☒ Owner's Estimates
☐ Investigator's Estimates

No. 6 BEM 9
Date 7-25-21 MLE

ANALYSIS OF TRUCK COST
According to National Standard Cost Practice of the Truck Owners Conference
H. P. GOULD, Chairman

Owner Abraham & Straus, Inc. Age of Truck at Start of Period 11 years
Address 422 Fulton St., Brooklyn, N.Y. Period Covered 1 year to 6/28/21
Operation Department Store Delivery
Truck Capacity 1 ton Make Lansden Model Mfgrs No Truck No

Analysis of Operation	A.	Number of Days Operated 288	C.	Delivery or Pick-up Stops 21,600		E	Total Units 0	In
	B.	Number of Round Trips 432	D	Total Units 43,200	Out	F	Miles Traveled 8640	

3A Investments			3B Fixed Expense	Year Estimated		Mtc. and Repair—Actual as Guide to (35)
(1) Chassis, body, etc.	$2900	00	(11)* Interest, Item (10) yrs. @ 7%	$174	75	(20) $
(2) Storage Battery (if Electric)	$1500	00	(12) Taxes (Property)	$		(21) $
(3) Body	$		(13) License (State, City, etc.)	$15	00	(22) $
(4) Top	$		(14) Administrative Overhead	$		(23) $
(5) Painting	$		(15) Garage (Rent, Light, Heat, Power)	$180	00	(24) $
(6) Freight	$		(16) Insurance	$200	00	(25) $
(7) Special Equipment	$			$		(26) $
	$			$		(27) $
(8) Total	$4400	00	(17) Total Fixed Expense per Year	$569	75	(28) $
(9) Subtract Tire Value	$121	80	(17a) Total Prorated for Period	$569	75	(29) $
(2) Subtract Storage Battery Value	$1500	00	(18) Total Fixed Expense per Month (17 ÷ 12) (17a ÷ A)	$47	48	(30) $
(10) Total (Less Tires and Batteries) to be Depreciated	$2778	20	(19) Total Fixed Expense per Day	$1	98	(31) $ (32) Total For Period $
Present Book Value	$					(32a) $ Per Mile

Depreciation Total Cost (10) $2778.20 For Minimum Life of (33) 86,400 Miles = (34) $.0322 Per Mile
Maintenance and Repair Estimated for Period (35) $100.00 For (F) 8,640 Miles = (36) $.0116 Per Mile
Repair Due to Accident (Not Covered by Insurance) (37) $ For (F) Miles = (38) $. Per Mile
Tire Cost (9) $121.80 For Life of (39) 15,000 Miles By Actual Experience / Estimated (Cancel One) = (40) $.0081 Per Mile
Charging Fuel Cost (41) 5763 KWH (42) @ 3¢ = (43) $172.89 For (F) 8640 Miles = (44) $.0200 Per Mile
Cylinder Oil Cost (45) None Gals (46) @ ¢ per Gal = (47) $ For (F) Miles = (48) $. Per Mile
Battery Renewals and Maintenance (49) $325.00 For (F) 8640 Miles = (50) $.0376 Per Mile

Total Variable Expense For Period (51) $946.08 (Excluding Driver's Wages) For (F) 8640 Miles = (52) $.1095 Per Mile
Total Fixed Expense For Period (17a) $569.75 For (F) 8640 Miles = (53) $.0659 Per Mile
Total Driver's Wages For Period (54) $2496.00 @ (55) $8.67 per Day For (F) 8640 Miles = (56) $.2889 Per Mile
Including Helper

Total Cost For Period (57) $4011.83 For (F) 8640 Miles = (58) $.4643 Per Mile

Cost per Day Variable Expense (52) $.1095 per Mile × Average Miles per Day (59) 30 = (60) $3.2850 Per Day
Fixed Expense = (19) $1.9783 Per Day
Driver's Wages = (55) $8.6667 Per Day
Total Cost per Day = (61) $13.9300 Per Day

Cost per Unit Total Cost for Period (57) $4011.83 ÷ Total Units Hauled (D+E) 43,200 = (62) $.0929 per (Unit) Package
(Unit) Package Miles for Period (63) 432,000 = ½ Total Miles (F) × Average Load per Trip
Cost per Unit-Mile Cost per Unit (62) $.0929 ÷ ½ Round Trip Distance or (½ × F/B) = (64) $.0093 Per (Unit) Package Mile

Capacity	(57) Cost for Period	(A) Days Operated	(61) Cost per Day	(59) Miles per Day	(F) Miles Traveled	(58) Cost per Mile	(62) Cost per Package	(64) Cost per Package Mile	Miles per KWH
1 ton	$4011.83	288	$13.93	30	8640	$.4643	$.0929	$.0093	1.50

Form 10 NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE, INC., 5 S. WABASH AVE., CHICAGO

CHECK SOURCES OF DATA
☐ National Standard System
☐ Individual System
■ Owner's Records
■ Owner's Estimates
☐ Investigator's Estimates

No. 6 BEM 9.
Date 7-25-21 MLE

ANALYSIS OF TRUCK COST
According to National Standard Cost Practice of the Truck Owners Conference
H. P. GOULD, Chairman

Owner Abraham & Straus, Inc., Age of Truck at Start of Period 12 Years
Address 422 Fulton St., Brooklyn, N.Y. Period Covered 1 year to 6/28/21
Operation Hauling Candies and Drugs between laboratory and store
Truck Capacity 3½ ton Make Gen'l Vehicle Model Mfgrs No Truck No

Analysis of Operation	A	Number of Days Operated 288	C	Delivery or Pick-up Stops 5760		E	Total Units 1008 Tons	In
	B.	Number of Round Trips 288	D	Total Units 0	Out	F	Miles Traveled 8640	

3A Investments			3B Fixed Expense	Year Estimated		Mtc. and Repair—Actual as Guide to (35)
(1) Chassis, body, etc.	$3500	00	(11)* Interest, Item (10) yrs. @ 7%	$210	00	(20) $
(2) Storage Battery (if Electric)	$1800	00	(12) Taxes (Property)	$		(21) $
(3) Body	$		(13) License (State, City, etc.)	$40	00	(22) $
(4) Top	$		(14) Administrative Overhead	$		(23) $
(5) Painting	$		(15) Garage (Rent, Light, Heat, Power)	$180	00	(24) $
(6) Freight	$		(16) Insurance	$300	00	(25) $
(7) Special Equipment	$			$		(26) $
	$			$		(27) $
(8) Total	$5300	00	(17) Total Fixed Expense per Year	$730	00	(28) $
(9) Subtract Tire Value	$222	90	(17a) Total Prorated for Period	$730	00	(29) $
(2) Subtract Storage Battery Value	$1800	00	(18) Total Fixed Expense per Month (17 ÷ 12) (17a ÷ A)	$60	83	(30) $
(10) Total (Less Tires and Batteries) to be Depreciated	$3277	10	(19) Total Fixed Expense per Day	$2	54	(31) $ (32) Total For Period $
Present Book Value	$					(32a) $ Per Mile

Depreciation Total Cost (10) $3277.10 For Minimum Life of (33) 86,400 Miles = (34) $.0379 Per Mile
Maintenance and Repair Estimated for Period (35) $150.00 For (F) 8640 Miles = (36) $.0174 Per Mile
Repair Due to Accident (Not Covered by Insurance) (37) $ For (F) Miles = (38) $. Per Mile
Tire Cost (9) $222.90 For Life of (39) 10,000 Miles By Actual Experience / Estimated (Cancel One) = (40) $.0223 Per Mile
Charging Fuel Cost (41) 11,520 Gals (42) @ 3¢ per Gal = (43) $345.60 For (F) 8640 Miles = (44) $.0400 Per Mile
Cylinder Oil Cost (45) None Gals (46) @ ¢ per Gal = (47) $ For (F) Miles = (48) $. Per Mile
Battery Renewals and Maintenance (49) $385.00 For (F) 8640 Miles = (50) $.0446 Per Mile

Total Variable Expense For Period (51) $1401.41 (Excluding Driver's Wages) For (F) 8640 Miles = (52) $.1622 Per Mile
Total Fixed Expense For Period (17a) $730.35 For (F) 8640 Miles = (53) $.0845 Per Mile
Total Driver's Wages For Period (54) $2496.00 @ (55) $8.67 per Day For (F) 8640 Miles = (56) $.2889 Per Mile
Including helper

Total Cost For Period (57) $4627.76 For (F) 8640 Miles = (58) $.5356 Per Mile

Cost per Day Variable Expense (52) $.1622 per Mile × Average Miles per Day (59) 30 = (60) $4.8660 Per Day
Fixed Expense = (19) $2.5359 Per Day
Driver's Wages = (55) $8.6667 Per Day
Total Cost per Day = (61) $ 6.0686 Per Day

Cost per Unit Total Cost for Period (57) $4627.76 ÷ Total Units Hauled (D+E) 1008 = (62) $4.5910 per (Unit) Ton
(Unit) Ton Miles for Period (63) 15120 = ½ Total Miles (F) × Average Load per Trip
Cost per Unit-Mile Cost per Unit (62) $4.5910 ÷ ½ Round Trip Distance or (½ × F/B) = (64) $.3061 Per (Unit) Ton Mile

Capacity	(57) Cost for Period	(A) Days Operated	(61) Cost per Day	(59) Miles per Day	(F) Miles Traveled	(58) Cost per Mile	(62) Cost per Ton	(64) Cost per Ton Mile	Miles per KWH
3½-T	$4627.76	288	$16.07	30	8640	$.5356	$4.5910	$.3061	75

ACCURATE ANALYSIS OF ELECTRIC TRUCK OPERATING COSTS DEMONSTRATED VALUE TO LARGE BROOKLYN DEPARTMENT STORE

"The 3½-ton 'electric' is used for hauling merchandise, consisting mainly of drugs and candies, from our laboratory in New York City to our store in Brooklyn. It also picks up merchandise of this sort from various drug houses and similar concerns on its way to and from our store. Its average load is 3½ tons, and it makes one trip a day, averaging about 25 miles and twenty stops.

"We depreciate this truck also on a ten-year basis and allow $150 a year to cover repairs and maintenance. Of this amount about $25 is for battery maintenance. It has a driver and a helper, who are paid at the same rate as those on smaller cars. Figured on the National Standard Truck Cost System, this 3½-ton truck costs $16.07 per day, $4.59 per ton and 30.61 cents per ton-mile. These are very reasonable costs, which we know could not be equaled by gas trucks or horses.

"Besides being cheaper for the zones in which we use them, electric trucks are much more satisfactory from every point of view. They are easier to maintain and easier to control—it is much easier to teach a man how to drive an electric than a gas truck. Their limited speed is a big advantage because it saves wear and tear on the truck and tires and results in fewer accidents."

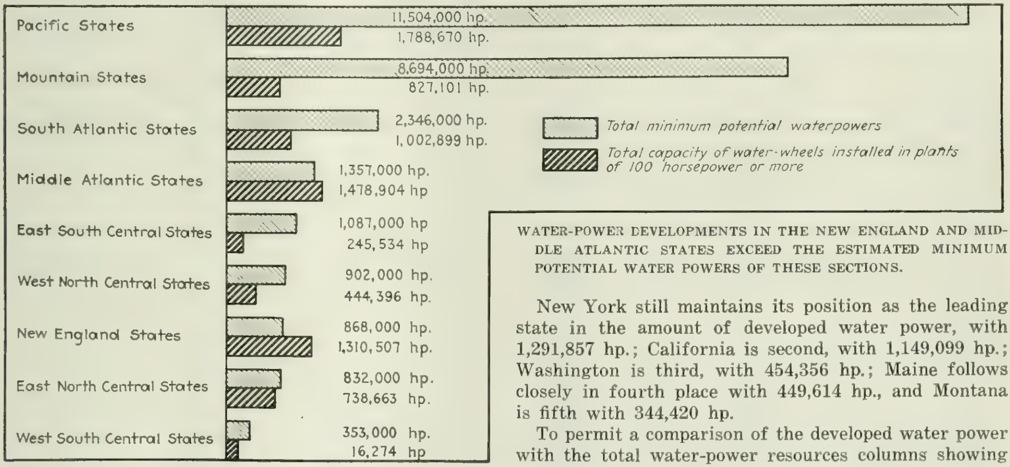
Substitutes for Platinum in Electrical Apparatus

SATISFACTORY substitutes have been found for platinum for various purposes, but in some chemical requirements and for use in high-duty electrical contacts no substitute has been found, the United States Bureau of Mines declares as the result of a study of this mineral just made. Some of the successful substitutes have been a combination of gold with one of the platinum metals. One known as palau (a combination of gold and palladium) resists the activity of most of the reagents; another, "rhotanium," is held to make a good substitute for electrical heating units. One of the most promising substitutes is the so-called "white gold," which is an alloy of gold and one of the platinum metals. This quite closely resembles platinum and is not attacked by nitric acid. A substitute successfully used in relay contacts when the voltage is low is made with nickel, chromium and tungsten, and this is used to some extent in dentistry. Another substitute for electrical purposes is a compound made with 70 per cent silver, 25 per cent palladium and 5 per cent cobalt. Many other alloys have also been patented as platinum substitutes.

Developed and Potential Water Powers of the United States

Government Compilation Indicates that Capacity of Waterwheels Installed in Plants of 100 Hp. or More Is 7,852,948 Hp. —Almost 80 per Cent in Public Utility Generating Plants

WATER-POWER development is progressing rapidly in the United States. The large number of applications on file with the Federal Power Commission for permits and licenses clearly indicates the large amount of thought which is being given to this type of motive power. The Muscle Shoals project now before Congress is only one of the large water-power possibilities of the country. An available market for energy generated and a return to a normal financial status will, without doubt, bring more of them into the limelight.



WATER-POWER DEVELOPMENTS IN THE NEW ENGLAND AND MIDDLE ATLANTIC STATES EXCEED THE ESTIMATED MINIMUM POTENTIAL WATER POWERS OF THESE SECTIONS.

The United States Geological Survey has just finished an investigation to determine the capacity of the waterwheels installed in plants rated at 100 hp. and over. The results are given in the accompanying table. These data were collected by the district engineers of the survey by correspondence or by personal visits to the plants. In 1908 the Bureau of the Census made a special census of the developed water powers of the country for the report of the National Conservation Commission. This census indicated that there were in the United States 31,537 water-power plants of all sizes, whose waterwheel capacity was 5,356,680 hp. The returns indicated that many very small plants were included in the survey as the reports showed only 602 plants with a capacity over 1,000 hp. The capacity of these 602 plants was 3,900,000 hp., leaving 1,457,000 hp. to be distributed among 30,935 plants with an average capacity of only 47 hp.

The survey just completed by the Geological Survey indicates that at the present time there are 3,116 water-power plants of 100 hp. or more, with a total installed waterwheel capacity of 7,852,948 hp. Of this total, 79 per cent is in public utility plants and 21 per cent in manufacturing plants. It is of interest to note that the census of 1908, which embraced plants of all sizes, included ten times as many plants as the present report, but it must be remembered that the present report embraces only plants of 100 hp. or more.

New York still maintains its position as the leading state in the amount of developed water power, with 1,291,857 hp.; California is second, with 1,149,099 hp.; Washington is third, with 454,356 hp.; Maine follows closely in fourth place with 449,614 hp., and Montana is fifth with 344,420 hp.

To permit a comparison of the developed water power with the total water-power resources columns showing the maximum and minimum potential water powers of the country are included in the accompanying table. These potential water-power figures are based on the estimates made by the United States Geological Survey in 1908 for the National Conservation Commission and revised by the Commissioner of Corporations for his report on water-power development in the United States in 1912 and by the United States Forest Service in the year 1916.

In comparing the figures of developed water power and potential water power for any state or group of states as given in this table, the basis for the data should be kept clearly in mind if gross and absurd errors are to be avoided. The potential water power of the United States was determined by dividing the rivers into sections of different lengths, the lengths depending on the slope of the channel, and the fall and flow of each section was determined from the best information available. With these factors the potential water power of each stream was determined on the assumption of an efficiency of 75 per cent in the waterwheels. The portions of the stream where the slope is so small that water power can probably never be profitably developed were not included.

The minimum potential water power is based on the average flow of the two seven-day periods of lowest flow in each year of record. This, of course, does not give the absolute minimum flow, but for all practical purposes potential water power based on this flow may be considered as continuous power. The maximum potential water power is based on the flow available for 50 per cent of the time. The use of storage was not considered in making the estimate of either minimum or maximum potential water power. The estimates of both minimum and maximum potential water power are considered conservative.

It is a general practice in the construction of water-power plants to install hydraulic machinery capable of utilizing stream flow far in excess of the absolute minimum and much in excess of the flow used in determining the minimum water power as given in the table. This practice is forcibly brought out by comparing the minimum potential water power with the total capacity of waterwheels installed in water-power plants in some of the New England States. If all the water powers of the United States were similarly developed, it would probably be necessary to install plants having three or four times the capacity of the estimated minimum potential water power as shown in the table. This condition should be fully considered when estimating the amount of potential water power that may still be available in any state at the present time.

Potential and Larger Developed Water Powers of the United States

State and Section	Potential Water Powers				Capacity of Waterwheels Installed in Plants of 100 Hp or More					
	Minimum		Maximum		Total		Public Utility and Municipal		Manufacturing and Miscellaneous	
	Horsepower	Per Cent of Total	Horsepower	Per Cent of Total	Number of Plants	Capacity in Horsepower	Number of Plants	Capacity in Horsepower	Number of Plants	Capacity in Horsepower
United States	27,943,000	100.00	53,905,000	100.00	3,116	7,852,948	1,322	6,200,245	1,794	1,652,703
SECTIONS:										
New England	868,000	3.11	1,605,000	2.98	1,234	1,310,507	246	583,130	988	727,377
Middle Atlantic	1,357,000	4.86	2,488,000	4.62	551	1,478,904	215	1,167,539	336	311,365
South Atlantic	2,346,000	8.39	4,257,000	7.90	260	1,002,899	127	799,632	133	203,267
East North Central	832,000	2.98	1,604,000	2.98	323	738,663	192	542,889	131	195,774
West North Central	902,000	3.23	1,956,000	3.63	179	444,396	112	360,625	67	83,771
East South Central	1,087,000	3.89	1,964,000	3.64	43	245,534	25	228,380	18	17,154
West South Central	353,000	1.26	822,000	1.52	26	16,274	12	12,515	14	3,759
Mountain	8,694,000	31.11	16,131,000	29.92	223	827,101	173	806,472	50	20,629
Pacific	11,504,000	41.17	23,078,000	42.81	277	1,788,670	220	1,699,063	57	89,607
NEW ENGLAND:										
Maine	443,000	1.59	809,000	1.50	256	449,614	71	156,549	185	293,065
New Hampshire	135,000	.48	246,000	.46	242	229,305	59	112,865	183	116,440
Vermont	94,000	.33	172,000	.32	206	129,566	59	72,651	147	56,915
Massachusetts	118,000	.43	228,000	.42	346	338,057	32	157,605	314	180,452
Rhode Island	6,000	.02	13,000	.02	60	30,136	5	3,510	55	26,626
Connecticut	72,000	.26	137,000	.26	124	133,829	20	79,950	104	53,879
MIDDLE ATLANTIC:										
New York	1,037,000	3.71	1,698,000	3.15	473	1,291,857	164	993,601	309	298,256
New Jersey	44,000	.16	106,000	.20	30	17,051	10	8,883	20	8,168
Pennsylvania	276,000	.99	684,000	1.27	48	169,996	41	165,055	7	4,941
SOUTH ATLANTIC:										
Delaware	5,000	.02	11,000	.02	9	3,133	0	0	9	3,133
Maryland and D. of C.	48,000	.17	133,000	.24	23	7,896	6	2,120	17	5,776
Virginia	492,000	1.76	870,000	1.61	71	103,693	35	76,551	36	27,142
West Virginia	381,000	1.36	1,051,000	1.95	11	14,675	6	8,410	5	6,265
North Carolina	578,000	2.07	875,000	1.62	70	255,843	30	126,070	40	129,773
South Carolina	460,000	1.64	677,000	1.25	21	330,012	16	321,250	5	8,762
Georgia	374,000	1.34	627,000	1.16	52	281,111	32	262,495	20	18,616
Florida	8,000	.03	13,000	.02	3	6,536	2	2,736	1	3,800
EAST NORTH CENTRAL:										
Ohio	59,000	.21	178,000	.33	25	28,663	17	24,236	8	4,427
Indiana	43,000	.16	118,000	.22	26	27,122	13	21,236	13	5,886
Illinois	192,000	.69	345,000	.64	41	85,002	15	73,591	26	11,411
Michigan	180,000	.64	293,000	.55	97	267,139	81	228,353	16	38,786
Wisconsin	358,000	1.28	670,000	1.24	134	330,737	66	195,473	68	135,264
WEST NORTH CENTRAL:										
Minnesota	232,000	.83	494,000	.92	56	205,180	35	145,247	21	59,933
Iowa	160,000	.57	382,000	.71	48	173,437	32	169,614	16	3,823
Missouri	72,000	.26	163,000	.30	7	17,970	5	17,670	2	300
North Dakota	88,000	.31	207,000	.38	1	245	0	0	1	245
South Dakota	43,000	.16	75,000	.14	8	18,227	5	6,050	3	12,177
Nebraska	196,000	.70	366,000	.68	39	14,726	25	12,036	14	2,690
Kansas	111,000	.40	269,000	.50	20	14,611	10	10,008	10	4,603
EAST SOUTH CENTRAL:										
Kentucky	83,000	.30	197,000	.37	5	855	1	115	4	740
Tennessee	463,000	1.66	761,000	1.41	22	126,891	15	125,865	7	1,026
Alabama	509,000	1.82	943,000	1.74	16	117,788	9	102,400	7	15,388
Mississippi	32,000	.11	63,000	.12	0	0	0	0	0	0
WEST SOUTH CENTRAL:										
Arkansas	22,000	.08	61,000	.11	2	1,189	1	720	1	469
Louisiana	1,000	.00	2,000	.00	0	0	0	0	0	0
Oklahoma	75,000	.27	208,000	.39	4	1,718	4	1,718	0	0
Texas	255,000	.91	551,000	1.02	20	13,367	7	10,077	13	3,290
MOUNTAIN:										
Montana	2,749,000	9.84	4,331,000	8.03	28	344,420	26	342,480	2	1,940
Idaho	2,362,000	8.45	5,067,000	9.40	45	224,368	41	222,471	4	1,897
Wyoming	773,000	2.76	1,305,000	2.42	9	7,560	9	7,560	0	0
Colorado	842,000	3.01	1,697,000	3.15	57	91,648	28	79,708	29	11,940
New Mexico	160,000	.57	439,000	.81	3	799	3	799	0	0
Arizona	893,000	3.20	1,698,000	3.15	8	38,760	8	38,760	0	0
Utah	743,000	2.66	1,318,000	2.45	64	106,096	51	101,844	13	4,252
Nevada	172,000	.62	276,000	.51	9	13,450	7	12,850	2	600
PACIFIC:										
Washington	4,932,000	17.65	8,647,000	16.04	69	454,356	62	443,139	7	11,217
Oregon	3,148,000	11.27	6,613,000	12.27	74	185,215	52	125,970	22	59,245
California	3,424,000	12.25	7,818,000	14.50	134	1,149,099	106	1,129,954	28	19,145

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Demand for Engineers with Commercial or Executive Ability

To the Editors of the ELECTRICAL WORLD:

Recently William L. Goodwin expressed what we have all recognized, namely, that we have an oversupply of men who can handle mathematical, design and other engineering problems, provided the problems are stated for them, and, further, provided the results are applied for them. At the same time there is a lack of men who should have engineering training but must have the ability to see the problems and take the commercial and executive action to put their engineering knowledge into practical use—in other words, to sell the engineering ideas.

From the few brilliant exceptions it becomes evident that in general something is lacking in the average run of engineering graduates which, if present, would very much enhance their value to the industry. We are inclined to say that something is wrong with engineering education. I think it would be truer to say that there is a need of further improvement in engineering education. Moreover, I believe it is up to the industries to indicate to the colleges which way to turn rather than blame the colleges for the quality of their product.

The men seem to be fairly well trained to do certain things, but they cannot be readily molded to do the things which are needed. They lack what we might call a business sense, an ability to see profitable solutions, to educate consumers regarding the value of engineering improvements, and to convince people that such value is there, in practice as well as in theory.

Changes in college training will undoubtedly help somewhat. That is not enough, however, and we need not only a different training but a different selection of men for the commercial engineering job. Let me suggest by analogy. When a college attains a reputation in some athletic sport—as, for example, football or rowing—it seems able to maintain its supremacy for a long period of time. I think there is a reason for this which goes deeper than any particular system of training. Is it not because those boys who have a facility for a particular sport incline to choose a college which excels in it, and does not this act as a selective force to provide better than average material on which to work?

While I believe in organized training, I do believe that the individuality of a man is a greater power than any influence of any special system of training. You cannot make a silk purse out of a sow's ear. Some men with relatively little training make greater runners, and others cannot excel as runners even though they are physically strong and receive the best sort of extended training. They, of course, can be improved, but not made into real leaders in the sport.

These extremes indicate what exists, in a smaller degree, in all men, and I believe that the parallel exists in men's vocational traits. I believe that at the time when men enter college some have qualifications which make it relatively easy to train them into laboratory or research engineers, others into general designing or operating engineers, still others into commercial sales management or consulting engineers or engineering executives. If these men could be correctly classified and trained in the direction indicated by their dominating talents, the question would be solved. Further, I believe if the problem was properly presented, the men would tend to classify themselves, either at entrance or during their college courses, with a surprising degree of accuracy.

Taking the situation as it is today, it seems to me that the reputation of the engineering professions and of the engineering colleges is drawing into the engineering courses just the kind of young men who make the class of engineers of which there is an oversupply, while other businesses and professions are inspiring and drawing into their folds the kind of men who would readily develop business or commercial sense. Of course, some men with business talents do stray into the engineering courses, but if they are the least bit weak in mathematical or some technical line, they are sifted out by the flunking process and thus switched back into another line of business.

To carry out the new idea (if it be new) we would still have courses for research and general engineering, perhaps verv much as they are now; but it would seem necessary to create new courses or options whereby those with business aptitude could avoid the extremes of specialized technics and receive instead training on commercial methods, ethics, law, etc. As soon as such options were available the industries co-operating with the colleges should, by means of publicity, divert into such courses a reasonable proportion of young men having commercial tendencies.

Of course, such a scheme would require a broad, comprehensive plan and organization, but I think it would be practicable to work in that direction and to make marked progress in a very short time. It seems evident that such a movement would not only insure better futures for all classes of engineers, but would also mean more efficient handling of the country's technical graduates.

G. H. STICKNEY,
Illuminating Engineering Assistant
to Sales Manager.
Edison Lamp Works,
Harrison, N. J.

Stokers with 645 Sq.Ft. of Grate Area for Paris Plant

To the Editors of the ELECTRICAL WORLD:

In your Jan. 21 issue, on page 129, there is a short article headed "Water-Cooled Generators in 200,000-Kw. Plant in Paris." In connection with this plant your readers may be interested to know that our French licensees are installing at this station Riley underfeed stokers which we feel quite sure are the largest in the world in grate area. Each boiler is equipped with two eighteen-retort extra-long stokers set back to back with a grate surface of 645 sq.ft.

Detailed information on this installation will be available shortly.

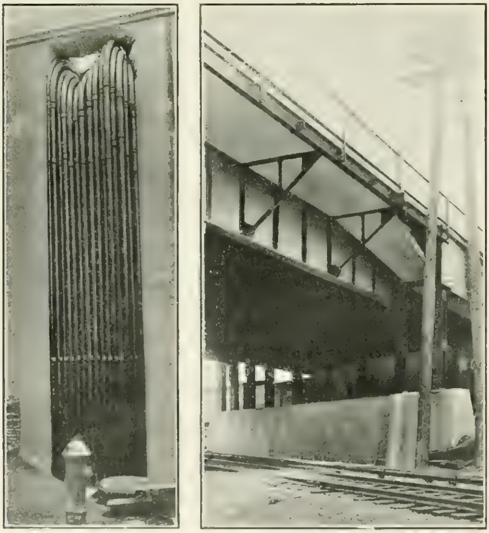
O. C. SHELDON.
Sanford Riley Stoker Company,
Worcester, Mass.

Industrial and Station Practice

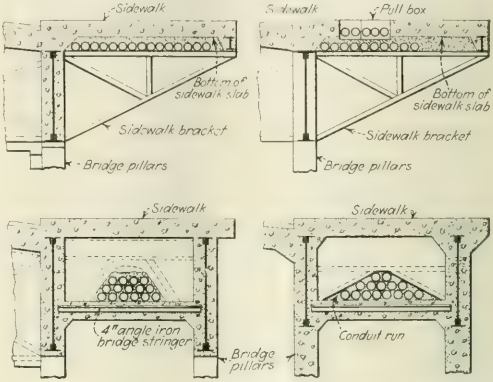
Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Circuits Over Railroad Run in Conduit Under Bridge Sidewalk

IN UNDERGROUND conduit installations it is sometimes necessary to resort to special or unusual forms of construction to overcome obstacles in the route of the subway. Such a condition was encountered by the New York & Queens Electric Light & Power Company in the construction of a heavy duct line in Long Island City, where it was necessary to cross the Sunnyside yards of the Pennsylvania Railroad. These yards extend for a distance of about 2½ miles and are crossed by five viaducts. The viaducts are either all-steel or a combination of steel sections and earth-fill sections. The route of the subway crosses one of the all-steel viaducts approximately ¼ mile long, and at this location the subway consists of fifteen 4-in. ducts. In the underground section of the subway fiber duct is used. The subway meets the viaduct approach, which is filled in between retaining walls, through a street running at an angle of about 45 deg. to the viaduct and at a level approximately 30 ft. below the level of the viaduct. The fiber conduits were terminated in a manhole in the lower street close to the viaduct retaining wall, and iron conduits were carried out of the roof of the manhole, up the face of the retaining wall and through the upper part of the wall into a manhole constructed at the viaduct level. The conduits were strapped to the wall and incased in concrete. The photograph on the left shows these conduits before strapping and concreting.



OVERHEAD CONDUIT CONSTRUCTION TO CROSS RAILROAD YARDS



SUBSTRUCTURE OF BRIDGE USED TO SUPPORT CONDUIT

Upper sketches are the usual construction under sidewalks, while the lower show arrangements in special cases to clear obstructions.

Across the steel structure for a distance of 830 ft., fifteen 4-in. iron conduits are carried in a space under the sidewalk and resting on one of the steel members in the sidewalk bracket. Steam trains are operated under the viaduct, and to prevent corrosion the conduits were incased in concrete. A light-mesh reinforcement was wrapped around the conduits, bottom and side forms were placed, and the concrete was poured through holes cut in the sidewalk above. The completed construction is shown in the right-hand photograph.

In order to pull and splice the cables, three splicing boxes were constructed near the middle of the span. These boxes were constructed of sheet steel and angles and are 3 ft. 5 in. square and 12 in. deep. They have checkered steel-plate covers. Five cables pass through each box, the boxes being staggered. Removable partitions of 1-in. asbestos board are provided to separate the cable splices.

W. C. Blackwood,
Electrical Engineer.
New York & Queens Electric Light & Power Company,
New York, N. Y.

Locating Proper Brush Position with a Voltmeter

SETTING brushes by means of the "fiber" brush described by Philip G. Bernholz in the issue of Nov. 5, 1921, is satisfactory in its results, but cumbersome, as it requires a differently sized, carefully dimensioned brush for each machine. The same readings and conclusions may be obtained and deduced by the use of two "points" applied to the commutator while running.

These points should be made of two pieces of No. 10 brass wire about 6 in. long, insulated their whole length, with tape or varnished cloth tubing to within ½ in. of the ends, which are pointed for application to commutator. These two rods are then soldered to voltmeter leads and the joints are carefully taped. They may also be taped together with ends even or held together with the hand, just as two pencils could be held together, when applying them to the commutator. No. 14 duplex copper wire may be used, but brass is better.

By moving these points to right or left on the surface of the commutator with the machine running at normal speed with full voltage applied, a series of readings may be obtained on an ordinary voltmeter which will give very complete data on the voltage conditions under and about the brush at any load, speed or field conditions.

Unless the machine is of the reversible type, it is well to adjust brushes so that the full-load neutral point—that is, the point where voltmeter reads zero on the commutator—is under the leading edge of the brush of a generator or motor, so that the brushes will carry no short-circuiting current when the segments pass from under them. In any case brushes should be adjusted so that the neutral point is always under some part of the brush at all conditions of load.

If neutral moves "back" against rotation of a motor or "ahead" with rotation of a generator, nothing can be done to strengthen interpoles except to wind on more wire. If the neutral moves the opposite way, however —that is, with rotation of a motor and against rotation of a generator—the interpoles should be weakened by adjusting a German-silver shunt across the terminals of the interpole circuit and the current adjusted so the neutral will stay in the same position at all loads, directly under the center or front half of the brush.

This "shunting" operation is sometimes necessary on regular commercial machines, as the manufacturers' testing forces are not infallible. Edward A. Gibbs.

Boston, Mass.

Precautions Must Be Taken When Using Fire Extinguishers

THE liquid used in most fire extinguishers for fighting electrical fires is carbon tetrachloride. This liquid, when heated by contact with fire or otherwise, gives off certain chemical fumes or gases which blanket the fire and extinguish it by shutting off the air.

The fumes or gases from carbon tetrachloride cannot be breathed if present in any large quantity. Free chloride forms a corrosive acid in nose, mouth, throat and lungs, producing a choking sensation. Hydrogen chloride and phosgene may be present—the latter a deadly poison if the supply of air is deficient. If the ventilation is fairly good, the phosgene is absorbed by the air and becomes harmless. The fumes, or the carbon tetrachloride itself before it is used on a fire, also have an anæsthetic effect similar to chloroform and may produce unconsciousness.

It is necessary to exercise great caution in the use of carbon tetrachloride in extinguishing fires in confined or poorly ventilated places, such as basements, closets, wire tunnels at points under a roof or close to the ceiling, and in any other place where smoke and fumes may become pocketed. The smallest possible quantity of the liquid should be used. Employees should be cautioned not to remain in the vicinity of such confined locations longer than is necessary, but should get out into fresh air as soon as possible. Where there are confined spaces in which fires are likely to occur a properly made gas mask will afford protection.

In case a person is overcome by carbon-tetrachloride fumes he should be removed to fresh air immediately, and if breathing is faint or suspended, the prone-pressure method of resuscitation should be applied.

Men whose duties require that they work in the small substations and in confined spaces in the larger steam plants, such as the basement, should exercise special caution in the use of carbon tetrachloride and should ventilate or change the air after its use.

Consumers' Power Company, H. J. Burton.
Jackson, Mich.

Aerial Span of 2,300 Ft. in Satisfactory Service for Nine Years

ALTHOUGH bridging a distance of 2,300 ft., an unusually good record for freedom from trouble is held by a transmission span on the lines of the San Joaquin (Cal.) Light & Power Corporation. During nine years of service only one transmission cable has failed and recently one telephone wire came down.

A span of this length is necessary where two circuits cross the Kings River among the foothills just below Piedra. One of these circuits is for 66,000 volts and runs 145 miles along the eastern edge of the San Joaquin Valley from the Fresno Copper Mine to Bakersfield. The other is an 11,000-volt line that joins the 66,000-volt line at the Kings River crossing. These two circuits each consist of three No. 4/0 aluminum stranded cables. For the span, which is the longest in the entire system of the company, each circuit is run to separate poles. The three wires in each case are spaced 10 ft. apart vertically on 50-ft. poles at each end. A guy for each wire takes the strain of the span and the poles are also guyed at right angles to take care of the wind load due to winds blowing up and down the canyon. One telephone wire is run beneath the power wires on each pole. No calculations as to stresses were made at the time of erection as points of support were so high above the canyon floor. Calculations were recently made showing a sag of 450 ft. This indicates a low stress in the wires and helps to explain the satisfactory operation.

A 2,300-FT. SPAN IS SUPPORTED BY EACH OF THE POLES ON THE LEFT

San Joaquin Light & Power Co., L. J. Moore,
Fresno, Cal. Electrical Engineer.

Outdoor Meter Installations Facilitated by Standardizing Construction

By STANDARDIZING the construction and mounting of outdoor meter cabinets and equipping them in advance of installation, the Ohio Power Company, Newark, Ohio, has been able to complete installations 30 miles from headquarters within one day after the order has been received. One standard design of cabinet will accommodate any metering outfit required for loads ranging from 50 kva., 220 volts, to 1,200 kva., 4,000 volts. The equipment is of the pole type, consisting of a transformer cabinet, a meter cabinet and conduit connecting the two. The entire construction is flexible in arrangement and is easily installed and maintained.

The cabinet used for the current and potential transformers is identical with the one for the meters. The detail of placing the meters and the testing facilities are shown in Fig. 1 on the left. The size of the cabinet allows the use of a kilowatt-hour meter, a reactive volt-ampere-hour meter and a demand meter. There is also sufficient space to install a graphic voltmeter or ammeter for special testing of complaints.

The instrument-transformer cabinet for a three-phase, four-wire, 4,000-volt installation using three current transformers and two potential transformers is shown in the center of the same illustration. To use this cabinet on three-phase, three-wire, 4,000-volt, or three-phase, three-wire, 2,200-volt circuits, the middle current transformer can be omitted and the type of potential transformers changed. If the initial installation was for a three-phase, three-wire, 2,200-volt circuit and it is necessary to change to three-phase, four-wire, 4,000-volt, one current transformer is added and the meter changed, which may be done at very small expense of material and labor.

In the case of a customer requiring a three-phase, three-wire, 220-volt installation the current transformers and meters are placed in a single cabinet as shown on the right of Fig. 1. The lines feeding this equipment may either come down the pole in conduit or run on insulators supported on the cross-arms with steel pins. The conduit method is much preferred and has been adopted by this company.

For the connections between the instrument transformer cabinet and the meter cabinet a standard 10-ft. length of galvanized conduit is used containing a multicolored six-conductor, 600-volt cable. The three conductors to the current transformer are red, green and blue respectively with a common current return of black. Potential connections are red and white for one transformer and blue and white for the other, with a common return of black.

The wiring in the cabinets is all done in the meter department work shop under ideal conditions by the construction man. This wiring is checked before it leaves the work shop by the meter superintendent or his assistant. Even the cable is checked for colors. Before leaving the shop the conduit is cut and bent to size and

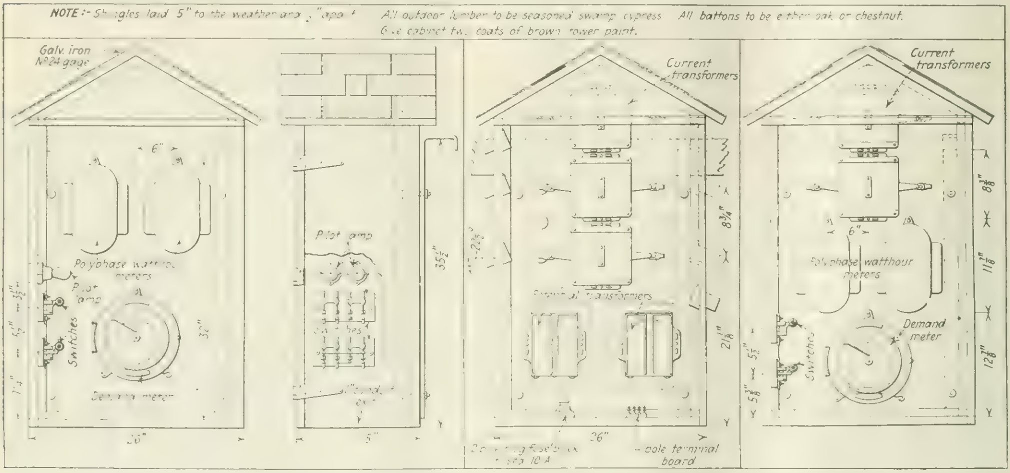

NOTE:- Shingles laid 5" to the weather and " apart
All outdoor lumber to be seasoned swamp cypress
All battons to be either oak or chestnut.
Give cabinet two coats of brown tower paint.
Galv. iron
Nº 24 gage
6"
Polyphase watthour meters
Pilot lamp
Switches
Demand meter
32"
5½"
5½"
1½"
26"
Pilot lamp
Switches
35½"
5"
Current transformers
Potential transformers
8¾"
22½"
21⅛"
26"
pole terminal board
Current transformers
Polyphase watthour meters
Demand meter
Switches
8⅜"
11⅞"
12⅞"
6"
5½"
5⅜"

FIG. 1—OUTDOOR METERING EQUIPMENT THAT IS FLEXIBLE, EASILY INSTALLED AND MAINTAINED

Left—Details of meter cabinet and testing facilities. Middle—Instrument-transformer cabinet. Right—220-volt installation, using one cabinet for both meters and transformers

MATERIALS REQUIRED FOR 4,000-2,300-VOLT OUTDOOR METER INSTALLATION

This table accompanies the line foreman's working chart shown in Fig. 2.

Key No.	Number Required	Materials
1	7	Standard six-pin cross-arms comp. "fir"
2	13	¼-in. x 1¼-in. x 28-in. cross-arm braces
3	6	⅝-in. galvanized machine bolts, length as required
4	8	⅝-in. galvanized D. A. bolts, length as required
5	13	⅜-in. x 5-in. carriage bolts
6	7	½-in. x 4-in. galvanized lag bolts
7	12	2¼-in. galvanized square washers
8	12	½-in. galvanized round washers
9	14	No. 8075 Hubbard & Co. pin or its equivalent
10	14	O. B. 9404 Brown insulator or its equivalent
11	7	O. B. 12464 disk insulator or its equivalent
12	14	O. B. 506 strain insulators for choke coils
13	6	G. E. No. 79219 comp. chamber lightning arrester
14	1	G. E. No. 146187 lightning arrester
15	3	G. E. No. 106918 expulsion cut-out
16	2	Galvanized ground pipe 1¼-in. x 10-in.
17		Wood molding, length as required
18	5	Galvanized iron pole steps, ⅝-in. x 9-in., hook-head
19	7	L. M. Co. 1741-G galvanized bolt clevis or its equivalent
20	7	O. B. 11546 suspension hook or its equivalent
21	7	O. B. 11545 ball-socket clevis or its equivalent
22	7	½-in. galvanized thimble
23	½ lb.	Eightpenny nails
24	.	¾-in. galvanized pipe straps as required
25	2	L. M. Co. No. 1765-G ground pipe points
26	..	No. 2 W. P. wire, lightning arrester and ground as required
27	215 ft	Wire for choke coils, same size as line
28	..	Wire for verticals as required, same size as line

shape and assembled and the cable is also pulled into the conduit. Only three pieces are required on the field job to make a meter installation, namely, a transformer cabinet, a meter cabinet and a length of conduit, standard drawings like that shown in Fig. 2 being followed.

Assembly of the equipment is handled in the following manner: A complete requisition is prepared by the superintendent of distribution. The portion referring to meters and specifying the kilovolt-amperes and voltage, phases of the circuit and the wire that is to be used is turned over to the meter superintendent, who also receives a memorandum from the power salesman, who specifies the rate at which the customer is to be charged and also confirms the kilovolt-amperes, number of phases, wire and voltage.

The bill of material is made out in the accompanying form by the meter superintendent, who then sends the proper wiring diagram, ratios of current and potential transformers and constants of meters to the construction man.

A copy of the bill of material also is sent to the storekeeper and shop foreman in order that there shall be no delays in obtaining the necessary material. Charges for all material used are sent to the meter superintendent, with the authorizations, after the execution of the requisition order. The latter is filed alphabetically or according to the requisition number.

The line foreman, working from prints similar to Fig. 2, notifies the meter department the day on which the pole will be set and ready for mounting of equipment. The meter department wires the equipment in one day and loads it on a truck, ready to start on the job the next morning. It is thus able to complete an installation 30 miles from headquarters in one day, which is only possible because of standardization of equipment and prearranged working plans.

For a 440-volt installation the same equipment is used as for 4,000-volt and 2,200-volt circuits. It has been found that a 110-volt meter and current and potential transformers give less trouble than a 440-volt self-contained meter. For installations of higher voltage, such as 11,000, 22,000, 33,000 and 66,000, where outdoor equipment is necessary, the apparatus is purchased from manufacturing companies instead of being made locally.

Ohio Power Company,
Newark, Ohio.

M. F. Smalley,
Meter Superintendent.

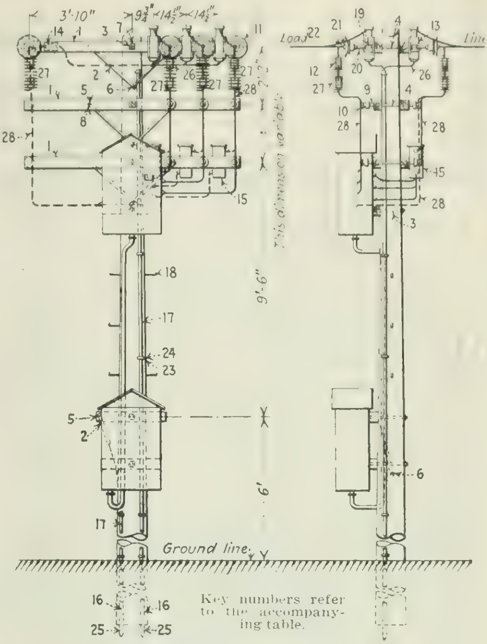


FIG. 2—LINE FOREMAN'S WORKING CHART

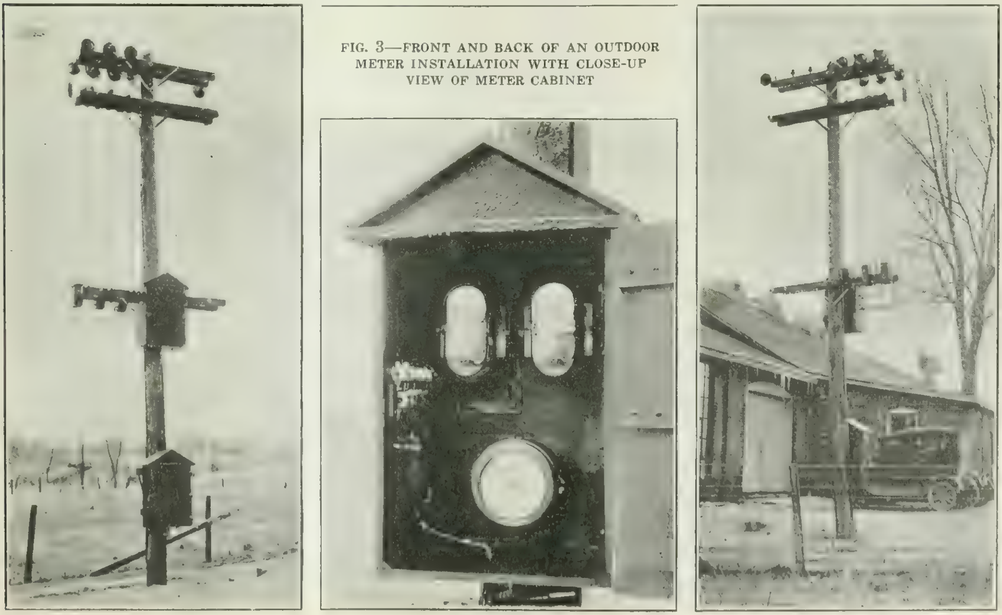


FIG. 3—FRONT AND BACK OF AN OUTDOOR METER INSTALLATION WITH CLOSE-UP VIEW OF METER CABINET

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Electric Trucks Most Desirable for Ice-Cream Deliveries

From a Paper Read Before the Illinois Association of Ice Cream Manufacturers by L. T. Carpenter, Transportation Engineer, Commonwealth Edison Company

WITHIN the last three years the number of ice-cream manufacturers in Chicago using electric trucks for their deliveries has grown from four to fourteen. The number of trucks in use has increased from one in 1916 to 106 at the present time. One firm has a fleet of thirty-five trucks, another a fleet of eighteen. One has fourteen, one has ten, one has eight, two have seven, two have four, two have three, two have two and one has one.

The daily performance of many of these trucks is surprising even to those most familiar with the wide range of usefulness of the electric vehicle. The conditions in the ice-cream industry are admirable for the electric truck because of the large energy demand of the ice-cream plant, beside which the cost of energy for the trucks is a small item. The demand for ice cream varies from 400 gal. per day per truck during hot spells to between 100 gal. and 180 gal. per day during the winter. Each truck covers a definite route, and while the ice-cream consumption per customer varies with the months, the mileage traveled daily per truck remains much the same the year round.

The longest route in Chicago is 50 miles; many of them are 45 miles, while the shortest is 10 miles. The average mileage per truck per day ranges from 16 to 30. The average number of customers supplied per truck per day is about thirty-five, the number varying from thirty up to fifty, with the majority around forty-five. At least one manufacturer maintains what is known as a relay system by which diminishing supplies on any truck are replenished without taking that truck off its route. This is done by sending out another larger truck with additional supplies.

Delivery Costs Halved

The owner of fourteen electric trucks has replaced forty-eight horses and three gas trucks, now using nothing but "electrics." In so doing the delivery cost has been cut in half. Two men do the entire work in connection with the upkeep of this fleet. It has been found that two men can overhaul three electric trucks in the time required to overhaul one 3½-ton gas truck. The former does not require an overhaul oftener than every two years, while the gas truck needs complete overhauling much oftener.

An instance was cited of a department store using twenty electric and fifty gas trucks. While one man takes care of all the work in connection with the electric vehicles, such as charging, minor repairs, flushing and so forth, fourteen men are kept busy keeping the fifty gas trucks on the job. This emphasizes the low upkeep cost and reliability of the electric truck.

Delivering ice cream is the most severe service to which a truck can be subjected outside of road building, because of the severe overloads that occur and the corrosion to which the truck is subjected by the water and salt. Yet some of the electric trucks in this business in Chicago are eight years old, and one is fifteen years old and good for many more years. Corrosion is not a serious matter with the electric truck because the parts are few and can be easily protected. It is estimated that electric trucks in this industry should have a life of from twelve to fifteen years, during which time they will pay for themselves from three to six times out of the savings over other methods of delivery.

The fact that 75 per cent of Chicago's ice-cream manufacturers have already adopted the electric truck and that most of them have already discarded or soon will discard other types of conveyance tells the story that the electric truck is the vehicle for this sort of work in the cities.

Preparing Employees to Meet Unfair Criticism of Their Company

TO ENABLE employees of the Edison Electric Illuminating Company of Boston to meet the public confidently and to face unfair criticism without hesitation during the progress of a rate case before the State Department of Public Utilities, L. R. Wallis, superintendent of the sales department, has addressed the following letter to them, emphasizing the return of the company to pre-war rates and contrasting the price of its service with that of other local utilities:

To Fellow Employees:

In presenting to your friends the advantage of electric service as supplied by our company, and in view of some of the unfair statements that have been made regarding increases that were made a part of the cost of service to the public during and following the war period, we should all keep in mind that 90 per cent of the users of Edison service are purchasing their electric requirements at the pre-war price of 10 cents per kilowatt-hour.

Compare this with the following prices:

	Present Price	Pre-War Price	Per Cent Increase
Boston *American*	3 cents	1 cent	200
Gas—Boston	$1.35	80 cents	68.5
Elevated railway	10 cents	5 cents	100
Railroad fares, per mile	3 cents	2 cents	50
Domestic coal, per ton	$15.25	$6.25	144

As our rate case is being tried before the Department of Public Utilities, we have not considered it either good judgment or good taste to enter into a newspaper controversy at this time.

Argument is not productive of sales, but a simple statement and appreciation of essential fact should help you to meet your friends with head up and confident knowledge that "our company" leads the procession in the "return to normalcy."

Boom your business and your interest in your business must boom. Very truly yours,

L. R. Wallis,
Superintendent Sales Department.

Central Stations Should Be Pacemakers in Electrical Merchandising

BY F. M. HOUSTON

Sales Engineer Elmira (N. Y.) Water, Light & Railroad Company

ANY central-station company which now discontinues the sale of appliances and leaves it entirely to others is, I believe, making a mistake which it will pay for in the next few years. The central station should be the one to set the pace and show the contractor-dealers and other merchants the way. While contractor-dealers are often good merchandisers, unless there is some stimulus in the way of friendly competition by the central-station company many are prone to say, "It can't be done." To illustrate, during 1920, although a good buying year, this company did little toward the selling of appliances other than having a few on display. As a result every dealer in town slackened up in his sales efforts. In 1921 we put on a large selling force and went after the selling of appliances in every sense of the word, and every dealer in town did likewise. The result is that at a meeting of the dealers every one reported an increase in the sales over the year before of from 30 per cent to 70 per cent.

We have an agreement here that there shall be no price cutting of any kind, and it is faithfully lived up to by every one. A number of years ago this company was in the housewiring business and gradually dropped out of it. Today the contractors have unanimously requested us to get back in the game again.

I have seen in three different places the experiment tried of the central-station company discontinuing the sale of appliances or having nothing to do with it, not only in the gas but also in the electric end, and in every one of these three places the sales are about one-third of what they should be.

A House-Warming Party for a New Turbine

THIS picture shows a few of the 4,000 people who visited the power plant of the Southwestern Gas & Electric Company, Shreveport, La., between 5 o'clock in the afternoon and 10:30 p.m. on Feb. 22. The occasion of this house-warming party was the initial putting into service of a new 3,500-kw. turbine. On Feb. 21 the company presented the motion picture film "Back of the Button" and through the daily papers invited the public to visit the plant the next day to see what actually is back of the company's service. Light refreshments were served and there was music and dancing. That the party was a success is attested by the picture and the attendance of 4,000 visitors.

The installation of new equipment in the central station is always a matter of real interest and concern to the public, and the Southwestern Gas & Electric Company has succeeded admirably in arousing this interest. The mere statement that a central-station company has installed a new turbine means nothing to the man on the street, but if he can stand before it and see it work he will appreciate that it is a product of marvelous ingenuity and power.

What Other Companies Are Doing

Oregon.—New business gained by the district offices of the Pacific Power & Light Company during January shows a net increase in new customers of thirty-seven. A total of 155 electric appliances were sold, of which the principal were thirty-two flatirons, sixteen percolators, eleven vacuum cleaners, four electric ranges, three water heaters and nine washing machines. The remainder were made up of miscellaneous appliances.

Provo, Utah.—A model "electrical home" was recently completed here, and was open to the public from March 1 to 5 inclusive. On Thursday, March 2, members of the Rocky Mountain Electrical Co-operative League and the Electrical Contractor-Dealers' Association of Salt Lake visited the home. A feature of the program was a luncheon given in their honor.

Providence, R. I. — During 1921 the Narragansett Electric Lighting Company in its house wiring campaign wired 2,097 old houses and paid electrical contractors nearly $350,000 for this work. The company secured in that time 7,200 new consumers, most of which were lighting customers. New services installed by the company averaged about fourteen for each working day of the year.

HOUSE-WARMING PARTY IN THE SOUTHWESTERN GAS & ELECTRIC COMPANY'S POWER PLANT

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Developing the Foreign Market for Electrical Specialties

By R. C. Lanphier
Vice-president and General Manager Sangamo Electric Company, Springfield, Ill.

THE problem of developing and holding a good export business in an electrical specialty for a manufacturer not having the extensive sales organization of the two or three very large manufacturers in the United States is an interesting one and has been approached in different ways by a number of American manufacturers. Many years ago, in 1902 and 1903, we realized the importance of foreign trade in electric meters, although the demand was then exceedingly small compared with what it has since become. At that time our efforts were entirely through agents in England, Japan, France and Australia, and we did not attempt to familiarize ourselves with the agents or with conditions in any of these countries as we would have done had not patent litigation at that time prevented our continuing this development.

R. C. LANPHIER

No effort was made to resume foreign sales to any great extent until 1913, when we began selling on scattered orders from dealers in several countries, including France, Cuba and Japan. When speaking of foreign countries we exclude Canada, which we consider in a large measure as domestic trade.

Investigation of Foreign Markets

During 1914 and 1915 we sent experienced men on long trips of careful investigation to South America and Europe and thus obtained a first-hand knowledge of the demand for electrical meters in the various countries visited, the best agents available, and the peculiar requirements of every country, that cannot possibly be obtained through any government or trade association reports, no matter how good. We do not mean by this that the government reports and those obtained through different trade associations are not useful, for they certainly are, but in a specialty like electric meters a manufacturer cannot reasonably expect to get complete information, enabling him to develop foreign trade, as he could for general lines such as lamps, motors and electrical supplies. From the beginning we made it a rule in every country to give exclusive representation to a first-class local concern, which we first thoroughly investigated as to business reputation, financial responsibility and technical knowledge of meters. We feel that our policy in this respect was good, as is attested by the fact that we have made only one change in foreign agents in the last five years.

From the beginning we adopted a policy of modifying details of our meters as far as possible to meet the peculiar requirements in many countries, especially in those having government regulations on meters, as is true of the majority of foreign countries. We also made a particular effort to satisfy our customers on details of packing, methods of handling shipping documents, drafts, and in general all details which affected the facility and convenience with which our agent in each country could do business both for himself and his customers.

Consigned Stocks Essential

After the first two or three years of these efforts we found it desirable to carry a consigned stock at many foreign points in order to make prompt deliveries. This is one of the most essential things in developing foreign business in an electrical specialty, and we have since carried adequate stocks in a number of foreign cities.

During the early part of the war we made sales arrangements in Japan with a well-known Japanese company whose president spent some time with us, and following this we sent one of our officials to Japan for a thorough investigation of the possibilities there and then to visit all the principal countries of the Orient. At the same time we sent other officials to Europe, with the result that we established branch factories with our Japanese representative at Osaka and later with our English representatives near London. At each of these branches we have endeavored to make our product conform in all respects to local requirements and conditions, and except for the men in charge sent from our factory, employ local labor throughout. During the past year adverse exchange has made it difficult to maintain satisfactory business in European countries, but with improving exchange and with the development of types of meters especially to meet foreign competition we anticipate a decided improvement before long.

Summing up, we feel that any manufacturer of detail electrical apparatus, particularly that of a technical nature, should carefully investigate, by means of representatives thoroughly familiar with his line, the possibilities in each foreign country where he desires to do business, or, if this is not possible, the best alternative is to join with one or more other manufacturers of electrical lines which work in sufficiently well with his own to permit of sending a joint representative to investigate conditions and form agency arrangements in the various countries visited. The Orient and South America at this time present the greatest possibilities for many electrical manufacturers and can be developed for many American electrical devices that are now being sold only in limited quantities, if at all.

The Cost of Doing Business at Retail

ONE of the most universal problems which confront the electrical industry today is caused by the lack of information on the cost of selling, the cost of doing business at retail. It affects not only the retail dealer, but the manufacturer and jobber as well, for prices and discounts must be adjusted to allow a margin sufficient to cover selling cost and show a net profit. Data showing the operating expenses or selling costs for department stores and other retail businesses are therefore particularly useful for comparative purposes.

In a recent report by the Harvard Bureau of Business Research figures showing the highest, lowest and common, or average, operating expenses in retail hardware stores are given in the accompanying table, in which total expense represents the cost of doing business. It includes all items of wages, payments for items such as postage, heat, light and taxes and insurance and also the salary of the proprietor, rent whether the store is owned or leased, and interest on borrowed capital and on the proprietor's net investment.

In a survey made by J. M. Barnes of Marshall Field & Company further information and data have been developed indicating what may be considered a fair cost of doing business at retail in towns and cities of different sizes, with some indication as to how this cost increases with the population. He says:

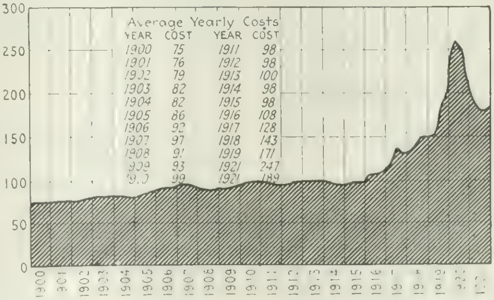
> If we consider towns having a population of less than 2,500, we will find that the cost of doing business usually runs from 15 to 20 per cent of sales. An average of about 18 per cent would appear to be normal for such towns. When we consider larger towns, having a population of from 2,500 to 10,000, we find that the cost of doing business usually runs from 18 to 23 per cent of sales. A fair average would be about 21 per cent. In cities having a population of from 10,000 to 50,000 we are apt to find that the cost of doing business has again increased and that it amounts to from 20 to 25 per cent of sales. An average would probably be about 23 per cent. In cities having a population in excess of 50,000, the cost of doing business has a further tendency to increase. Here it usually runs from 23 to 28 per cent. About 25 per cent of sales would be an average.
>
> There are some unusual exceptions to the above figures. There are some merchants in small towns who do business at a cost of not more than 10 per cent of sales. There are other merchants in cities who do business at an even greater expense than 28 per cent. Such cases are abnormal. What we desire to know for purpose of comparison is the average expense of the successful merchant and not the unusual expense of the exceptional merchant. Having these figures in mind, every merchant should carefully scrutinize each item of his expense account. If he finds that his expenses do not exceed the above average, he may feel assured that he is on a competitive basis. But if he finds that his expenses are much in excess of the average mentioned above, he may feel certain that he is operating at a disadvantage and possibly at a loss.

While conditions in the electrical industry do not exactly parallel those in either the department or hardware stores, electrical dealers, jobbers and manufacturers may well compare their figures to see how close the costs run to those of other successful merchants.

OPERATING EXPENSE IN RETAIL HARDWARE STORES IN 1919
(Net Sales 100 per cent)

	Percentage		
	Lowest	Highest	Common
Wages of sales force	2.57	15.8	6.2
Other selling expense	0.03	4.12	0.7
Total selling expense	3.02	15.8	7.0
Delivery expense	......	3.22	0.7
Buying, management and office salaries	0.66	9.64	4.0
Office, supplies, postage and other management expenses	0.08	1.87	0.3
Total buying and management expense	1.15	10.6	4.4
Rent	0.38	6.09	1.7
Heat, light and power	0.06	1.35	0.4
Taxes (except on building, income and profits)	0.04	1.14	0.5
Insurance (except on building)	0.08	1.02	0.4
Repairs of store equipment	0.01	1.11	0.1
Depreciation of store equipment	0.02	1.6	0.3
Total interest	0.95	8.95	3.3
Total fixed charges and upkeep expense	3.07	12.68	7.0
Miscellaneous expenses	0.01	3.86	.9
Losses from bad debts	....	6.8	0.5
Total expense	11.42	36.3	21.0

Building Costs Decrease



EVERY new building that is started means more business for the manufacturer, the jobber and the dealer and nothing will quicken building like decreasing costs. This chart pictures the marked decline in prices of construction material. It is worthy of a bit of thought.

Making Imitation Jobbers Out of Screwdriver Electricians

ANOTHER sidelight on how easy it has been made by some manufacturers for mushroom jobbers to spring up in the electrical trade is seen in this letter from a branch office manager to the general sales manager of one of the largest electrical manufacturers. The names and location have been deleted, but the letter points only too clearly to a condition which is menacing the distribution of electrical supplies. The letter reads:

> General Sales Manager:
>
> The establishment of new jobbing concerns in the surrounding territory still continues, and every large community will soon have at least one and in some cases three jobbers to look after local service. Many of these concerns appear to be able to start in with very little capital, and in most cases they have affiliated with standard lines. One of the worst cases is that of ——— in ———, who has been placed on the distributers' list by the ——— Manufacturing Company and several other manufacturers. The interesting part is that ——— is a village of 2,500 people and has no special advantages as a distributing center—in fact, quite the contrary, as some of the regular trains on the only railroad passing through do not even stop.
>
> I understand that the ——— Lamp Company is also considering putting him on a jobber basis, although he has had an agent's contract for the past two years and never exceeded $1,200 per year. Don't you think that there should be some restriction as to the appointment of jobbers who have never done anything to show that they can get business?
>
> District Manager.

This is, unfortunately, not an exceptional case but is only one of many which could be cited. It represents a situation which is not only uneconomical but will ultimately, if the practice is not stopped, undermine and create chaos throughout the whole system of distributing electrical supplies.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Single-Phase and Three-Phase Alternating-Current Commutator Motors with Series and Shunt Characteristics.—STANLEY PARKER SMITH.—The author deals with the electrical and mechanical characteristics of the motors of this type. These machines possess certain practical difficulties from both the designer's and the manufacturer's point of view. Though they were invented some years ago, their commercial development has been slow, but recent demands for alternating-current motors have led to their possibilities being further considered.—*Electrician* (*London*), Jan. 13, 1922.

The Problem of the Most Economic Transformer.—J. HAK.—A purely theoretical paper in which a general equation for the efficiency of a transformer is developed. By its aid the most favorable dimensions for a given transformer and the losses in iron and copper can be determined. The difference is shown between the least expensive and the most economical design.—*Elektrotechnische Zeitschrift,* Jan. 26, 1922.

Three-Phase Generators with Vertical Shaft.—G. LEWINNECK.—The great shortage of coal and the abundance of low-head water power in Germany and Sweden were responsible for the recent installation of a number of remarkable low-speed, vertical-type generators. This paper describes three of these—a 1,050-kva., 58-r.p.m. generator; a 1,300-kva., 83-r.p.m. generator and a 6,500-kva., 83-r.p.m. machine. The latter, as far as bulk is concerned, is one of the largest vertical-shaft machines in existence. It is 23 ft. (6.9 m.) in diameter and stands 17 ft. (5.1 m.) above the floor of the operating room. All stator coils are machine-wound and embedded to make them short-circuit-proof. The rotor construction is designed for 80 per cent overspeed. There is no exciter on the shaft.—*A. E. G. Mitteilungen,* January, 1922.

Lamps and Lighting

Lighting of the Clothing Industry.—A. B. ODAY and R. W. PEDEN.—A discussion of the present practice of lighting in clothing factories. The requirements as regards location and intensity of light are given for machine sewing, hand sewing, cutting, knitting, inspecting and folding, fitting, pressing, laundering, stockroom, sample room and showroom, and for packing and shipping.—*Bulletin L. D. 133 of the Edison Lamp Works.*

Interlaboratory Photometric Comparisons of Gas-Filled Tungsten Lamps.—W. E. FORSYTHE and F. E. CADY.—Reports of comparative photometric tests of incandescent lamps have been made to the Illuminating Engineering Society on several occasions, and in order that such information should be as complete as possible, it was thought that it might be helpful to have a set of measurements made by the authors duplicated in other laboratories. The bodies co-operating in such a test were the research section and testing section of the National Lamp Works, the Westinghouse Lamp Company, the Electrical Testing Laboratories, the Edison Lamp Works, the Nela Research Laboratories and the Bureau of Standards.—*Transactions of the I. E. S.,* Dec. 30, 1921.

Generation, Transmission and Distribution

Economies of Very High Steam-Pressure Plants.—WILHELM SCHMIDT.—For the last forty years the author has experimented with the commercial possibilities of using steam pressures as high as 60 atmospheres (875 lb.) and a steam super-temperature up to 400 deg. C. A boiler with a firing surface of 1.42 sq.m. and a heating surface of 72 sq.m. was built recently, producing 1,340 kg. of steam per hour at 60 atmospheres pressure. This boiler has given perfect service for 14,500 firing hours. Several firms have built reciprocating engines to be operated from this boiler. In general the advantage of such high pressure will be considerably smaller floor space and weight for the same efficiency. For example, a 4,000-hp. engine will weigh about 50 tons for 60 atmospheres and 188 tons for 15 atmospheres. —*Elektrotechnische Zeitschrift,* Jan. 12, 1922.

Developments in Power-Station Design. — Another article of a series, this one dealing with water-tube boilers.—*Engineer* (*London*), Jan. 13, 1922.

Hydro-Electric Developments Near Bathurst, N. B.—JAMES DICK.—Construction details are given of the new hydro-electric plant of the Bathurst Company, Ltd., at Grand Falls, on the Nepisiguit River, in the Canadian province of New Brunswick. This plant is to have a capacity of 13,500 hp. and operate under a head of 100 ft. and a generating potential of 4,400 volts. For transmission 33,000 volts will be used.—*Canadian Engineer,* Jan. 31, 1922.

Overhead Lines for Medium Voltage.—E. GUIGNARD. —With the aid of an actual example the author investigates the comparative advantages of a three-phase line installed on wooden poles and the same line on reinforced-concrete poles. For both cases a straight right-of-way and an irregular right-of-way are considered. Assuming an amortization at 7 per cent for fifty years, the author comes to this conclusion: (1) For irregular lines of small medium copper cross-section the choice of wooden poles is more economical, resulting in a saving of 170 francs per kilometer-year; (2) for straight lines the use of cement poles is a decided advantage, saving 67 francs per kilometer-year as compared with wooden poles.—*Revue Industrielle,* January, 1922.

Traction

Passenger Locomotives for Chilean State Railways.—Features in design of the passenger locomotives for the Chilean State Railways electrification on the Santiago-Valparaiso-Los Andes section are discussed. The experience with the St. Paul and Paulista locomotives was utilized in the selection of these locomotives. One of the features pointed out is the interchangeability of parts, permitting the carrying of a small stock of renewable parts, which facilitates the maintenance of locomotives and keeps down the maintenance cost. A description is given of the local and express passenger locomotives, which are supplied with regenerative braking equipment.—*Electric Railway Journal*, Feb. 25, 1922.

Electrification of the St. Gotthard Railway.—The actual equipment of the railway that runs from Lucerne to Chialso on the Swiss-Italian frontier is described. Two hydro-electric generating stations, one at Amsteg and the other at Riton, supply energy at 60,000 volts for transmission. This is reduced to 15,000 for trolley use. The locomotives are manufactured by the Oerlikon company.—*Engineer (London)*, Jan. 20, 1922.

Installations, Systems and Appliances

Electric Power Application to Passenger and Freight Elevators.—HARRISON P. REED.—Report of the subcommittee on elevators of the industrial and domestic power committee of the American Institute of Electrical Engineers on the application of electric power to passenger and freight elevators. An enormous amount of electrical energy is used for the operation of elevators, and the problem should be studied from a power economy standpoint as well as from the standpoint of protection to life. The subjects taken up are: (a) History and service requirements; (b) types of elevator machines and the limitation of each; (c) characteristics and limitations of direct-current and alternating-current motors; (d) elevator controllers; (e) brakes and other safety accessories; (f) power consumption.—*Journal of the A. I. E. E.*, January and February, 1922.

Plant Production Organized Around a Material-Handling Plan.—This article gives the details of the transportation system and production program in the South Bend (Ind.) works of the Studebaker Corporation of America. In this plant storage-battery tractors are used with an assortment of trailers, some of standard design built for general use, others designed for specific purposes. These comprise a vital part of the entire transportation plan around which the plant production is organized.—*Electrical Review and Industrial Engineer*, February, 1922.

Electrophysics and Magnetism

Characteristic Soft X-Rays from Arcs in Gases and Vapors.—F. L. MOHLER and PAUL D. FOOTE.—Potentials required to excite successive types of radiation in a low-pressure Wehnelt arc were measured by observing the photo-electric effect of the arc radiation on other electrodes within the same tube. Critical radiating potentials for eleven gases and vapors were measured in a range from 17 volts to 500 volts. The corresponding limiting spectral frequencies include the softest characteristic X-rays for all the elements considered. Experiments with radiation from solids indicate the existence of soft characteristic X-radiation, with no measurable general radiation under the best vacuum conditions.—*Scientific Papers of Bureau of Standards, No. 425.*

Dynamic Methods of Determining Triode Valve Constants.—HIDETSUGU YAGI.—A discussion of the operational constants of triode valves such as the amplification constant, the mutual conductance and the internal impedance. The author in the determination of these constants used two methods, both at radio frequency. These methods were developed by Dr. J. M. Miller and Stuart Ballantine.—*Technology Reports of Tohoku Imperial University*, Vol. 2, No. 3.

Electrochemistry and Batteries

Roasting Zinc Ores for Electrolytic Reduction.—THOMAS FRENCH.—The object of this article is to suggest various means by which the methods of roasting may be so modified as to give increased extractions. Some of the suggested alterations are quite different from the present recognized practice, but the results obtained are satisfactory. Quick roasting with thin beds is advised. When ores containing a minor percentage of lead are treated with ground coal, there is little danger of the lead separating in the metallic state.—*Engineering and Mining Journal*, Feb. 18, 1922.

Overhauling Storage Batteries—CHESTER SCHENCK.—In spite of the best care that can be given it, a storage battery must be overhauled sooner or later. In this article the author summarizes the symptoms that give warning of the need of overhauling. He gives the preparation necessary to carry on the work, with explicit directions covering two methods of procedure, one to be used when the work is carried to completion and the other where interruption is probable.—*Power*, Feb. 28, 1922.

Telegraphy, Telephony and Signals

Radio Calling Apparatus.—L. CHAUVEAU.—To Compete with ordinary wire telephony and telegraphy, it was necessary to develop some simple and reliable system whereby a radio operator might call a certain person or station. The author claims to have solved this problem and gives a description of his automatic radio calling apparatus. It consists of a combination of twenty magnetic relays—ten responding to "dot" and ten to "dash" calls—and a time relay. The apparatus can be set for any combination up to five letters or numerals, and if the call arrives in proper sequence and at proper time intervals, the last relay will close a signaling circuit, notifying the attendant of the receiving station. To insure the essential accuracy of sequence and time, the sending station emits the call with a mechanical caller.—*Radioelectricité*, January, 1922.

Telephone Line Work in the United States.—E. S. BYNG.—This paper was read before the British Institution of Electrical Engineers and contains observations made by the author on telephone-line construction during a trip to the United States.—*Journal of the Institution of (British) Electrical Engineers*, January, 1922.

Miscellaneous

Effect of Moisture Content Upon the Expansion and Contraction of Plain and Reinforced Concrete.—TORATA MATSUMOTO.—Investigations of the effect of moisture on the appearance and durability of concrete. Some of the conclusions reached were: (1) Concrete expands when it absorbs moisture and contracts when it is dried. (2) Contraction of concrete by the loss of moisture causes stress in the concrete when it is restrained by an external force. (3) The shrinkage stress caused in the steel in reinforced concrete may reach the usually accepted working stress of steel when the amount of reinforcement is less than 1.5 per cent. (4) The greater the percentage of reinforcement, the greater the tensile strength that may be developed in the concrete. (5) In reinforced concrete out of doors, subject to alternate wet and dry conditions, cracks may readily be formed under the repeated stress. This may be prevented by finding a cement giving less expansion and contraction, or by the use of a waterproofing treatment.—*University of Illinois Bulletin, No. 126.*

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **Prof. Vladimir Karapetoff**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CIRCUIT-BREAKERS, OIL, TESTS ON.

Numerous tests have been lately made on large-capacity oil circuit breakers, prominent manufacturers and operating companies co-operating in these tests. The purpose of the tests was to ascertain the actual rupturing capacity of the breakers since the manufacturers do not have sufficient generating capacity in their factories. The tests proved to be of considerable interest and caused but little disturbance in transmission and distributing networks.—*N. L. Pollard, Public Service Electric Company, Newark, N. J.*

ELECTROSCOPE FOR DETECTING HIGH POTENTIALS IN CABLES.

An aluminum-vane electroscope has been developed, with the vane pivoted slightly above its center of gravity and the supporting frame mounted on hard rubber. A ring of the lead sheath about 4 in. wide is removed from the cable to be cut and the electroscope is held near the exposed insulation. If the cable is alive, the vane will be attracted to it. At 500 volts the attraction is easily noticeable, and at 1,000 volts it is vigorous. The instrument works satisfactorily under almost any weather conditions and in damp manholes where the gold-leaf type will not work.—*W. J. McIlvane, United Electric Light & Power Company, New York, N. Y.*

TIMING INSTRUMENT.

A process timing and signaling instrument has been developed which has no clock mechanism. It consists of a small self-starting synchronous motor connected to a 60-cycle source of supply. The dial is calibrated directly in minutes and seconds of time. It can be set for a desired length of time and automatically rings the bell or lights a lamp at the expiration of this time interval. Pushing a button resets it, and pushing another button starts it for another similar interval of time.—*Stromberg Electric Company, Chicago, Ill.*

CURRENT TRANSFORMERS, SHORT-CIRCUIT-PROOF.

It has been reported from Germany that current transformers have been developed which can stand tremendous transient short-circuit currents without mechanical or thermal damage (*Elektrotechnische Zeitschrift*, Vol. 42, page 905). Such transformers are sometimes made with two cores—an iron core with a winding to which the measuring instrument is connected, and a second core, of smaller cross-section, with a winding for connecting the overload relay. The second core is so made that the secondary current rises at a much slower rate than the primary. By this means the violent mechanical shock to the relay mechanism is avoided and the burning out of the relay winding is rendered impossible.

HEATING, ELECTRIC, OF RESIDENCES.

An investigation has been completed of the actual use of electrical energy for heating residences in the Western States, and computations have been made as to its cost, energy consumption, conditions under which it can compete with coal, etc. The results have been published in full in a University bulletin. —*E. A. Loew, University of Washington, Seattle, Wash.*

BATTERIES, STORAGE, RESISTANCE OF SEPARATOR PLATES.

Soft woods, such as poplar and basswood, have the lowest resistance. Cedar and cypress, on the other hand, have considerably higher resistance, but are known to have better lasting qualities when used in storage batteries. A number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn to determine the decrease in tensile strength. —*Bureau of Standards, Washington, D. C.*

TELEPHONE RECEIVERS, RADIO, CRITICAL FREQUENCY OF.

On account of the distributed capacity between the windings of telephone receivers and between the closely spaced leads used with them there is a critical frequency at which the resistance is a maximum. Just below this critical frequency there is a sharp maximum of inductive reactance, and just above a sharp maximum of capacitive reactance. Measurements have been made on commercial types of radio head sets, and the critical frequency has been found to vary between 8,000 cycles and 60,000 cycles, with maximum values of resistance and reactance of the order of 100,000 ohms.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

RADIO CIRCUITS, POWER FACTOR OF.

In order to measure the phase angle between the sinusoidal currents in two radio circuits a third circuit is used in which the induced current is measured thermally. This tertiary circuit is successively subjected to the influence of each radio circuit separately, and then of the two simultaneously. This gives the values of the two currents and of their vector sum. From the vector triangle so obtained the phase angle can be determined. — *N. H. Williams, University of Michigan, Ann Arbor, Mich.*

CORONA, THE VIBRATION OF WIRES DUE TO.

The vibration of wires carrying a sufficiently high potential to show the corona has been reported by a number of observers. This effect takes place with both direct-current and alternating-current corona. In view of the close relation between the electric wind, the corona pressure and this type of vibration, the conditions for its production have been studied experimentally. Thus far these studies have been confined to the case of an alternating potential between parallel wires, and the results will be published later.—*Charcs S. Fazel, Department of Physics, University of Illinois, Urbana.*

MAGNETS, PERMANENT, RAPID AGING PROCESS FOR.

It has been found that a partial demagnetization of a magnet previously brought to saturation gives nearly the same effect as aging, either with time or by the use of boiling water. If the preliminary tests are substantiated by a more extensive study, the time of maturing a magnet may be considerably reduced. (See *Electrician*, Vol. 87, 1921, p. 263.

Suggestions for Research

DIELECTRIC LOSSES.

Analysis of dielectric losses is greatly needed, with a view to the determination of process specifications for the manufacture of dielectrics and with a view to the determination of dielectric constants which may be depended upon in the design of dielectrics.—*Prof. Harold B. Smith, Worcester Polytechnic Institute, Worcester, Mass.*

ALTERNATORS, EDDY CURRENTS IN ARMATURE CONDUCTORS.

When large conductors are subdivided to reduce eddy-current losses, the main current is divided unequally among the parallel circuits, owing to their different inductance. Besides the usual remedy of transposition and extra iron on end connections, Dr. Lehmann (*Revue Générale de l'Electricité*, Vol. 9, 1921, p. 915) proposes the two following remedies: (a) To provide the armature teeth with long, inclined incisions; (b) to envelop the different bars with iron sheaths so as to equalize their self-inductions. Further experiments in this direction are desired.

TURBO-GENERATOR FIRES DUE TO DIRT AND STATIC.

Some tests have been made by D. D. Higgins on the inflammability of dirt on armature windings under the influence of static sparks and of overheated conductors. More systematic and thoroughgoing researches in the same direction are desired with a view to devising practical means for removing such dirt or making it harmless.

FUSE METAL.

To what is the change in carrying capacity of fuse ribbon with service due, and can a more permanent alloy be found for this purpose?—*M. G. Lloyd, Bureau of Standards, Washington, D. C.*

INDUCTION MOTOR, MAXIMUM INPUT AND MAXIMUM POWER FACTOR.

Usually the circle diagram is determined by the no-load and short-circuit points. The latter point cannot be determined very accurately, and there are inaccuracies in the theory which make the use of the short-circuit test somewhat undesirable. It is proposed to supplement the test by obtaining the values of maximum power factor and of maximum input. The polyphase wattmeter and the power-factor meter in the primary circuit can be watched, either when the motor is running up to speed or when it is pulling out of step, and the maximum indications noted. This will give the maximum ordinate of the circle and a tangent to the circle from the origin. The short-circuit point can be used as a check. It is desired to verify this proposal experimentally.

PROTECTION AGAINST PHASE FAILURE.

When a three-phase induction motor is running and one of the line conductors becomes accidentally opened, the motor continues to run single-phase unless the load is sufficiently heavy to actuate an over-load device. Unfortunately, overload devices are often set too high for such a purpose. An under-voltage relay will not operate either, because the revolving magnetic flux induces virtually a full-line voltage in the dead phase. A simple and reliable protection is desired for such an emergency, a device that would at least call the operator's attention to the trouble, if not stop the motor.

GEARS, PITTING OF.

In power units employing gear drive it has been noticed that the gearteeth are subject to a decided pitting or erosion along the line of maximum tooth pressure. From the results of preliminary investigation it would seem that this pitting is due to the oxidizing action of air in the oil film which is entrapped at high pressure between the teeth. Further investigation is desired as to the cause and possible remedies for gear pitting.—*N. E. L. A. Prime Movers Committee.*

OIL, INSULATING, ESTIMATION OF WATER IN.

The proposed method is based upon the evaporation of the water by passing a current of dry air through the moderately heated oil, and then, by active refrigeration of the air, condensing the aqueous and other vapors which it carries. It would be of interest to develop a simple practical device for testing oil on this principle.—*Comptes Rendus*, Vol. 173, 1921, p. 311.

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

Possibility of Delay in Muscle Shoals Settlement

THERE is a growing feeling in Washington that the tangle over Muscle Shoals may not be unraveled for some time. The proposal of Chairman Kahn of the House committee on military affairs to refer the proposition to a commission consisting of the Secretaries of the Treasury, War and Agriculture, if carried into effect, might mean delay, as the Cabinet officers are already overburdened with work. Since it seems probable that Mr. Kahn has sufficient support within his committee to dominate its action on the Muscle Shoals matter, it is believed that his attitude means at least that no recommendation as to legislation will be made at this time.

As the analysis of Mr. Ford's offer proceeds it is becoming more and more apparent that Mr. Ford's opportunity to earn unusual profits is great. One nationally known engineer remarked that Mr. Ford's earnings would entirely overshadow the rate of profit made on the most flagrant cost-plus war contract. He said the offer is unfair in that it gives Mr. Ford an undue advantage over other industrial concerns, since the United States would pay fully 50 per cent of his power cost.

Recommendations for Government Radio Control

TENTATIVE recommendations as to methods and policies for radio-telephone control have just been issued by the technical committee of the radio-control conference called by Secretary Hoover. A meeting will be called in a week or two to consider such constructive criticisms as may be made.

The recommendations, which are of great length and detail, point out the necessity for government control of radio telephones as the only solution to the present chaos of interference. The committee therefore recommends that the existing powers of the Department of Commerce be extended to complete control of transmitting stations. It does not recommend any control of receiving stations. The committee recommends that wave lengths below 6,000 m. should in a general way be reserved for radio-telephone service, but that those wave lengths which have become fixed in service for telegraph service within this range, such as S O S signals, shall be retained.

The committee considers that the present development of the art warrants the separation of twenty different wave bands within this range, of which seventeen lie between zero and 2,000 m. In the assignment of these wave bands the committee recommends that priority first be given to broadcasting service and that, secondarily, broadcasting service itself should be divided into priorities in the following rotation: First, government broadcasting; second, educational and public broadcasting; third, private broadcasting, including entertainment, news, etc., and fourth, toll broadcasting.

Reservation of wave lengths between 150 m. and 275 m. is made for amateurs, and some opportunity in experimental wave lengths would be assigned to them in addition. The committee says that, in addition to the establishment of wave bands for different services in various priorities, it is also necessary to limit the amount of power used in transmitting stations, thus limiting each of them to some special zone in order further to limit interferences and enable a wider variety of wave lengths to be assigned to different localities. The committee also recommends that the selection of the time of day to be occupied by different transmitting stations for different services should be controlled.

Report of Joint Committee on Inductive Interference

THE joint general committee of the National Electric Light Association and the Bell Telephone System is sending out the report of its sub-committee, which is recommended as a basis for the handling of the inductive-interference problem between electric light and power companies and telephone companies. A sub-committee, consisting of M. R. Burt, R. F. Pack and Bancroft Gherardi, has been instructed to proceed with the further work as recommended under the section devoted to standards of construction and operation and to report before May 15.

The general committee as soon as standards of construction and operation are adopted will consider whether principles can be established to aid in the fair allocation of the costs of co-ordinate measures. In the meantime, the committee believes that with the co-operative spirit which now is evident a mutually equitable adjustment can and should be made in each specific case. It is understood that any adjustments made will not be considered as precedents by either party to the prejudice of future understandings.

The sub-committee report, which is signed by R. F. Pack representing the N. E. L. A., and Bancroft Gherardi, representing the Bell Telephone System, follows:

> A committee of engineers was brought together consisting of H. P. Carlesworth, S. P. Grace, H. S. Osborne and H. S. Warren for the Bell Telephone System and W. J. Canada, A. E. Silver and F. H. Lane for the National Electric Light Association. This group of engineers proceeded, under our direction, to hold a series of meetings (in conformity with a memorandum prepared by us and attached hereto) for the purpose of (1) analyzing the situation to determine the extent to which standards of practice and construction exist which are mutually acceptable, and (2) setting forth certain principles of procedure for the treatment of those situations of proximity for which such standards have not been mutually acceptable.
>
> In accordance with your instructions the question of allocation of cost of co-ordinative measures has not been discussed.

Your sub-committee has gone over the results of this work carefully and now presents this initial report outlining certain recommended principles and standards. These apply generally to future construction but may be employed as occasion requires in clearing up existing situations.

As an essential step in promoting conformity with these recommended standards and principles, an arrangement should be set up between the respective utilities providing for the interchange of pertinent data and information relative to proposed and existing construction and changes in operating conditions concerned in situations of proximity.

Classification of Situations of Proximity.—Existing standards acceptable to both utilities are available covering the situations arising out of crossings, conflicting construction and jointly occupied poles. As to the question of parallel construction, standards acceptable to both utilities are not yet available but certain general principles of procedure have been agreed upon and a program is recommended with a view to the early development of mutually satisfactory standards.

Crossings.—The National Electrical Safety Code provides an acceptable guide to practice.

Conflicts.—By "conflicts" are meant situations where two separate pole lines parallel each other in close proximity under conditions more specifically defined in the National Electrical Safety Code. The National Electrical Safety Code provides an acceptable guide to practice. The safety code does not include the subject of inductive interference in its scope. As far as inductive co-ordination of circuits is concerned, the principles recommended below under "Parallel Construction Generally" may be considered as applying to "Conflicts" and "Jointly Occupied Poles."

Jointly Occupied Poles.—There are very substantial advantages to both utilities in the employment of jointly occupied poles where the conditions and character of the circuits permit. The joint use of poles by supply and signal circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience and presuming satisfactory agreement between the parties concerned as to terms and conditions. The preferences and construction requirements of the National Electrical Safety Code for joint use between supply and signal circuits are tentatively accepted. In order to reach a final understanding, particularly with regard to the question of joint use involving certain types of circuits, your committee finds that further consideration is necessary.

Parallel Construction Generally.—The problem of inductive interference requires the combined consideration of both power and communication utilities because it arises from contributing characteristics of both systems and their physical relations. The situations encountered include parallel lines, whether on separate or jointly used poles.

In approaching the solution of this problem it is recognized that the public interest is paramount and that the power and communication utilities must be able to render service to the public in an economical and efficient manner, and that for this purpose both have been granted rights to use highways, and that they must utilize the highways to serve their customers properly with plants so laid out as to be readily accessible and easily operated and maintained.

The power utilities, thoroughly recognizing the desirability of co-ordination, state that as necessity requires and in order to serve their customers they have the right and the duty to the public to place an electric light or power line of any type on a highway, provided that the location and type of construction are such as reasonably to co-ordinate with similarly co-ordinated lines owned or operated by the communication utilities, and that they cannot be restricted from serving their customers in a reasonably economical and satisfactory manner because of the presence of communication circuits on the highways involved.

The communication utilities, thoroughly recognizing the desirability of co-ordination, state as their position that it is their right to have their service, when rendered over properly constructed lines, free from impairment caused by either (1) subsequently constructed parallel supply lines or (2) existing supply lines by reason of subsequent changes in such lines or their operation, including in either case, as far as practicable, impairment caused by transient operating conditions on such supply lines. In cases of parallel construction on highways such that impairment cannot be avoided at the proposed separation by available co-ordinative measures the communication utilities believe they not only have the right but it is their duty to the telephone-using public to require that some plan, including separation adequate to prevent impairment, be employed.

While neither party hereto subscribes to the statement of position of the other party or relinquishes any of the rights claimed by it, the desire of both parties is to co-operate for the purpose of avoiding controversies which might arise out of their differences as to their relative rights, and we, therefore, recommend that they proceed along the following general plan, which plan it is confidently believed will enable both parties to meet their service requirements in a satisfactory manner and at the same time leave unimpaired all of the rights claimed by either party.

Recommended Plan for the Solution of Inductive-Interference Situations

I. General Principles:

A. Co-operative planning for all new construction.

B. The location, construction and operation of all supply and signal circuits in conformity with generally co-ordinated methods, including precautionary measures which can reasonably be applied under generally prevailing conditions as distinguished from special situations.

C. Where specific co-ordinative measures are necessary, those providing the best engineering solution should be applied. This involves: (1) Meeting service requirements of both systems; (2) the co-ordinative measures applied shall be selected without regard to whether they apply to one system or the other system or both; (3) the solution to be based as far as practicable on the state of the art at that time; (4) measures of co-ordination wholly by separation should be considered with other measures of co-ordination where the former will not sacrifice economy and practicability and the convenience of rendering present and future service.

D. Neither party should assume to be the judge of the service requirements of the other system, or of what constitutes good practice in that system.

E. Existing cases to be cleared up in an orderly and systematic way as occasion requires in accordance with the above principles.

II. Standards of Construction and Operation in Accord with the Foregoing Principles:

A. Adoption of more detailed principles as soon as possible for temporary use.

B. Preparation by further co-operative work, based on the existing state of the art, of definite standards covering all classes of inductive exposures.

III. Development Work:

As soon as it can be done without interfering with the work recommended under II above, a co-operative study of the art shall be made in order to determine what practicable measures, if any, may be developed and adopted to lessen the contributing characteristics of both systems.

Conclusions

Your sub-committee believes that great progress has been made toward the solution of the problems arising out of the proximity of supply and signal circuits and to further promote the satisfactory working out of these situations recommends as follows:

1. That the joint committee, if it approve, adopt the principles and standards herein set forth and recommend them for general use by the respective utilities.
2. That special emphasis be given to the importance of working out problems of interference before definite plans are made for construction, both with regard to immediate extensions and to general plans for future development.
3. That when differences do arise every effort be made to arrive at a settlement through negotiations rather than resorting to court or commission proceedings.
4. That arrangements be made for proceeding with further co-operative studies along the lines indicated herein.

Lower Freight Rates on Coal Believed Certain

ADVICES from Washington state it to be a foregone conclusion that the Interstate Commerce Commission will order a reduction in coal freight rates. About 300 witnesses appeared during the general rate-reduction hearing. Every important industry was represented, as were the consumers and the public generally. One-sixth of those appearing expressed positive convictions that freight rates on coal should be reduced materially. Only one of the fifty asking for such a reduction represented coal producers. In view of a nation-wide unanimity of opinion that coal rates should come down, there is a general belief that the reduction will be a substantial one.

Chicago Fire Wipes Out Stocks of Four Electrical Distributers

THE Chicago fire which destroyed the Austin, Atlantic and Burlington buildings on Wednesday morning completely consumed the stocks of the Electrical Supplies Company at 511 West Jackson Boulevard, the Co-operative Electrical Company at 314 South Canal Street, the James E. Gleason Electrical Company at 515 West Jackson Boulevard and the Consolidated Wire & Machinery Company at 527 West Van Buren Street. A. A. Togesen, manager of the Electrical Supplies Company, said to a representative of the ELECTRICAL WORLD that his firm was fully insured and that he would start anew immediately. The Co-operative and the Gleason companies also were insured.

Electric service in this section was not seriously interrupted. Only one feeder on the Commonwealth Edison distribution lines was affected. When this circuit became grounded in the burning building it was cut out and service for the district was obtained through another route.

Urges Plant Rehabilitation Before Lowering Rates

REMOVAL of restrictions and insistence on plant rehabilitation, thereby insuring adequate and efficient service, was indicated by John W. Shartel, president of the Oklahoma Utilities Association, at its annual meeting this week in Oklahoma City, as the attitude that should be adopted by state regulatory bodies. Until this shall be done the question of lower rates should be kept in the background and utilities should be allowed to charge rates sufficient to insure such a result.

The indeterminate franchise was characterized by J. W. Dana of Kansas City as an unfortunate expedient. Mr. Dana contended it would be better if for the term "indeterminate franchise" were substituted the term "indefeasible street rights." This, he said, meant definitely giving to the utilities the same right to the use of the streets that is enjoyed by any other user of the public highways.

Elmer Schoggin of Little Rock, Ark., urged accident prevention as one method of increasing net revenue without encountering opposition from any one. The human element was viewed as the biggest cause of accidents, and newspaper advertising and educational work within the schools and among the company employees were suggested as the best means of preventing accidents. Discontented employees were declared to be a prolific source of accidents, and steps to correct the causes of discontent or as a last resort to get rid of such employees were recommended.

Politicians Organize to Push California Water and Power Act

THE latest development in the fight in California over the proposed state water and power act is the formation of an active committee to lead the campaign for the passage of the measure. This committee is largely composed of city mayors, state senators and other politicians, with a sprinkling of small-town newspaper editors. Funds are being solicited.

Although it is too early to predict how the election will go, there are indications that the measure, even if defeated, will not be beaten by the overwhelming vote that the business and industrial interests of the state desire. A bare majority of the votes cast will suffice to carry the measure. There are indications at this early date that more than one-third of the total vote will show a desire for this form of state socialism. Many of the smaller newspapers, and even several of the more influential ones, are strongly in favor of the bill.

Connecticut Commission to Approve Joint-Pole Use for Over 5,000 Volts

THE rules and specifications governing joint-pole construction which were submitted to the Connecticut Public Utilities Commission on Monday of this week by the utilities committee will, according to A. E. Knowlton, electrical engineer of the commission, probably, with slight modifications, be adopted shortly by the commission. These rules were prepared in co-operation with the commission's engineering staff.

These rules are considered quite a step forward in that they provide for joint use of poles of power and telephone circuits of over 5,000 volts as well as for pressures not exceeding 5,000 volts.

Engineering Council Not Favorable to Muscle Shoals Investigation

AT THE Chicago meeting of the American Engineering Council's executive board on March 10 a proposal to take part in the governmental investigation of the Muscle Shoals development was laid on the table. Opposition to the proposal was based on the considerations that many investigations had already been made, that any inquiry to be adequate at this time would cost from $150,000 to $200,000, and that what was really needed was a consistent summing up of the engineering factors involved.

The Great Lakes-St. Lawrence waterway project, which had been discussed at two previous meetings, was laid on the table for somewhat similar reasons. It was emphasized in both cases that the public needed an *ex parte* statement representing the point of view of engineers as a whole with regard to the engineering factors and that the difficulty lay in finding, without a considerable appropriation, a group of men who could sift out from the mass of controversial material the facts which would rightly represent the relation of the engineering factors to public policy.

Other matters coming before the meeting were an indorsement of the action of the National Board for Jurisdictional Awards in its controversy with the carpenters' union, congratulatory messages on the passage of the federal legislation to reform the United States Patent Office, discussion of the international organization of engineers, including the possible constitutional changes necessary to admit the Engineering Institute of Canada, and the indorsement of the Sterling reclassification bill.

Employment service, which the committee on that subject believed should be turned back to the jurisdiction of the constituent societies, was left unchanged, but a new committee was authorized to bring in a report. It was intimated that possibly some working arrangement might be made with the American Association of Engineers. The existing committee held that the fundamental object of the Federated American Engineering Societies is the rendering of service to the public where engineering problems are involved, while employment service is essentially personal, the direct personal contact of the engineer being with the constituent societies.

It was reported that the financial outlook of the federation for 1922 is much brighter than it appeared at the time of the meeting of council in January.

Electrical Contractors' Association Changes Constitution

NUMEROUS changes were made in the constitution of the National Association of Electrical Contractors and Dealers at the meeting of the executive committee Monday and Tuesday this week at headquarters in New York, all tending to make it easier for the organization to function as a national body. The various committees reported and officers were elected. James R. Strong of New York was re-elected president. Changes in the constitution will have to be ratified at the annual convention in Cincinnati in October.

It was voted to change the name of the organization to the International Association of Electragists. A new form of geographical representation is recommended. Heretofore the executive committee has consisted of nineteen members. It is now proposed to increase the number of divisions from four to eight and let each division select one executive committee member, in addition to which there is to be one member at large and two from the new labor sections, making in all eleven members.

By the formation of the two labor sections it is proposed that the labor question shall no longer come up at the executive committee meetings or on the floor of the convention. A questionnaire disclosed that out of 12,761 men, employed by 1,100 electrical contractors, 6,489 were union men and 6,272 non-union. The new matter in the constitution forming the sections is as follows:

Sec. 1. Such members as so desire may form a section of this association for the purpose of making contracts or agreements or conferring with labor unions, but the business of such section shall be confined to labor matters. This shall be known as the Union Shop Section.

Sec. 2. Such members as so desire may form a section of this association to operate open or non-union shops. The business of such section shall be confined to labor matters. This shall be known as the Open Shop Section.

Sec. 3. Each section shall elect its own chairman, who shall automatically become a member of the International Association executive committee.

Sec. 4. In the conduct of labor matters the Open Shop and Union Shop Sections shall enjoy complete autonomy, except as hereinafter provided.

Sec. 5. Both the Open Shop and Union Shop Sections shall appoint from their membership three members, of whom the chairman of the section shall be one. These six will form the labor committee of this association. The creation of this committee will enable the Open Shop and Union Shop Sections to co-operate if they so desire in labor matters of mutual interest.

Sec. 6. Each of the sections shall have full control of its own funds and may levy upon its members such additional dues or assessments as it may deem necessary; but no International Association funds shall be used to promote the work of either section. Neither section shall make any rules or contracts in conflict with the International Association's constitution and by-laws or contrary to state or federal laws.

Sec. 7. Neither the Union Shop nor the Open Shop Section may admit to membership any person, firm or corporation not a member of the International Association.

Another important change in the constitution enables the members to come into direct contact with the national body rather than having to go through a state or regional body. It was felt that this would not only strengthen the national body but at the same time would encourage development of more local organizations.

The central-station committee indorsed the National Electric Light Association business development campaign and the national association pledged its fullest co-operation.

Within the next few months the cost data committee will, it reported, issue an estimating manual. It is proposed by the committee on the data and sales book to give it more of the character of a data book.

Considerable interest was taken in the report of the electrical code committee, which again went on record as advocating the use only of approved apparatus and material of both foreign and domestic manufacture. The committee reported that investigations were being made with respect to raising the 660-watt standard. If the results are favorable, the committee will recommend that a higher safe rating be given to outlets, always keeping in mind, however, that proper safeguards must be provided.

City of Los Angeles Protests Against State Regulation

OPEN conflict with the California Railroad Commission over the control of the utilities within Los Angeles is expected as a result of the Board of Public Utilities of Los Angeles having notified the commission that the authority of the state body over these utilities is at an end. The notification declares that the so-called "gentlemen's agreement" under which the city surrendered many of its regulatory powers to the commission some years ago is to be canceled and that the board is willing to enter into a friendly suit with the commission to determine the jurisdiction of each. Whether or not this is a move of the city to forestall regulation by the commission of the Los Angeles Bureau of Power & Light, which operates the electric system of the city, in the event that the initiative measure to effect this is passed in the November election, will probably be made clear by court action. The city desires to regain complete regulating power over all its utilities.

Water-Power Permit Asked

APPLICATION for a preliminary permit has been made to the Federal Power Commission by the Mokelumne River Power & Water Company, which has its headquarters at San Mateo, Cal. The project consists of the proposed diversion of the waters of the middle fork of the Mokelumne River to a reservoir at the headwaters of the north fork of the Calaveras River. Two dams and a canal 65 miles long are involved. The proposed use is for irrigation and power for public utility purposes.

Kansas City Plant Being Increased 50 per Cent in Capacity

ADDITIONS to the Northeast plant of the Kansas City Power & Light Company are under way that will increase the capacity 50 per cent. At present there are three units, totaling 60,000 kva., in service in the plant. A 30,000-kva. unit is in process of installation, and with it are four 1,250-hp. boilers. Power service at 25 cycles has been given in the city heretofore from the plant, which was originally built for railway and power service and is owned by the street-railway system. This has been changed over so that now the entire light and power service in the city is at 60 cycles.

Northern Ohio Traction & Light Issues $7,500,000 in 6 per Cents at 96

THE most interesting feature of the week's financing was the new issue of $7,500,000 of twenty-five-year general and refunding mortgage series A 6 per cent gold bonds of the Northern Ohio Traction & Light Company at 96, yielding slightly over 6.3 per cent. The proceeds will reimburse the company for construction expenditures during the past two years and for the retirement of $1,145,000 first-mortgage 5 per cent gold bonds of the Canton-Akron Railway Company which matured March 1, 1922, and, through redemption, the entire outstanding issue of $2,454,200 secured 7 per cent gold bonds.

S. E. D. Establishes Clearing House for Association Meeting Dates

THE Society for Electrical Development has announced that it has established as a gratuitous service to the industry a clearing house for the scheduling of electrical meetings. This action has been taken in direct response to an editorial suggestion in a recent issue of the ELECTRICAL WORLD in which it was pointed out that the too frequent conflicts between meetings of different groups of electrical men interfere with the attendance of many.

The Electrical Supply Jobbers' Association has offered to co-operate by forwarding to the society tentative dates set for important meetings and receiving information as to what other meetings may have been set for the same date so that, if advisable, conflict can be avoided. It is believed that the other associations will take similar action in the same spirit of co-operation. It will not be possible, it was stated at the office of the society, to establish this service immediately on a basis that will embrace all meetings of all the associations within the industry without special provision in the society's budget for the work that would be entailed. The society expects, however, to be able to function at least so far as the principal gatherings of the more important electrical organizations are concerned.

Great Western to Buy Out Spreckels Block Power Company

CONSOLIDATION of the Great Western Power Company of California and the Universal Electric & Gas Company of San Francisco is to be effected by purchase of the latter company by the Great Western Power Company for a price of approximately $2,500,000.

Final transfer of the properties and approval of the contract is subject to a hearing by the California Railroad Commission. The Universal Electric & Gas Company has a small steam generating station and serves approximately 4,250 consumers in the central portion of the city of San Francisco.

In the application to the commission the Universal company covenants not to engage in the electric or steam business in the city and county of San Francisco so long as the Great Western or its successors continue in business. This merger is expected to clarify materially the San Francisco electric light and power supply situation. R. J. Spreckels, who is vice-president of the Universal company, has been an advocate of the block system of electric service. While the Universal company has not a great number of customers, still its existence has frequently been of considerable annoyance to the local public utilities.

Work Under Way on New Southern Power Hydro-Electric Plant

CONTRACT for the building of the 80,000-hp. hydro-electric plant of the Southern Power Company at Mountain Island has been awarded to the Rhinehart-Dennis Company of Charleston, W. Va., at a price to aggregate around $3,000,000, officials of the company announced last week. The construction work is already under way. Houses have been erected for officials of the contracting company and other preliminary steps have been taken. It is estimated that it will require two years for the construction of this development.

The plant will be the second largest development of the company, being exceeded by the Wateree (S. C.) station, which has a capacity of 85,000 hp. The dam at Mountain Island will be 80 ft. in height.

The company proposes also to begin at an early date the development of another plant at Great Falls, S. C., where an additional 60,000 hp. will be developed.

Equipment Contracts for $3,500,000 Let by California Utility

CONTRACTS totaling approximately $3,500,000 have just been let by the Southern California Edison Company covering complete generating equipment and auxiliary apparatus for a 75,000-kw. hydro-electric station, an additional 16,000-kw. generator in an existing hydro-electric station, miscellaneous apparatus for several substations and the conversion of the present 150,000-volt Big Creek lines to 220,000-volt operation.

This apparatus is to be used in a new station, Big

Creek No. 3, in Big Creek No. 1, in stations on the Big Creek transmission lines and terminal substations. The first two units in Big Creek No. 3 and the additional unit in Big Creek No. 1 will be placed in operation in the spring of 1923, at which time it is planned to have the Big Creek transmission lines converted and reinsulated for operation at 220,000 volts. The third unit in Big Creek No. 3 will be placed in operation early in 1924 thereby bringing it to one-half its ultimate capacity.

The impulse wheel in Big Creek No. 1 will be supplied by the Allis-Chalmers Company, the reaction turbines in Big Creek No. 3 by the Wellman-Seaver-Morgan Company, the penstocks by the Kellogg company, the electrical equipment for Big Creek No. 3 by the Westinghouse Electric & Manufacturing Company, and the other equipment ordered will be supplied by the General Electric Company, excepting the switches which will be supplied by several manufacturers.

Government and Industry Co-operate in Standardization

AT THE request of Secretary Hoover, the American Engineering Standards Committee has designated its retiring chairman, A. A. Stevenson, as a special representative to work with the Department of Commerce in co-operation with the department's division of simplified practice.

The division of simplified practice is a co-ordinating unit of the Department of Commerce assisting in those reductions of excessive variety and other simplifications which many industries are undertaking in order to decrease the cost of production and distribution of manufactured articles.

The American Engineering Standards Committee, which serves as a national clearing house for a broad field of engineering and industrial standardization, has offered Secretary Hoover the use of its machinery in carrying out the detailed work on technical projects initiated in the simplification program. The committee has been actively at work somewhat over two years, during which time it has brought about a large measure of industry-wide co-operation. In this work more than a hundred national organizations are participating through representatives officially designated by them.

Electric Vehicle Show Next Month Attracts Many Exhibitors

MORE than thirty manufacturers have signified their intention of taking part in the electric vehicle show to be held from April 3 to April 15 in the showroom of the New York Edison Company at Irving Place and Fifteenth Street, New York City. During the first week street trucks ranging from 750 lb. capacity up to 5 tons will be shown. Passenger cars will also be displayed during this week. On April 9 the "big fellows" will give way to electric industrial trucks, and the second week will be devoted to the demonstration of methods of handling materials at freight stations and in industrial plants. Accessories will be exhibited both weeks.

A luncheon will be held at the Hotel Astor on Tuesday, April 4, and an electric vehicle conference will be held during the street-truck show, when problems concerning the operation of street trucks will be discussed. A second conference is to be held during the week given over to industrial trucks.

To Give Short Meter Course at Yale

TO GIVE electric metermen a better understanding of the increasingly technical requirements of commercial measuring instruments and methods a course will be given on April 17 to 22 at the Dunham Laboratory of Electrical Engineering, Yale University, New Haven, Conn.

The Public Utilities Commission of Connecticut maintains its standardizing laboratory at the school, and the commission's electrical engineer, Prof. A. E. Knowlton, will have charge of the course. Meter manufacturers will supply literature, sample instruments, and in some cases a representative. The course will be conducted as far as possible in accordance with the recommendations of the meter committee of the National Electric Light Association. A supplementary program includes addresses by M. H. Aylesworth, executive manager N. E. L. A.; B. W. St. Clair, General Electric Company, West Lynn, Mass., and A. J. Campbell, Samuel Ferguson and G. B. Leland of the Waterbury, Hartford and Stamford central-station companies. Radio telephony and radio-frequency metering will also be demonstrated.

To Celebrate Forty Years of Electric Service in New York

ARRANGEMENTS are being made to celebrate this fall, probably on Sept. 4, the fortieth anniversary of the beginning of New York central station service.

On Sept. 4, 1882, New York's first central station and underground system of distribution were completed and placed in operation according to plans conceived and executed by Thomas A. Edison. The original generating station occupied a reconstructed brick warehouse at 255 and 257 Pearl Street and supplied a distribution system serving only a square mile of territory. There were fewer than sixty customers when service began. Energy was used only for lighting, and there were only 1,200 lamps in all in the customers' premises. Today the Edison system in New York supplies 296,560 customers and is used for lighting approximately 9,000,000 lamps, for operating 688,000 hp. in motors and for heating purposes to the extent of 12,800 kw.

On the occasion of the thirty-fifth anniversary of the beginning of service the American Scenic and Historic Preservation Society and the New York Edison Company caused to be placed on the site of the original station a bronze tablet setting forth the facts connected with this important event in electrical history.

Electric Signs Barred from Fifth Avenue, New York City

A DECISION handed down last week in the Supreme Court of New York State has sustained an ordinance of the city of New York barring electric signs on the fronts of buildings in Fifth Avenue from Washington Square to One Hundred and Tenth Street, in Madison Avenue from Thirty-fourth to Seventy-second Street, and in Thirty-fourth and Fifty-seventh Streets for several blocks in the neighborhood of these avenues.

Judge Vernon M. Davis, who gave the decision, held that the law was not discriminatory and was in the "interest and convenience of the public." The finding opens the way to other municipal legislation restricting electric signs.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Electric Safety Lamps in British Mines.—Electric lamps to the number of 245,900 were used in British mines in 1920, as compared with 197,722 in 1919. There was a drop in the flame safety lamps from 636,158 to 635,127, but lighting by electricity was used for 422,167 of these as against 418,344 in the previous year.

Tampa Replaces Gas with Electricity.—The City Commissioners of Tampa, Fla., have ordered the substitution of electric lighting for gas lighting in nine out of thirty-six sections into which the city has been divided and the Tampa Electric Company will complete the new installation, with the exception of the Bayshore Drive, in 120 days.

All Sweden Linked Up Electrically.—Sweden now has an interconnected electric power system extending from Norrland, in the extreme north, to Skane, in the south. Advices to the Department of Commerce tell of the completion of the last link in the system, which covers the 196 miles between Trollhättan and Vesteräs. The line is intended to carry 220,000 volts.

Facilitating Reference to Bureau of Standards Papers.—A new grouping of the technologic papers of the Bureau of Standards into consecutively paged volumes has been adopted by the bureau in order to make reference and citation simple. A leaflet explaining the method and giving the terms of subscription has been issued by the bureau, which may be addressed at Washington, D. C.

University of Arkansas Offers Metermen's Course.—The College of Engineering of the University of Arkansas, in co-operation with the Arkansas Utilities Association, will conduct a metermen's course from April 14 to April 19. This course will consist of a study of the fundamentals of polyphase alternating-current watt-hour meters, instrument transformers and demand meters.

Pennsylvania Police Adopt Wireless Reports.—A system of sending crime reports by wireless will soon be placed in operation throughout the state by the Pennsylvania State Police and promises to be of great use as a check on criminals. The mast for the broadcast station has been erected at the State Arsenal in Harrisburg, and receiving stations are being fitted up in Butler, Greensburg, Pottsville, Wyoming and Lancaster. The municipal police chiefs of nearly all the large cities up the state have volunteered to build stations and co-operate.

New York Electrical Show to Go Back to Grand Central Palace.—The 1922 New York Electrical Show is to be held from Oct. 7 to Oct. 14 at the Grand Central Palace. Last year's show was held elsewhere, and owing to the limited space the number of exhibits had to be greatly curtailed. This year an exhibition on the scale of other years will be held in the quarters used prior to 1921.

British Institution Celebrates Jubilee.—In commemoration of the first meeting of the Society of Telegraph Engineers, which took place on Feb. 28, 1872, the Institution of Electrical Engineers held a semi-centennial "jubilee" comprising a series of special meetings at its London headquarters. One of the features of this celebration was an experimental lecture by Dr. J. A. Fleming upon "Michael Faraday and the Foundation of Electrical Engineering." Early history and reminiscence were the basis for most of the papers and proceedings.

Electric Expansion at Cape Town.—Growing demand for electric heaters and appliances for domestic use at Cape Town, South Africa, has necessitated an expansion of the municipal electric light and power plant. The department of electricity is gradually substituting three-phase alternating current for direct current. The Cape Province Council recently enacted an ordinance empowering municipalities to insist on registration of electrical contractors and licensing of electric wire men in the interest of better electric connections and lighting and power service.

Accomplishments of Missouri Committee on Public Utility Information.—This committee, in active operation since Oct. 1, 1921, had up to Jan. 31 of this year established favorable contacts with 600 newspapers in the state, issued 15,000 copies of a new bulletin (which has now been made a monthly with a circulation of 7,200), kept a complete record of taxation upon utilities, maintained a speakers' bureau, interested the universities of the state in its work, got into close touch with forty-six operating utilities, held regional meetings of operators, and formulated a plan by which the salesmen of manufacturers and jobbers will further its work.

Automatic Telephone Proposed for France.—Complete financial and technical reorganization of the French telegraph, telephone and postal service is provided for in two bills which have been submitted to the Council of Ministers. According to advices received by the Bankers' Trust Company of New York, the new bills provide for the creation of an entirely separate budget for each of these three services, which were formerly provided for jointly. Improvement and extension of the telephone lines is contemplated at an estimated cost of at 1,675,000 francs. One feature of the proposed changes is the installation of automatic telephones both in ordinary city exchanges and in rural districts.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Rochester Engineering Society.—The quarter centennial of this society is to be celebrated tonight (March 18) at the Powers Hotel, when the members of all the local engineering bodies will join in a dinner.

New York Electrical League.—Frank W. Smith, vice-president of the United Electric Light & Power Company, will talk on the development of the alternating-current system in New York City at a luncheon of the New York Electrical League on next Wednesday, March 22, at 12:30 o'clock, at the Hotel Astor, after which those present will be invited to visit the company's new Hell Gate station.

Early Meetings of A. I. E. E. Sections.—Programs of section meetings scheduled for early dates are: Cleveland, March 21, "Power-Plant Economics, with Special Reference to the Steam Turbine," by T. E. Keating of the Westinghouse Electric & Manufacturing Company; Erie, Pa., March 21, "Electrochemistry," by Mr. Swartz; Philadelphia, March 21, hydro-electric symposium; Akron, March 22, "Illumination," by A. R. Holden; Toronto, March 24, joint meeting at Hamilton, and April 7, "Explanations and Demonstrations of Power Factor," by Prof. H. W. Price; Atlanta, March 30, "Steam Turbines," by E. F. McLaughlin of the General Electric Company; Utah, March 31, "Illumination and Eye Strain," by H. T. Plumb; Vancouver, B. C., April 7, "Safety Card in City and Suburban Service," by H. M. Lloyd.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, March 18; Youngstown, March 25; Birmingham, March 25; Cleveland, April 10; Philadelphia, April 18.

A. I. E. E. Section Meetings.—Cleveland, March 21; Erie, March 21; Philadelphia, March 21; Akron, March 22; Toronto, March 24 and April 7; Atlanta, March 30; Utah, March 31; Vancouver, April 7.

Wisconsin Electrical Association—Milwaukee, March 22-24. (For program see issue of March 11, page 496.)

A. S. M. E. Spring Meeting—Atlanta, April 8-11.

A. I. E. E. Spring Convention—Chicago, April 19-21.

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.

American Physical Society—Washington, April 22.

American Electrochemical Society—Baltimore, April 27-29.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

N. E. L. A. Geographic Divisions: Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, [illegible], June 7-10; North Central, St. Paul, June 13-15.

A. I. E. E. Annual Convention—Niagara Falls, Ont., [illegible] 26-30.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

United States Supreme Court Declares New York Gas Laws Confiscatory.—The eighty-cent and dollar gas laws of New York State, which have been fought persistently by the gas companies of Greater New York and which the city authorities have tried to enforce, have been finally declared confiscatory by the United States Supreme Court in a unanimous decision, and as a result about $20,000,000 of funds impounded by the state courts to reimburse customers should the decision go against the companies has been released to the utilities. This sum was accumulated under the operation of a rate of $1.20 per 1,000 cu.ft. The decision puts the making of a new rate squarely up to the Public Service Commission, the Supreme Court saying: "Rate making is no function of the courts and should not be attempted either directly or indirectly. We do not intend by anything said herein to intimate what would have been a reasonable rate for the sale of gas under the circumstances disclosed. The eighty-cent rate was confiscatory; the one-dollar-and-twenty-cent maximum imposed by the court during a specified period as a condition to the injunction was a limitation in favor of the consumers." Regarding the suggestion that the loss of income during the war period should be made up out of prior earnings, the court said that "mere past success could not support a demand that the company continue to operate indefinitely at a loss."

The Theory of a Service Charge.—In declaring the imposition of a service charge to be legal, in the suit of the People vs. Rochester Gas & Electric Corporation (see issue of March 11, page 500), the New York Court of Appeals made this defense of the practice: "The expenses of a gas company are incurred partly in manufacture and partly in distribution. Its income must be adequate to reimburse it for the one outlay as for the other. Expenses of manufacture may be apportioned among consumers in proportion to the quantity of gas consumed. Expenses of distribution in their division may follow other lines. Some remain constant whether consumers are few or many. Others increase or diminish at a uniform rate with the number of the patrons. A service charge is an attempt to make the incidence of the burden as wide as the incidence of the benefit. From all the items included in the cost of distribution it segregates and divides per capita those dependent upon numbers. Such items there always are. . . . The law imposes the duty to establish connections for the householder who demands them, but it does not impose the duty either to install or to maintain them gratuitously. If he demands the facilities with the added expense that follows, he thereby invites a service and must be numbered among those for whom service is maintained. A service charge is not something in addition to the price that would otherwise be fair and reasonable. It enters into the price of the commodity not as an element of addition but as an item of deduction. In the case at hand the finding is that if the service charge were dropped the price of gas, now $1.30, would become $1.45. The revenues of the company are the same whether rates are computed on the one basis or the other. The variance is solely in the distribution of the burden."

Commission's Course Found to Constitute a Denial of Due Process of Law.—Remanding for further proceedings, an action brought by the Appalachian Power Company against Commonwealth ex rel. National Carbide Corporation, the Supreme Court of Appeals of Virginia declared the action of the commission in adopting a rate for electric power recommended by its engineer without giving the power company the opportunity to be heard was a denial of a hearing and of due process of law. The court also insisted that on an appeal from an order fixing rates the commission must certify the facts found and not merely the evidence upon which its order was based, as otherwise it is impossible for the appellate court to know to what facts or conclusions it should give the prima facie presumption of correctness. (110 S. E., 360.)*

Company's Responsibility for Accident Which Was Due to Proximity of Decayed Tree to Transmission Line.—A transmission line of the Hagerstown & Frederick Railway Company was broken by the impact of a large limb falling from a decayed tree, and the broken wire came in contact with a wire fence, thus bringing about the death of a child who touched the fence while running to the scene of the accident. The trial court admitted evidence to show that limbs had previously fallen from the same tree and that the company was chargeable with knowledge of the danger from the tree's condition. The Court of Appeals of Maryland, in an appeal brought by the company against the state (for use of Weaver), has found that this evidence was properly admitted, that the company was required to protect persons using the public highways against danger from its transmission wires, and that the company should have had the tree limb removed or have taken other precautions against accident, even though the tree was not on its right-of-way. (115 At. 783.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Powers of Nebraska Commission.—On application of the Brittan Electric Light & Power Company for authority to issue and sell bonds, the Nebraska State Railway Commission declared that it had no jurisdiction as to security issues over a company organized under the common law as a "declaration of trust" company.

Reducing Rates Because of Inadequate Service.—In reducing the rates of a gas company, the Indiana Public Service Commission said: "A public utility is entitled to earn its proper operating expenses, including taxes and depreciation and a reasonable return on the fair value of its property, if it furnishes reasonable service. The evidence in this case shows, and at the hearing respondents admitted, that the gas service in New Albany is not adequate."

Rate Base in Depopulated Community.—Holding that the usual formulas of reproduction value or of historical cost could not be used to establish the rate base of a water utility which, on account of large decrease in population, was serving only a fraction of the number of consumers for which the plant was originally constructed, the Arizona Corporation Commission established a rate base after consideration of the cost of the property to the present owners, who had purchased at a time when there were no net earnings. Allowance for depreciation was reduced.

Separate Schedules for Rural Localities Condemned.—In adjusting rates for the Badger Electric Service Company the Wisconsin Railroad Commission remarked in explanation of why it treated as a unit the six communities affected: "In considering the suggestion that a separate schedule be established for each locality served by the applicant, we desire to point out that to fix a separate schedule for each community and for each farm line would necessitate the apportionment of the property as well as a very detailed apportionment of the joint operating expenses. In fact, to allocate all possible expenses direct to a particular locality would necessitate a much more elaborate accounting system, which would mean considerable additional labor expense. This extra expense would have to be apportioned among the communities served. . . . In fact, it is only by combining a number of localities similar to those supplied in this case that a reasonable schedule of rates can be obtained for each."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

V. L. Board, for twelve years a member of the Doherty engineering staff, has been appointed to the newly created position of assistant general manager of the Denver Gas & Electric Light Company. Mr. Board not only succeeds to the responsibilities of the operating department formerly discharged by Superintendent T. O. Kennedy, but he will also exercise executive supervision over all branches of the company's activities. He was graduated from the University of Missouri in 1910 and became identified with the Denver Gas & Electric Light Company the same year in the capacity of junior engineer. At the end of two years he was transferred to the New York offices of the Doherty interests, where he was engaged in engineering and rate work. In 1917 he was assigned to special work with the Denver Gas & Electric Light Company. Mr. Board is secretary-treasurer of the Rocky Mountain Committee on Public Utility Information, in the organization of which he was instrumental.

V. L. BOARD

John W. Lieb, vice-president of the New York Edison Company, accompanied by Mrs. Lieb, is leaving for a three months' trip to Europe on March 8 on the steamship Arabic of the White Star Line, bound for Naples via the Mediterranean route. Mr. Lieb expects to visit Italy, Switzerland, France, Germany, Holland and England, but will spend most of his time in Italy visiting his old friends and business associates. He was chief engineer and technical director of the Italian Edison Company from 1882 to 1894, and many engineers who were on his staff at the time are now occupying prominent positions as executives or managers of electric light and power companies in different parts of Italy. While in Europe he will be interested in the latest engineering developments, particularly in connection with the construction and operation of power plants and transmission systems. He will also endeavor to strengthen the international relations between the principal engineering societies in the United States and the national engineering societies in Italy. While in Rome Mr. Lieb will present the certificate of honorary membership in the American Society of Mechanical Engineers which was recently conferred on Gr. Uff. Pio Perrone. Mr. Lieb will also convey the felicitations of the American Institute of Electrical Engineers to its sister society, the Associazione Elettrotecnica Italiana, on the twenty-fifth anniversary of its organization, which it celebrates this year. Mr. Lieb is a past-president of the Association of Edison Illuminating Companies, the National Electric Light Association, the American Institute of Electrical Engineers, the New York Electrical Society and the Edison Pioneers.

Charles A. Culver, recently elected president of the Radio Research Club of Canada, is chief high-frequency engineer of the Canadian Radio Corporation, Ltd. Mr. Culver was graduated from Carleton College, Northfield, Minn., in 1902, and received the degree of doctor of philosophy from the University of Pennsylvania in 1907. Immediately after graduation he took charge of the department of physics in Beloit College, Beloit, Wis., remaining as head of that department until, in July, 1920, he resigned to take charge of high-frequency engineering work in connection with the development of guided-wave telegraphy and telephony in Canada. When the United States entered the war Mr. Culver obtained leave of absence from Beloit College and served in the United States Army on the staff of the Chief Signal Officer, holding the rank of major when discharged. During the greater part of his military service he had charge for the Signal Corps of an investigation into trans-atlantic radio communication which was perhaps the most comprehensive piece of research work into trans-oceanic communication ever carried out.

C. A. CULVER

B. F. Sunny, president of the Illinois Bell Telephone Company and formerly for nearly fourteen years president of the Chicago Telephone Company, has retired to become chairman of the board of directors of the Illinois company. Mr. Sunny resigned as vice-president and Western manager for the General Electric Company in May, 1908, to become head of the Chicago Telephone Company. His retirement from the active management of the telephone company removes one of the outstanding executives in the utility field. He came into the electrical industry as a messenger for the Atlantic & Pacific Telegraph Company, going to Chicago for that company in 1875. He joined the Bell Telephone Company in 1879 as superintendent in Chicago. In 1888 he became president of the Chicago Arc Light & Power Company, and later he was general manager of the Thomson-Houston Electric Company and Western manager of the General Electric Company. From 1911 to 1920 he was president of the central group of Bell companies operating in Illinois, Wisconsin, Michigan, Indiana and Ohio. These are now operated as separate organizations.

B. F. SUNNY

Rumsey W. Scott was elected a vice-president of the Chemical National Bank of New York at the annual election of officers. Through a mistake it was announced in the ELECTRICAL WORLD of Feb. 25 that Mr. Scott had been elected president of this bank.

H. D. James, manager of the control engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been re-elected president of the Engineers' Society of Western Pennsylvania. Mr. James has served as director of the society for three years and has been president for the last two years. He was graduated from the University of Pennsylvania in 1906, and after spending five years with the Westinghouse Electric & Manufacturing Company he became connected with the Union Gas & Electric Company of Cincinnati as power engineer. Mr. James served in the war and at the time of his re-entering the employ of the Westinghouse company was with the Chase Engineering Company of Cincinnati.

H. D. JAMES

I. R. Reddinger, president of the Reddinger-Ball-Morris Electric Appliance Manufacturing Company, Logansport, Ind., has disposed of his interests to M. W. Morris, vice-president of the company.

Henry Harnischfeger, president of the Pawling & Harnischfeger Company, electric crane manufacturer, Milwaukee, left on Jan. 28 on a combined business and pleasure trip around the world, accompanied by his wife. The trip will extend to Japan, the Philippines, China, Burma, Ceylon, India and Europe, and Mr. Harnischfeger will investigate general business conditions and possibilities in the Far East.

Horace B. Smith has been appointed manager of the domestic service section of the industrial department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. Smith was born at Martinsburg, Pa., and spent his early life in Altoona, Pa., where he was educated. He attended Yale University, where he was graduated in electrical engineering in 1906. From 1906 to 1908 he was engaged as an engineering apprentice with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, and in 1908 he traveled abroad. From 1909 to 1911 he was engaged as assistant chief electrician of the Allegheny Steel Company, Pittsburgh, Pa., and in 1911 entered the employ of the industrial sales department of the Westinghouse company, where he has been continuously since that time. As manager of the domestic service section, Mr. Smith will have charge of the Westinghouse company's dealings with the baking, confectionery, canning, preserving and other industries.

E. C. Headrick, vice-chairman of the Denver Electrical Co-operative League since its inception last year, has been appointed chairman to succeed T. O. Kennedy, who left that post recently to assume management of the Ohio Public Service Company. Mr. Headrick has been one of the prime factors in developing the co-operative effort in Denver. He has just completed a term as president of the Electrical Contractors and Dealers' Association of Denver. He is also chairman of the building committee of the co-operative league and will have charge of the building of Denver's first electrical home.

W. O. Renkin, formerly chief engineer for the A. M. Byers Company, Pittsburgh, has been appointed engineer in charge of the Quigley pulverized-fuel department of the Hardinge company, New York. Mr. Renkin obtained his enginering education through a special course conducted by Prof. R. H. Thurston of Cornell University in 1894 and 1895 and upon completion of this course went into the Renkin shops at Pittsburgh, where he specialized on the problems attendant on the manufacture of steam-power apparatus. He then was placed in charge of construction in several plants, including work in Toulon, France. Four years were spent in Jamshadpore, Bengal, British India, as resident engineer in charge of pioneer construction for the Tata Iron & Steel Company, a modern steel plant and a community settlement for the workingmen being built. Returning from India, he became connected with the Byers company and there studied pulverized-fuel problems.

W. O. RENKIN

Obituary

George F. Parker, vice-president and general manager of the New York Electrical Show Company and president of the Fox Electrical Corporation, died on Tuesday, March 7, at his home at Hasbrouck Heights, N. J., at the age of fifty-two. His death was due to heart trouble, from which he had been suffering for almost a year. To Mr. Parker is due most of the credit for the success of the electrical shows in New York, which have been held since he opened the first show in Madison Square Garden in 1907. From but a few exhibitors he saw the shows grow to several hundred, including manufacturers of virtually every kind of electrical apparatus and appliance for home or industrial use. Mr. Parker acquired his experience in managing large exhibitions while employed by several well-known circus companies.

G. F. PARKER

James W. Gore, manager of the North Virginia Power Company, died on Feb. 1 in Millville, W. Va., at the age of fifty-four years.

Colonel John Lambert, first president of the American Steel & Wire Company and an associate of John W. Gates and E. H. Gary in the formation of the United States Steel Corporation, died at his winter home in Pasadena, Cal., on March 7.

Dr. Charles W. Waidner, chief physicist of the Bureau of Standards and widely known for his scientific studies of temperatures and heat measurements and applications, died at his home in Washington on March 11. Dr. Waidner was a native of Baltimore and a graduate of the Johns Hopkins University. Before joining the Bureau of Standards, soon after its establishment in 1901, he was an instructor in physics at Johns Hopkins and later at Williams College. He was a member of many scientific organizations and had written numerous scientific papers.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Electrical Exports Continue to Drop in Value

JANUARY, 1922, signalized in the export world by the putting into effect of the new export classification of the Department of Commerce, proved a slow month for exports otherwise. The total value of electrical machinery shipped during the month to foreign buyers was $4,273,248, almost 75 per cent below exports for the same month last year. This mark is slightly under November, 1921, the lowest month in 1921, and $904,311 under December, 1921.

On the surface these returns are rather discouraging, but there are several factors which render the figures less depressing. One is the fact that normal seasonal influences tend to reduce January exports, and some at least of the decline from December can be accounted for in that way. However, when all is said, the fact remains that the export situation is quieter than at any time since 1915.

Comparison of subdivision totals with previous months is practically impossible owing to the lack of detailed information on those months. Only a few items in the new list stand out with more than ordinary totals. They are: 493,134 lb. of electrical porcelain, valued at $103,923; 628 generators, 500 kw. and over, valued at $185,073; 1,115,074 lb. of insulated wire and cable, valued at $234,537; accessories and parts for generators, valued at $250,605, and 122,529 switches, valued at $175,382.

Price Drop Anticipates Spring Demand for Armored Conductor

MANUFACTURERS' quotations on flexible armored conductor have been dropped by several producers in the last two weeks, the reduction amounting to about 5 per cent. The new prices represent approximately the lowest levels reached since the early years of the war and should prove of considerable saving in the house-building campaign which is expected to develop this spring.

Some producers feel, however, that the change was untimely viewed from the angle of the manufacturer. They assert that the quotations just put into effect merely about cover the factory cost of armored conductor and that the commercial costs, such as freight charges and sales expenses, are left out of consideration. At least one manufacturer states that every foot of armored conductor sold at the new price will mean a loss to him. With the spring

ELECTRICAL EXPORTS FOR JANUARY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	January, 1921		January, 1922	
	Volume	Value	Volume	Value
Electrical glassware, except for lighting, lb			81,627	$13,074
Electrical porcelain, lb			493,134	103,923
Carbons for electric lighting, electrodes and batteries, lb.		$70,823	203,082	19,312
Insulated wire and cable (iron and steel), lb.			513,483	80,618
Other manufactures of aluminum, lb.		521,965	88,502	49,602
Copper wire (bare), lb.	1,922,887	455,705	360,935	56,459
Insulated copper wire and cable, lb.		2,447,654	1,115,074	234,537
Generators:		629,461	.	....
Direct current—				
Under 500 kw., number			628	28,621
500 kw. and over, number			628	185,073
Alternating-current—				
Under 2,000 kw., number			18	6,202
2,000 kw. and over, number.			77	80,022
Accessories and parts for generators			754,917	250,605
Self-contained lighting outfits, number			125	39,776
Batteries:		655,712		
Primary, dry, number			257,480	71,306
Primary, wet, number			987	2,905
Storage, wet, number			6,361	51,216
Transforming or converting apparatus:				
Power transformers, number			912	84,379
Other transformers, number			1,602	106,207
Rectifiers, number			28	4,987
Condensers, double-current and motor-generators, dynamotors, synchronous and other converters, number			258	62,885
Transmission and distribution apparatus				
Switchboard and panelboards, except telephones, number			284	45,066
Switches and circuit breakers, number			122,599	175,382
Fuses and fuse plugs, number			106,851	13,259
Watt-hours and other measuring meters, number			10,925	66,116
Volt, watt and ampere meters, and other recording indicating and testing apparatus, number			3,942	68,006
Lightning arresters, choke coils, reactors and other protective devices, number			3,565	14,230
Motors, starters and controllers				
Motors under 1 hp., number			1,937	36,040
Stationary motors—				
1 hp. to 200 hp., number			1,283	145,883
Over 200 hp., number			13	4,427
Railway motors, number.			1	390
Electric locomotives, number	9	95,016	....	....
Railway, number		.....	1	17,505
Mining and industrial, number			3	8,926
Other motors, number		2,064,424	2,554	65,563
Rheostats, controllers and other starting and controlling equipment, lb.		161,253	182,652	73,535
Accessories and parts for motors, lb.		.	290,704	146,521
Electric appliances:				
Electric fans, number	20,047	358,444	2,144	47,061
Electric lamps—				
Arc, number	61	1,430	103	1,344
Incandescent—				
Carbon filament, number	43,228	9,075	11,963	3,050
Metal filament, number	2,314,676	620,434	360,049	95,057
Other electric lamps, number.			12,153	18,486
Flashlights, number			20,297	14,855
Searchlights and projectors, number			379	12,130
Motor-driven household devices, number			699	22,704
Industrial electric furnaces and ovens, number		....	31	22,951
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc., number		....	443	41,703
Signals and communication devices:				
Radio and wireless apparatus, lb		..	7,215	9,274
Telegraph apparatus, lb.		.	9,333	25,380
Telephone apparatus, including telephone switchboards, lb.			289,476	370,055
Police, fire and burglar alarm apparatus, lb		....	3,026	3,856
Railway signals, switches and attachments, lb			109,059	46,156
Bells, buzzers and annunciators, number			3,321	4,148
Other electric apparatus:				
Spark plugs, magnetos and other ignition apparatus, lb		303,900	112,776	103,311
Insulating material, lb.			254,396	56,498
Metal conduit, outlets and switch boxes, lb			236,839	53,655
Sockets, outlets and receptacles, number		.	100,354	10,738
Other wiring supplies and fixtures, lb.		422,017	136,336	79,375
Other electrical apparatus not elsewhere specified, lb.			1,689,718	833,203
Total Electrical Machinery				$4,273,248

only a few weeks off, he expressed his belief that the makers of armored conductor should have waited to see whether there would not be sufficient demand to move stocks at the old price. If it had developed then that there would be no buying at the old price, he said, the cut could have been made and few sales would have been lost in the intervening time. So far the reduction has had little effect on sales.

The call for conductor during the past two months has been fairly steady, though not of large volume. Competition has been keen owing to good stocks. In the metropolitan district jobbers' quotations have been ranging from $43 to $44 per 1,000 ft. for the No. 14, two-wire single-strip, with the double-strip two dollars higher. Approximately the same conditions prevail in the Middle West. There are few sales of armored conductor on the Pacific Coast, because of the preference there for rigid conduit.

Stoker Market Shows Improvement

SINCE 1922 began a better tone has been apparent in the market for mechanical stokers, and at present manufacturers are operating generally on a five-day week basis. The demand has not increased rapidly, but central-station companies in the Middle West have placed a number of orders for equipments of the latest types, and some important proposition work is pending. The Boston Elevated Railway, the United Electric Railways of Providence, R. I., the Public Service Electric Company (Essex station) and others are considering bids for new equipment, and important engineering developments are being tried out in connection with stoker application to very large boilers in the direction of improved coal-handling apparatus. Manufacturers are having no difficulty in procuring either material or labor of the best class, and deliveries of standard parts are being made easily from stock. In this field there is always more or less production of parts for factory stocks, and purchasers seldom have to wait for shipments beyond the transit time required. It is the opinion in manufacturing circles that business is likely to improve, although nothing spectacular is anticipated at present.

February Construction Exceeds That of Year Ago by 73 per Cent

FEBRUARY construction activity was 73 per cent greater in volume than it was in the same month of last year, according to figures compiled by the F. W. Dodge Company. The total amount of contracts awarded last month in the twenty-seven Northeastern States of the country amounted to $177,365,000, an increase of 7 per cent over January and the second largest February total since the company began to collect statistics on the industry.

A significant feature of the February construction record lies in the increase in business buildings over January. The increase in square feet of space contracted for amounted to 30 per cent, and the increase in total cost was 65 per cent. February business buildings amounted to $39,180,000, or 22 per cent of the month's total, an unusually high percentage for this class, which was exceeded only by residential buildings, amounting to $75,703,000, or 43 per cent of the total. Public works and utilities took third place, amounting to $21,193,000, or 12 per cent of the total.

The accumulated volume of construction since the first of the year has been 60 per cent greater than in the first two months of last year. Contemplated new work reported in the first two months has amounted to more than $800,000,000, over twice the amount of work actually contracted for in the same period.

Contracts awarded in the New England States during February amounted to $15,623,000, more than double the amount for February of last year and the second largest February total on record for that section of the country. The month's building contracts in New York State and northern New Jersey amounted to $59,328,000, the largest recorded February total for that district. It was 250 per cent ahead of February last year. Work contracted for showed an increase over February of last year of 67 per cent in the Middle Atlantic States, 28 per cent in the Pittsburgh district, 39 per cent in the Middle West and 62 per cent in the Northwest.

Clotheswashers Not Yet Popular in England

CLOTHES-WASHING machines have not been popular in the south of England, according to a report to the Department of Commerce by Consul Coulter at London, partly because servants object to having the laundry done at home. In the north country and in the industrial centers hand washing machines have found a good market. Cost militates against the American as well as the British and Canadian-made electrically driven machines. They retail for about £40 ($160) as against £7 to £8 ($28 to $32) for the hand-driven machines.

Metal Market Situation

DEVELOPMENTS in the last two weeks indicate that the flurry of buying at the beginning of that period has changed into a healthy buying movement. At the end of last week producers and large selling agencies advanced the price of electrolytic to 13⅛ cents for May delivery and held March and April deliveries at 13 cents. Sales have been numerous, though rather light individually. Export demand is as good as, if not better than, domestic, and a rumor was current last week that one foreign order for 3,500,000 lb. had been booked. The Copper Export Association at the present time has no definite price, but outside interests are reported to have effected sales at 13¼ cents, c.i.f. European ports. In the domestic market, as has been the case for some time, wire drawers are the most active buyers.

There is reason to expect marked improvement in the statistical position of copper by the end of June. Assuming that domestic consumption and exports are likely to absorb 750,000,000 lb. of new refined copper during the first half of 1922 and that refinery output will not exceed 600,000,000 lb., a decided reduction will have been accomplished in the heavy surplus stocks carried over from last year. However, in addition to the output of refined copper there are large quantities of secondary copper recovered in this country. Reliable figures on the production of copper from secondary sources in 1921 are lacking, but during the year 1920 the total quantity of secondary copper recovered in this country at plants treating this sort of material amounted to 624,920,000 lb. and that in 1919 was 574,380,000 lb. Present government holdings of brass and copper scrap are unknown. Large quantities have been disposed of from time to time, and it is probable that further quantities will be offered for sale. The copper market cannot afford to ignore the fact that these secondary products play a big part in the copper situation on account of the margin in price between remelted and virgin metal.

NEW YORK METAL MARKET PRICES

	March 7, 1922	March 14, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	60 2 6	60 12 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00–13.25	13.00–13.25
Electrolytic	12.87½	13.00
Casting	12.62½	12.62½
Wire, base	14.00	14.00
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.20	4.15
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	4.97½	5.00–5.05
Tin, straits	29.00	28.87½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	March 7, 1922	March 14, 1922
Heavy copper and wire	11.00–11.25	11.00 –11.25
Brass, heavy	5.00 – 5.25	5.00 – 5.50
Brass, light	4.37½– 4.62	4.75 – 5.00
Lead, heavy	3.75 – 3.87½	3.75 – 3.87½
Zinc, old scrap	2.25 – 2.50	2.25 – 2.50

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A SLIGHT improvement in jobbers' sales is reported for the last week, and it is hoped that this is the beginning of the spring demand upon which many hopes have been pinned. In the Southeast good seasonal business is experienced whenever there is a let-up in the bad weather conditions. St. Louis jobbers have had good sales of meters, distribution transformers and other pole-line material. Employment there increased 3 per cent in February. In New England jobbers are selling more, though the small order still rules; demand for meters there is 20 per cent ahead of last year at this time and 25 per cent more turbo-generators have been sold since Jan. 1, 1922, than during the same period of 1921. San Francisco has experienced unusually cold weather, and while this has made for a successful heating pad season, it has retarded other sales. Gains in both general and electrical trade are reported from the Northwest.

News comes from Washington that the army appropriation bill as reported to the House by the appropriations committee provides $270,000 for electrical installations and searchlamps at seacoast defenses next year, an increase of $205,000 over funds allowed for the current year. For electrical installations on Hawaiian coast defenses $120,000 is provided.

NEW YORK

The volume of business in the electrical trade shows slight improvement over last week. Orders for wiring supplies are coming through at the same steady rate, but for the most part they are for comparatively small quantities and the buying is still of a hand-to-mouth nature. New buildings in the residential sections of outlying districts are chiefly responsible for the present demand for wiring supplies. This promises to increase shortly as a considerable amount of home building is planned for this year. Continued favorable weather will hasten the development of this business.

Industrial business as yet shows few signs of actual revival, but one jobber, who specializes in this kind of equipment, stated that he is receiving an increasing number of inquiries from this class of customer. This, at least, can be taken as an indication that renewed activity in industrial lines is not so far off.

No important price changes were reported this week, although price competition on some items is very much in evidence. The appliance business, except for the keen demand for radio equipment, is very quiet.

Rigid Conduit.—Jobbers' stocks are good in all the usual sizes, and prices remain unchanged. The following prices were quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44 to $45; ¾-in., $57 to $58, and 1-in., $82 to $83 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $49 to $50, $64 to $66 and $91 to $93 per 1,000 ft. Demand is spotty and most sales are in small quantities.

Rubber-Covered Wire.—Prices and conditions in the wire market show no change since last week. No. 14 rubber-covered is quoted at $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots. Stocks are fair to good.

Flexible Armored Conductor.—Prices for this material were rather unsteady this week without any actual change in quotations, although some price cutting has been reported. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $45 per 1,000 ft. in that quantity.

Lamp Cord.—Demand is spotty and jobbers report little movement of either cotton or silk cord. No. 18, cotton, twisted, is quoted from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft.

Tape.—This material is moving in line with other wiring supplies. Both friction and rubber sells for 36 cents a pound in 100-lb. lots.

Appliances.—Activity in heating devices has been very limited. Vacuum cleaners are moving fairly well and the sale of washing machines is also beginning to show improvement.

Radio.—Demand for radio apparatus is unabated, but stocks in the hands of electrical jobbers are virtually nil. Department stores and sporting goods houses have received some complete outfits as they appear to have "got the jump" on the electrical trade in sensing the possibilities of this business and were first in line with their orders for the new wireless apparatus.

CHICAGO

The electrical trade has reported price reductions this week on flush receptacles and gang boxes. The demand for wiring materials has been spasmodic, most jobbers reporting a fair action on rubber-covered wire with a good movement of the flexible armored conductor. A variation in the price of conduit has also been noted, which would seem to indicate that prices are being shaded in order to start a movement on this material. Several good orders for high-tension equipment were reported by manufacturers.

Wire.—The market for rubber-covered wire has been fair during the past week with few large calls for the No. 14, which sells for $6.25 to $6.30 per 1,000 ft. in 5,000-ft. lots. Stocks are ample. The demand for bare and weatherproof wire has been on a steady basis, but no price changes have been reported. The price of weatherproof wire varies around 16¼ cents a pound, depending upon conditions of sale. The bare wire sells for the same price. Stocks of both commodities are fair.

Flexible Armored Conductor.—The steady business in this material has lowered most dealers' stocks so that they are ordering again from manufacturers. The No. 14 two-wire, single-strip conductor sells for $45 per 1,000 ft. in 5,000-ft. lots.

Conduit.—The keen price competition is varying prices on the ½-in. black pipe from $40 to $42.25 per 1,000 ft. in 5,000-ft. lots. However, the call for this material has not been strong. Stocks of the majority of dealers are good.

High-Tension Equipment.—Two 600-kw., 22,000-volt outdoor substations were sold during the week by one company to a central station in the Northwest. They also shipped an order for 600-volt heavy-duty plug receptacles to St. Louis. Another company has sold 2,300-volt switching equipment to a Central Western utility. Outdoor disconnecting switches, lightning arresters and fuses rated at 50,000 volts were sold to a Oklahoma utility by another company.

Flush Receptacles.—Prices on this line have been lowered so that the single receptacle now sells for 25 cents in lots of 100. The duplex type is quoted at 37 cents in lots of 100. The movement is only fair and stocks are ample

Porcelain.—The demand for porcelain has been growing along with the upward trend in the radio line. "Nail-it" knobs sell for $17 per 1,000 in barrel lots. The 5/16-in. x 3-in. tubes are obtainable for $6.90 per 1,000, also in barrel lots.

Gang Boxes.—A price reduction has increased the discount to 55 per cent, and dealers report a fair market.

Radio.—This line continues to be the one center of attraction, but the demand far exceeds the supply. The public seems to be willing to buy almost any kind of equipment just as long as it is an apparatus that will operate.

BOSTON

Despite the retarding effect of the strike in the cotton textile areas of New England, business shows some improvement in the electrical field. Small-order transactions rule in buying, but the volume of these tends to increase. Deliveries are excellent except in radio apparatus, which is in such great demand as to crowd existing factories hard and much overtime work is being done. Prices underwent few changes of consequence last week, although motors are somewhat weaker and various readjustments were recorded in the jobbers' price sheets sent into the sales field. In the building and engineering field over $5,000,000 worth of work was placed in the latest week reported by the Dodge organization, or far ahead of most corresponding weeks for the past twenty years. The Federal Reserve Bank states that building costs have now decreased to a point where they bear the same relation to rents as in 1913, so that nearly a pre-war return on the investment can be obtained.

Motors.—Business is spotty, with a very fair volume of inquiries and a good deal of application engineering under way. The recent price reduction of 8 to 10 per cent has not apparently started up any material increase in demand. Interest is evident in fractional-horsepower sizes.

Wire.—Demand is moderate with easy deliveries. Rubber-covered No. 14 is moving at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base early in the week was 15½ cents. Little bare wire is moving at present.

Radio Apparatus.—Local manufacturers are pushing production hard, and increased facilities are being planned in some quarters. A genuine boom is under way in this branch of the industry, and interest in broadcasting increases weekly. Public utilities are beginning to study the possibilities of radio telephony for operating service, but few installations have as yet been made in this district.

Storage Batteries.—Batteries for automobile starting and lighting service are moving well, and business is much better than it was two months ago.

Turbo-Generators.—Since Jan. 1 New England central-station companies have purchased from a single maker about 50,000 kw. in steam turbo-generators, or 25 per cent above the corresponding period last year. Plans for additional central-station development are being considered.

Flexible Armored Conductor.—Moderate sales are reported, No. 14 single-strip moving at $45 per 1,000 ft. in 1,000-ft. lots to 2,500-ft. lots. Good stocks are in hand.

Meters.—The demand is better than last year at this time by about 20 per cent, according to a representative producer. New mercantile building operations are absorbing a few of the larger units, but residential services are pulling hardest on stocks. Central-station outputs are increasing substantially over last year's figures in noteworthy cases, and house-wiring campaigns at Worcester and Providence are yielding excellent results.

Appliances.—Smaller devices are moving fairly well, and some demand is evidently growing for the larger labor-saving outfits. One jobber sold two carloads of washers last week. Interest in cleaners is picking up somewhat, and jobbers are beginning to order fans.

ATLANTA

Although a slight improvement is reported by the jobbing and other business interests in the section, business activities have not come up to the point that was anticipated, owing undoubtedly to the unfavorable weather which has existed for the last thirty days. It has been almost impossible to undertake and carry on with any degree of continuity out-door work of any kind, with the result that a great many of the building projects undertaken at the first of the year have progressed very little. This is reflected in the slackened demand for electric building material, lumber, brick and hardware lines and has served further to increase non-employment. Business, therefore, has been unable to show the normal increase to be expected at this season of the year. Taking the district as a whole, the valuation of building permits for January and February, 1922, compares favorably with the figures for the same period of 1921. While delayed, the building activities will get under way as soon as conditions will permit, and this will serve to improve sales in all lines. In the lines of manufacture it is reported that the overall manufacturers have sufficient orders in hand to continue operations for several weeks, with cotton hosiery showing but little change for the past ninety days. Brick and lumber products also show little change, while furniture manufacturers are on about 75 per cent capacity.

Lighting Fixtures.—Industrial types and the better class of commercial fixtures are moving quite satisfactorily, with an anticipated brisk demand for residential equipment. Stocks are in good shape with no recent change in prices.

Vacuum Cleaners.—This specialty has not responded to the expected spring demand, dealers hesitating to order in quantities for stock until conditions better themselves. Jobbers' stocks are good to heavy, with prices steady.

Insulators.—A fair demand in certain localities for insulators of the high-tension type is reported, but low-tension porcelain insulators are somewhat slow. The glass telephone type continue to move satisfactorily, with good stocks throughout the section.

Conduit.—Pipe continues a steady movement, the ½-in. type at present being the most popular, with an increasing demand in all the popular sizes, both black and galvanized, to be noted.

"Nail-It" Knobs.—A price reduction of 15 per cent is to be noted, effective last week, with the demand only fair. Jobbers have accumulated quite respectable stocks in the porcelain lines.

Safety Switches.—Safety switches continue very active as additional municipalities require them for all new installations. The 30-amp. two-wire and three-wire continue to lead in popularity, though all sizes up to 100-amp. three-pole are fast movers. Stocks of all sizes are good.

Cut-outs.—Cut-out prices have been reduced 10 per cent since last week. Sales are reported only fair because of inability to complete construction work recently started.

ST. LOUIS

Some improvement in sales was experienced by jobbers here last week, reflecting the general increased activity as spring approaches. Meters, distribution transformers, poles and cross-arms are being purchased in greater amounts by the central-station companies, indicating that an increase in load is expected, which will result in improved sales of electrical goods generally. Municipal extensions are dormant pending the spring elections, most of which will be held next month. Motors and other industrial goods show continual improvement in demand, and the call for wiring supplies is at least being steadily maintained.

Industrially and commercially the situation in this territory is somewhat improved. Employment is reported to have increased about 3 per cent in February over January, but non-employment still exists in virtually every line of endeavor except that of shoe manufacture. Several of the steel plants and iron foundries are now operating at about 50 per cent of capacity. Construction work is increasing in volume, and building wages are gradually declining. The ironworkers accepted a 15 per cent reduction last week, and the sentiment on the part of the other trades toward wage reductions is becoming more favorable. The buying power in this territory is gradually bettering as conditions in agriculture, the basic industry, become improved. The prices of farm products have increased about 20 per cent in the last six months, and the farmer should be in much better financial condition when this year's crops are harvested.

Porcelain.—Prices are materially reduced. Stocks are in good shape and the demand is steady, with slight improvement from week to week. "Nail-it" knobs are being sold for $15 per 1,000 in barrel lots. The 5/16-in. x 2½-in. tubes are priced at $3.75 per 1,000 in barrel lots, and the 5/16-in. x 3-in. tubes at $4.50 per 1,000. Two-wire and three-wire unglazed cleats sell for $10.70 per 1,000 in barrel lots, and 5½-in. split knobs for $10.70 per 1,000 in barrel lots. Leather nail heads are quoted at 35 cents per 1,000 in lots of more than 25.

Fuses.—A leading manufacturer reports that business is running about 40 per cent greater than this time last year. All jobbers report that the demand has been unusually good considering industrial conditions. Stocks have been weak but now are generally in good shape. Clear-window plug fuses sell from $2.75 to $3.65 per 1000 in lots of 1,000 or more. For orders of from 200 to 1,000 the price varies from $3 to $4 per 100.

Rigid Conduit.—The following prices obtain: ½-in. black, $4.35 per 100 ft.; ½-in. galvanized, $4.95 per 100 ft.; ¾-in. black, $5.50 per 100 ft.; ¾-in. galvanized, $6.30 per 100 ft. Stocks are in good shape, and the demand, while slow, is steady.

Conduit Boxes.—Typical quotations are as follows: 3¼-in. octagon black, $7 per 100; 3¼-in. octagon galvanized, $8 per 100; 4-in. octagon black, $8.50 per 100; 4-in. octagon galvanized, $9.50 per 100.

Lock Nuts and Bushings.—Prices are about 10 per cent lower. Representative quotations, in lots of 100, per 100, are: ½-in. lock nuts, 54 cents; ½-in. bushings, $1.35; ¾-in. locknuts, 78 cents; ¾-in. bushings, $1.80. Stocks are reasonable in size, considering the comparatively slow demand.

Wire.—The demand is virtually unchanged, by far the greater portion of the sales being of No. 14 rubber-covered. Quotations on solid, single-braid rubber-covered are about as follows, per 1,000 ft. in 5,000-ft. lots: No. 14, $6.25; No. 12, $8.50; No. 10, $11.25; No. 8, $15.05.

SAN FRANCISCO

The general trend of business is one of slow but steady improvement. Of course, there are occasional slight retrogressions and perhaps this past week may be considered one of them. Competition has never been so acute and constructive. In this district at least it has long recovered from the easy-order period of war times.

Weatherproof Wire.—Triple braid base sizes are being quoted in coil lots at $20.50 per 100 lb. with 1 cent per pound increase in 500 lb. lots. Local stocks are low on sizes No. 2 to No. 8 inclusive, with a steady distribution line demand from the power companies. Lower prices are being quoted on No. 14 single-braid solid rubber-covered. Quotations as low as $6.50 per 1,000 ft. in 2,500-ft. assorted lots have been reported, and special prices on application are made on $500 net assorted shipments.

Farm Plants.—The slight improvement noticed last fall has slumped to a poor sales volume, probably because former agents have drifted away to new fields. It is confidently expected that the distribution of the next crop will aid demand.

Porcelain.—This material is still in a state of flux, "nail-it" knobs being generally quoted at $18 per 1,000 in packages and 5/16-in. x 3-in. tubes at $5 per 1,000 lots. The demand is excellent. Jobbers' stocks are just now rather low but with good shipments en route.

Conduit Fittings.—New prices on bushings and lock nuts are being quoted in accordance with the present policy of giving as far as possible maximum prices on minimum orders. Sizes ½ in. to 1 in. inclusive are being quoted in cartons at about $1.50 per 100 on the ½-in. bushings and 65 cents per 100 on the lock nuts. The 1-in. sizes are quoted respectively at $3.70 and $1.50 per 100.

Conduit.—Conduit is unchanged from previous quotations. The call is very good. Local stocks are in good shape.

Heating Appliances.—Jobbers' sales of small appliances are improving. The public demand is a little better, but sales have been cut down because of cold weather, which is very unusual for California. Occasional normal days show bursts of selling. Heating pads, of course, have had perhaps their best season, with occasional shortages. Small flatirons in the 3-lb. and 1½-lb. size have been very popular. Small open-disk stoves, too, are very popular, not so much on account of lower prices as of better merchandising.

Sewing Machines.—From now until after Easter sales may be expected to improve considerably, although the market will not be stabilized until unsold machines of makes now retired from the market are disposed of. Such machines are usually quoted net at about $50 for the rotary style, whereas $75 is the average retail price for standard makes.

PORTLAND—SEATTLE

That the Pacific Northwest is coming back in a business way is clearly indicated by reports of bank clearings for the past two weeks. The clearings for Seattle for the week ended March 13 showed a gain of 28 per cent over the corresponding week of a year ago. Similar figures for the week ended March 2 showed a gain of 24 per cent over the year previous. Other cities in the Northwest all showed substantial gains over 1921 for the same weeks. Logging and lumbering continue to gain somewhat, both in the number of men employed in the industry and in the amount of business transacted.

Expenditures for highway construction throughout the State of Washington which will begin soon will total more than $1,750,000. This will furnish employment to a considerable number of men. Shipments of wheat from Portland are materially increasing this month. In the electrical trade some improvement in business is noted. One jobber with branch offices up and down the Coast has been carrying on an extensive advertising and educational campaign, the purpose of which is to educate home owners and contractors to the necessity for better wiring in order to secure maximum service from the completed installation. It is claimed that in an effort to meet the demand for cheap installations the number of convenience outlets installed has been kept down to not over one-half of the number necessary to get the best service. Results of the campaign are already becoming apparent.

Residence construction both in the city of Portland and in the surrounding country is very active, and jobbers report sales of rubber-covered wire, conduit and other wiring material as improving materially. The demand for radio equipment continues very active. There has been a slight drop in plug cut-outs and porcelain articles. Inquiries relative to new business are good.

Contractors generally throughout Oregon report business to be very slack, but with the large amount of projected building which will undoubtedly be started soon these conditions should mend in a very short time.

SALT LAKE CITY—DENVER

Coincidental with the development of road building projects to be launched soon in the Intermountain region, keen interest is being shown in electrical installations for highway illumination. The success attained in using high-power reflectors at dangerous curves and crossings has suggested the feasibility of lighting entire paved highway systems. It is believed that the power rate in this region would not make it at all prohibitive.

Although the money market is slowly easing, many electrical dealers throughout the Intermountain territory are still seriously handicapped by a very limited credit standing with jobbers, a condition that keeps the volume of sales at a low mark. There is a good demand for money for home building, with the banks in a fair position to handle well-secured loans. Builders' hardware and lumber are showing a decided pick-up with the near approach of spring.

Washing Machines.—The big drive continues on washers. Intensive competitive selling is having the effect of lowering retail prices. One well-known cylinder machine is now advertised at a reduction of $42.50. The volume of washer sales is good.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

General Electric Buys Western Factory Site

Another Western factory branch in the electrical field is seen in the announcement by the General Electric Company of the purchase of approximately 24 acres of land in East Oakland, Cal. The company states that no definite plans for the use of this site have been formulated, but it is understood that the property will be improved in line with the extension of manufacturing activities in Oakland.

For about ten years the company has manufactured "Mazda" lamps in its Oakland factory. It announces at the present time its confidence in the future of the Pacific Coast and that, looking toward this future growth, certain of its products will be made there.

Wireless Specialty Company Seeks New Home

The Wireless Specialty Apparatus Company, South Boston, Mass., has leased a five-story modern reinforced-concrete factory on Atherton Street, in the Jamaica Plain section of Boston, and will move into its new quarters about April 15. Increasing demand for radio equipment and the need of obtaining better facilities for quantity production led to the change. Soon after moving, more than twice the floor space at present utilized will be occupied in radio-equipment production, and ultimately about five times the present floor area will be employed. The company is carrying on investigations in the static-condenser field for power-factor correction in addition to its radio-equipment production.

New Plant for Electrical Foundry & Equipment

A new plant, estimated to cost about $200,000, including machinery, is now being constructed at Tacony and Bleigh Streets, Philadelphia, for the Electrical Foundry & Equipment Company. It will specialize in steel castings, with facilities to manufacture castings up to 200 lb. William P. Cunningham is president.

Gurney Elevators to Be Made by Brooklyn Company

The American Machine & Foundry Company has acquired a substantial interest in the Gurney Elevator Company, it is announced, and hereafter Gurney elevators will be manufactured in the plant of that company in Brooklyn, in addition to the Gurney Elevator Company's plant at Honesdale, Pa. This arrangement was brought about to provide increased manufacturing facilities for the growing business of the Gurney Elevator Company, partly because of its entrance into the field of high-speed gearless elevators. With these added facilities the Gurney Elevator Company will have one of the largest elevator manufacturing plants in the country.

Graton & Knight Increase Production Schedule

Improved business conditions have led to the establishment of a fifty-hour week at the plant of the Graton & Knight Manufacturing Company, Worcester, Mass. J. R. Fox, sales manager, informed the Electrical World recently that, although no boom has occurred in the demand for belting, a better tone is evident in sales and that orders are coming in at an improved rate from the East and South. The Middle West is still quiet. About 1,000 employees are now on the company's payroll.

Federal Trade Commission Dismisses Western Electric Complaint

The Federal Trade Commission has dismissed the complaint against the Western Electric Company, alleging unfair competition and violation of the tying-contract provision of the Clayton law.

The complaint against the Western Electric Company, which is understood to be the principal manufacturing agent of the American Telephone & Telegraph Company, was considered as far back as Jan. 5, 1921. Now it appears that legislation passed by Congress on June 10, 1921, affecting the consolidation of telegraph companies has made it uncertain that an effective order could have been issued in relation to the complaint against the company. One construction of this law is that it permitted in the consolidation of telephone companies acts which might otherwise have been looked on as violations of the Sherman law. The opinion has been expressed that where such consolidations by the telephone interests have been made legal it would be difficult to control the manufacturing interests involved.

In a statement issued to the press, the Western Electric Company states that the attorney of the commission after a thorough investigation lasting fourteen months failed to find any facts which would substantiate the original charges.

Results of Geier Company Price Questionnaire

Large Majority of Company's Dealers Against Any Substantial Cut as Dangerous to Sales Volume—Say Public Will Pay Fair Prices

There will be no change at the present time in the price of the vacuum cleaner manufactured by the P. A. Geier Company, Cleveland, as the result of a questionnaire on the subject of prices sent out to its dealers a short while ago and noted in the Electrical World at the time. A large majority of the dealers queried replied that more business could be done at the present price of the appliance than could be done were a substantial cut to be made. The exact feeling of the dealer in the matter of price is shown in an article by F. J. Gottron, sales manager of the company, in the latest issue of the company's house organ, which reads in part as follows:

"More than 69 per cent of the distributers, dealers and salesmen who replied to our questionnaire asking whether the price of Royal cleaners should be reduced have either suggested such a very slight concession that it would not affect the situation or else they came out emphatically, 'Don't change the price.' And since these dealers not only were in the majority as to numbers, but because they also represent more than 75 per cent of the sales, we are accepting their judgment as our guide. 'No price change' is the verdict of a jury of our most experienced and successful sales outlets. About 12½ per cent of Royal dealers, however, suggested a substantial cut. We studied these returns carefully with a view to finding exactly what lay behind their advice. In most cases we found just one reason—the fear of lower price competition. 'Other cleaners have reduced prices, and lots of people who want Royals are waiting for the Royal to reduce also,' is a characteristic explanation of this group of dealers.

"When people insist that they want lower price, many manufacturers and retailers commit the error of thinking that these people want cheaper merchandise. Not at all. The demand for lower price is based upon the conviction that the prevailing price is too high for the value of the merchandise. But that they will not pay $2 for a 25-cent article does not mean that they will refuse to pay $2 for an article worth 200 cents. You'll notice that the price of Liberty bonds, which went down when people were wasting their money, are now quoted around par when people are insisting on value. This great underlying truth, that the public will pay a fair price if it is given fair value, is the foundation of successful business."

Form New Jobbing Company

The Twin Cities Electric & Supply Company, Menasha, Wis., has discontinued its contracting business and will engage in the wholesaling of electrical supplies and equipment and mill supplies. The company was established in 1917 for the purpose of retailing electrical supplies, but found there was such a large field in the jobbing, contracting and milling supply branch of its business that it was decided to devote all of its attention to those lines. As an aid in handling this business the company has incorporated a subsidiary, the Wisconsin Electric Appliance Company, with a capital stock of $75,000. Plans are being made to open another establishment in Wisconsin. The officers of the company are: G. E. Lewis, president; H. E. Bullard, vice-president; V. M. Gombert, secretary-treasurer.

Savage Arms to Make Washing and Refrigerating Machines

Plans are under way, according to officials of the Savage Arms Corporation, 50 Church Street, New York, for that company to go into the production of electric washing machines and refrigerating machinery and parts. The company has plants at Utica, N. Y., and at Pittsburgh and for many years has been engaged in the manufacture of firearms and ammunition. Final plans for the entrance of the company into the electrical field have not been made as yet, and it will probably be several months before either of the plants will be ready to go into production of the new lines.

It is announced also that the Chicopee (Mass.) factory of the Westinghouse Electric & Manufacturing Company, which was used in the production of small armament during the war and operated under the same supervision as the plant at East Springfield, Mass., has been sold for $1,500,000 to the Savage Arms Corporation. The East Springfield factory was converted after the war to the requirements of peacetime production, and an article describing the electrical distribution and power problems of this transformation was published in the ELECTRICAL WORLD for Sept. 20, 1919, page 620. The East Springfield factory is now devoted to the production of electrical equipment for automobile starting and lighting, small motors, and radio apparatus under the direction of A. B. Reynders, works manager.

Whiting Corporation Announces Branch Changes

The Whiting Corporation, manufacturer of electric traveling cranes, Harvey, Ill., has established a branch office in New York City at 136 Liberty Street, having discontinued its agency agreement with Wonham, Bates & Company, who formerly had the Eastern representation of the company. J. Ross Bates, one of the vice-presidents of the Whiting Corporation, is in charge of the new office. He is to be assisted in the New York territory by D. Polderman, Jr., and in the New England States by R. C. Maley, who will open an office at Springfield, Mass. These three men were formerly associated with Wonham, Bates & Company. Another branch office has been opened in Indianapolis at 305 Merchants' Bank Building, in charge of S. E. Stout, who was formerly at the main office, Harvey, Ill. This office will have charge of the business in southern Indiana and adjoining cities in Ohio and Kentucky. The Detroit office of the company has been moved from the Penobscot Building to 206 Stahelin Building.

Refractories Manufacturer Established

The Keystone Refractories Company has been formed with offices at 120-122 Liberty Street, New York, to manufacture high-temperature cements and granular refractories. The company will have a factory in Jersey City. F. W. Reisman, formerly traveling sales manager of the Quigley Furnace Specialties Company, is president and general manager, and L. E. Turk, formerly treasurer of the Quigley company, is secretary and treasurer.

Balancing Machine Manufacturer Wins Patent Suit

Decision has been rendered for the plaintiff in the United States District Court for the Eastern District of Pennsylvania, according to the Tinius Olsen Testing Machine Company, 500 North Twelfth Street, Philadelphia, in the suit brought by that company against the Vibration Specialty Company and Nicholas Akimoff for infringement of patents owned by the Olsen company. The defendants in that suit, T. Y. Olsen, vice-president and treasurer of the Olsen company, says, are now under injunction, and an accounting for damages and profits has been ordered.

International Combustion Notes Increasing Foreign Demand

World-wide demand for the products of the International Combustion Engineering Company, New York, and its foreign subsidiaries is indicated by dispatches recently received from London showing that in December the company received contracts for installing stoking equipment in almost every large construction project undertaken in England. This included equipment for new power houses at Belfast, Ireland, and Nottingham, England, and for the Morwell power station, Melbourne, Australia—three contracts which alone total close to $420,000 worth of business at normal exchange rates. The company also has just received a large order for stokers and ash conveyors for India and is working on another large project for Johannesburg, South Africa. The officials of the London subsidiary report that the present outlook for new business is better than it has been in several years.

Westinghouse to Erect St. Louis Warehouse

Plans have been announced whereby the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., will consolidate its St. Louis warehouse, service shop and offices in a new building which is to be erected for it at Twelfth and Gratiot Streets, at a cost of about $150,000. According to J. S. Tritle, manager of the St. Louis branch, the new building, which will be a three story, reinforced-concrete structure, will allow the company to expand its St. Louis business and will result in the employment of about sixty more men. Provision will be made for the erection of two additional stories later if needed. In the new quarters the company plans to enlarge the service department and to include the manufacture of panelboards.

McClellan & Junkersfeld, Inc., consulting engineers, have announced that permanent headquarters have been established at 45 William Street, New York. The formation of the organization, headed by William McClellan, Peter Junkersfeld and Horace T. Campion, was described on page 348 of the Feb. 18, 1922 issue of ELECTRICAL WORLD.

The Autovent Fan & Blower Company, manufacturer of ventilating fans and blowers, Chicago, has opened a direct factory branch office in Cleveland at 508 Fidelity Mortgage Building. L. B. Dewey, formerly with the Westinghouse Electric & Manufacturing Company has been appointed manager.

The Dominion Engineering Agency, 24 Adelaide Street, East Toronto, Canada has been formed to represent manufacturers in the Canadian territory. The company is now the representative of the Cutter Electrical & Manufacturing Company and Schweitzer & Conrad, Inc. Daniel M. Fraser is president of the company.

William R. Noe & Son, manufacturers of lighting fixtures, 43 East Tenth Street New York, have purchased 16,000 sq.ft. of property at Willoughby Avenue and Raymond Street, Brooklyn. Plans are being prepared to improve the property with a three-story reinforced concrete factory for their own occupancy.

The Yale & Towne Manufacturing Company, Stamford, Conn., has transferred C. H. Pearson and C. B. Veit, formerly district managers, in the New England and Chicago territories respectively. Mr. Pearson will cover Arizona, Colorado, California, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming, Alberta and British Columbia. Mr. Veit will cover New England, and in Canada the territory east of Montreal, including New Brunswick, Nova Scotia and Prince Edward Island, as well as Newfoundland. Both Mr. Pearson and Mr. Veit have been with the Yale & Towne organization about fifteen years

Foreign Trade Notes

ELECTRICAL DEVELOPMENTS IN AUSTRALIA.—A bill authorizing the Lawson Ministry to borrow £2,000,000 for the purpose of carrying out the projects and undertakings of the State Electricity Commission of Victoria, *Electrical Industries* states, has been approved by the Victorian House of Assembly. Practically all tenders have been awarded for the larger sections of the electricity scheme.

POWER DEVELOPMENT OF THE RIVER RHONE. — A report from Commercial Attaché W. C. Huntington at Paris to the Department of Commerce contains detailed information regarding the harnessing of the River Rhone for power, navigation and irrigation purposes. An outline of France's wealth in waterpower is given, with particular reference to the River Rhone as the most important source of potential hydro-electric power in France. The total cost of the proposed developments is placed at 1,848,000,000 francs. The financing of this project will be accomplished by a gradual carrying out of the entire scheme, extending over a period of years. Copies of the above report and of the law authorizing the power development, etc., may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, or from the bureau's district offices, by referring to Exhibit No. 1178.

ELECTRIC EQUIPMENT FOR CALCUTTA, INDIA. — At a meeting held Jan. 25 the stockholders of the Calcutta Electric Supply Corporation, Ltd., according to *Commerce Reports*, decided to expend £500,000 for additional power equipment to extend its service. The equipment loan is to be facilitated by a loan from the treasury and by a guarantee on behalf of the government of both capital and interest.

CHILEAN RADIO CONTRACT INEFFECTIVE. — The contract entered into between the government of Chile and the Siemens-Schuckert Company, the American Embassy, Santiago, Chile, has informed the Department of State, will become ineffective at the termination of the present session of the Chilean Congress, on or about April 1 through lack of an appropriation. New bids will then be invited and proposals from American firms will be welcome. The contract with the Siemens-Schuckert Company called for the installation of eleven radio stations, which were to be of the Telefunken type and would cost 1,385,000 gold pesos of 18d ($505,525 at par of $0.365). The above contract caused considerable objection because it called for a change from the Marconi type, with which all wireless stations of Chile are equipped, to the Telefunken type.

AMERICAN FIRMS LOSE NEW ZEALAND ELECTRIC CONTRACTS.—Owing to the effects of the adverse rate of exchange, combined with the New Zealand government's avowed policy of giving preference to British manufacturers wherever possible, the *Journal of Commerce* states, the contracts for the Mangahao hydro-electric station were awarded to a British company, although the tenders submitted by the National Electric Company, which handles the business of the General Electric Company in New Zealand were lower than those of the English company. The prices in question were as follows: For generators—accepted, British, £54,968; rejected, American, £40,000; transformers—accepted, British, £16,574; rejected, American, £15,500; difference in price in favor of American tenders, £16,192. Quality was not in question. The American quotation was at $4.20. The National Electric Company strongly protested against this preference, pointing out that while it was accustomed to reckon that 10 per cent preference was the usage, this was a case, as to generators, of 37½ per cent. It was also pointed out that the products of the General Electric Company were already in extensive use in the various electric undertakings and had been specified by the government engineers, irrespective of price. Moreover, they were popular throughout New Zealand in public and private plants. The answer of the Minister of Public Works was: "With regard to settlement of public tenders particular stress is laid on preference to British goods, especially in view of financial relations and the shipping position existing between this dominion and the mother country at the present time. It would not, however, be correct to infer that no tender other than British would be considered, irrespective of price." The matter was raised in Parliament when the American tenders were mentioned. The Minister then said the government preferred where possible to give preference to British goods made by British workmen. A contract for lightning arresters was obtained by the National Electric Company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile corporation in Austria (No. 1,057) desires to obtain a forwarding agency for the sale of electrotechnical articles, tools of all kinds, etc.

A manufacturing firm in Spain (No. 1,059) desires to purchase small electrical supplies, pistol-shaped flashlamps (enameled back) and storage batteries. An agency for the sale of these goods is also desired.

A firm of hardware merchants in Canada (No. 1,062) desires to obtain an agency on commission for the sale of electrical novelties, etc.

Agencies are desired by an importer in Australia (No. 1,076) for the sale of electrical goods, specialties and motor accessories.

New Apparatus and Publications

WATER HEATER. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has placed on the market a small electric immersion waterheater, designed to heat a small quantity of water quickly. The voltage of the heaters is from 110 to 120 and the wattage is 350.

STOKER.—The Combustion Engineering Corporation, New York City, is distributing a leaflet describing its type K automatic stoker.

PULVERIZED FUEL. — The Hardinge Company, 120 Broadway, New York City, is distributing catalog No. 12, which describes the preparation, transportation and burning of pulverized fuel as obtained by the Quigley fuel system, manufactured by this company.

LIGHTING FIXTURES.—The Mid West Chandelier Company, Kansas City, Mo., has issued catalog No. 10, describing and illustrating the line of lighting fixtures manufactured by it.

MOTORS. — The Baldor Electric Company, 4,351 Duncan Avenue, St. Louis, has prepared Bulletin No. 3, describing its type R repulsion induction electric motors.

INSTRUMENTS. — The Pyrolectric Instrument Company, Trenton, N. J., is distributing catalog No. 19, containing information upon its electrical precision instruments, hydrogen-ion apparatus, laboratory accessories, pyrometers and electric furnaces.

MOTOR. — The France Manufacturing Company, Berea Road and West 104th Street, Cleveland, has recently placed on the market an ⅛-hp. "F-F" synchronous motor.

SIGNAL SYSTEM. — The Connecticut Telephone & Electric Company, Meriden, Conn., has recently placed on the market a complete hospital nurses' silent-call system.

WASHING MACHINE.—The Blackstone Manufacturing Company, Jamestown, N. Y., has placed on the market an electric washing machine, under the name of the "American Classic."

TEST UNIT. — The Beehler Electrical Equipment Company, Yuma, Col., has recently placed on the market a motor and generator testing unit.

New Companies

THE JENNINGS (LA.) UTILITIES COMPANY has been incorporated with a capital stock of $75,000. The officers are: Fred I. Getty, president; J. O. Modisette, vice-president, and D. E. Nims, secretary and manager.

THE WILLOUGHBY (OHIO) LIGHT & POWER COMPANY has been incorporated by R. W. Russell, L. E. Peck, Winfield Worline, W. A. Steong and J. L. Donnelly.

THE NEBO (KY.) LIGHT COMPANY has been incorporated with a capital stock of $3,000 by L. J. Morrow, J. W. Stevens and J. H. Herron.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 21, 1922)

1,407,313. APPARATUS FOR ELECTROLYSIS; Edward A. Allen, Portland Me. App. filed Feb. 15, 1919. For decomposing compounds by electrolysis.

1,407,353. TROLLEY; Louis T. Outhier, Eureka, Cal. App. filed June 4, 1921. Trolley-pole wheel fastened on rocker arm.

1,407,363. RECTIFIER; Russell T. Walker, Chicago, Ill. App. filed June 28, 1920. For single-phase alternating current.

1,407,383. METHOD OF OPERATING STORAGE BATTERIES, ETC.; John L. Creveling, Auburn, N. Y. App. filed July 13, 1915. Automatic charger.

1,407,386. DRY CELL; Henry R. Dam, Brooklyn, N. Y. App. filed June 21, 1920. Electrodes are separated while inactive.

1,407,420. EXTRACTION AND RECOVERY OF COPPER; Noak V. Hybinette, Ottawa, Ontario, Canada. App. filed Feb. 15, 1921. Electrolyzing roasted ore with sulphuric acid.

1,407,430. ELECTRIC IRON FITTED WITH A CURRENT INDICATOR; George H. Lofts, Hobart, Tasmania, Australia. App. filed Sept. 21, 1920. Indicates when power is on.

1,407,489. PRIMARY BATTERY; William M. Shakespeare, South Orange, N. J. App. filed May 6, 1920. Means for indicating energy available.

1,407,508. ELECTRIC MOTOR; Vincent G. Apple, Dayton, Ohio. App. filed Aug. 6, 1919. Sewing-machine motor.

1,407,527. ELECTRIC FIXTURE FITTING AND METHOD OF MAKING SAME; David Goldich, Winsted, Conn. App. filed Aug. 27, 1920.

,407,564. APPARATUS FOR DISPLAYING LIGHT ADVERTISEMENTS; Bertel A. Nielsen, Kvissel, Denmark. App. filed Nov. 11, 1919. Stereopticon lantern with rotating disk.

1,407,572. TELEGRAPH TRANSMITTER; Charles Phillips, Jr., Philadelphia, Pa. App. filed Oct. 18, 1920. Operated as a typewriter.

1,407,604. REPEATER CIRCUIT; John F. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Connected to and disconnected from telephone circuit by operator.

(Issued Feb. 28, 1922)

15,297 (reissue). ELECTROLYTIC APPARATUS; Henri Tobler, Hackensack, N. J. App. filed Dec. 30, 1921. For producing bromine from natural brine.

1,407,692. HEATING UNIT FOR ELECTRICALLY HEATED TOOLS; Frank Kuhn, Lawrence Thomas and Jules G. Spiess, Detroit, Mich. App. filed May 27, 1920.

1,407,693. INSULATION-TESTING DEVICE; John A. Heany, New Haven, Conn. App. filed Dec. 6, 1918. Tests continuity of insulating sheath on wire as fast as made.

1,407,722. ELECTRIC SOLDERING IRON; William A. Braun, Dover, Ohio. App. filed Oct. 22, 1919. Means for two different heats.

1,407,726. THERMOPHONE AND METHOD OF MAKING IT; Theodore C. Browne, Belmont, Mass. App. filed April 26, 1920. Use carbon for the conductors.

1,407,761. ELECTRIC-ARC-STRIKING MECHANISM; Clarence M. Langfeld, Baltimore, Md. App. filed May 13, 1919. Operates automatically.

1,407,794. METHOD OF MANUFACTURING ONE-PIECE RUSTLESS KNIVES FOR TABLE USE; Robert T. Lee, Northampton, Mass. App. filed Oct. 16, 1919. Steel blade welded to non-ferrous handle.

1,407,804. MEANS FOR OPERATING ELECTROMAGNETIC RECIPROCATING TOOLS WITH PULSATING DIRECT CURRENT; Henry Poth, Cincinnati, Ohio. App. filed July 25, 1919. Special tool and generator.

1,407,887. TESTING MACHINE FOR DIELECTRIC OBJECTS; Ernest A. Pigeon, Akron, Ohio. App. filed Dec. 13, 1920. Battery jars tested with metal mandrel.

1,407,892. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed Oct. 11, 1914. Applied to associate multiple.

1,407,900. APPARATUS FOR ELECTRIC WELDING; Richard Stresau, Wauwatosa, Wis. App. filed July 17, 1920. Current regulated by solenoid around movable electrode.

1,407,918. ELECTRIC HEATING ELEMENT; Pierre J. H. Bernard, Montreal, Quebec, Canada. App. filed Dec. 9, 1920. For room heater.

1,407,937. REVOLVING CONNECTOR FOR ELECTRIC CURLING IRONS; Maurice F. Fitzgerald, Torrington, Conn. App. filed June 25, 1920.

1,407,953. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed May 6, 1918. Automatic starting device for converters.

1,407,958. DIRECT-CURRENT MOTOR AND GENERATOR; Greenwood Stirk and John G. Stirk, Halifax, England. App. filed Sept. 18, 1920. Single-pole, two-way switch for field.

1,407,983. METHOD OF AND MEANS FOR DETERMINING UNBALANCE; Alva B. Clark, Brooklyn, N. Y. App. filed July 10, 1920. Of impedance on communication lines.

1,407,985. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 14, 1917. Automatic machine switching.

1,408,040. REGULATION OF ELECTRICAL APPARATUS; Byron W. St. Clair, Lynn, Mass. App. filed Feb. 13, 1920. Speed control for motor-generator, converters or motors.

1,408,046. TELEPHONE SYSTEM; Horace W. Ulrich, East Orange, N. J. App. filed July 11, 1919. Long lines equipped with amplifiers.

1,408,048. TROLLEY-CONDUCTOR CLAMP; Nils J. A. Wahlberg, Wilkinsburg, Pa. App. filed March 31, 1920. For grooved wire.

1,408,053. HOT-CATHODE APPARATUS; Roy J. Wensley, Edgewood Park, Pa. App. filed Aug. 8, 1919. Double-anode rectifier tube.

1,408,071. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw, Wilkinsburg, Pa. App. filed Aug. 7, 1917. Excess-demand meters of induction type.

1,408,118. APPARATUS FOR PRODUCING MODIFIED CURRENTS, ETC.; Friedrich W. Meyer, Milwaukee, Wis. App. filed Feb. 1, 1918. Frequency converter.

1,408,119. ELECTRICAL MEASURING INSTRUMENT; John H. Miller, Wilkinsburg, Pa. App. filed Aug. 11, 1917. Excess power over a predetermined value measured.

1,408,125. TELEPHONE EXCHANGE SYSTEM; George E. Mueller, La Grange, Ill. App. filed Nov. 29, 1920. Automatic machine switching.

1,408,140. DRY BATTERY; Walter B. Schulte, Madison, Wis. App. filed March 13, 1919. Several cells arranged vertically within individual compartments.

1,408,141. ELECTROLYTIC APPARATUS; George O. Seward, Niagara Falls, N. Y. App. filed Oct. 11, 1917. Process for electrodepositing magnesium from salts.

1,408,142. ELECTROLYTIC APPARATUS; George O. Seward, Niagara Falls, N. Y. App. filed Oct. 11, 1917. Process for electrodepositing magnesium from salts.

1,408,158. COLLECTOR LIFTING MECHANISM; Samuel Arnold, 3d, Ben Avon, Pa. App. filed Sept. 22, 1921. For disconnecting crane trolley shoes.

1,408,183. ELECTRIC HEATER FOR OUTDOOR USE; Edward A. Everett, New York, N. Y. App. filed March 13, 1919. For thawing frozen railroad switches, etc.

1,408,196. ELECTRIC HEATER FOR THAWING PIPES; Albert C. Hoffman, Huntington, Ind. App. filed March 5, 1921. Half cylinder to fit pipe.

1,408,211. SYSTEM OF SPEED REGULATION AND CONTROL OF INDUCTION MOTORS; Harry A. Laycock, Schenectady, N. Y. App. filed Aug. 8, 1919. For sugar, paper or rubber mills.

1,408,255. DEMAND METER; Clarence A. Boddie, Pittsburgh, Pa. App. filed Sept. 9, 1916. Logarithmic average-value type.

1,408,268. ELECTRIC APPLIANCE; Hoyt Catlin, Bridgeport, Conn. App. filed March 26, 1920. Terminal block and switch used on grills, etc.

1,408,308. HEATING ELEMENT FOR INCUBATORS; Rowland P. Rhodes, Indianapolis, Ind. App. filed March 5, 1921. Covers entire top area.

1,408,364. MANUFACTURE OF PERBORATES; Johann K. Langhard, Fredriksstad, Norway. App. filed Feb. 6, 1920. By electrolysis of borate solutions.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

SEDGWICK, ME.—A committee has been appointed to confer with the officials of the Bar Harbor & Union River Power & Light Company in regard to extending its service to Sedgwick.

BROOKLINE, MASS.—Electrical and mechanical equipment will be installed in the addition to be erected at the high school, Tappan Street and Welland Road, to cost $550,000. French & Hubbard, 260 South Street, Boston, are engineers.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has filed plans for the erection of a two-story switching plant at Western Avenue and Blackstone Street, to cost $161,000.

MALDEN, MASS.—The Malden & Melrose Gaslight Company has received permission from the Department of Public Utilities to issue $651,700 in stocks, the proceeds to be used for extensions and improvements in its system. The company has tendered an offer to the Council at Wakefield, Mass., for the purchase of its municipal electric plant and gas works for $300,000.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company has applied to the Department of Public Utilities for permission to issue $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

WORCESTER, MASS.—Plans are under way by the Worcester Electric Light Company for doing a large amount of underground conduit work this spring and summer.

HARTFORD, CONN.—The Hartford Electric Light Company has submitted a recommendation to the street commissioners relative to placing its overhead wires in underground conduits, involving an expenditure of $206,000 during the next two years, of which $106,000 would be spent in 1922 and $100,000 in 1923. Samuel Ferguson is president.

Middle Atlantic States

BUFFALO, N. Y.—The Council is arranging a new street-lighting contract with the Buffalo General Electric Company and plans to extend the use of magnetite lamps in other districts and to replace gas lamps with electric lamps.

HUDSON, N. Y.—The Hudson City Steel Corporation, 233 Broadway, New York, will build a power house in connection with its proposed steel works at Hudson, comprising six one-story buildings, to cost $1,000,000. Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York, are engineers.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has issued $700,000 in bonds, the proceeds to be used for extensions and improvements.

LONG BEACH, N. Y.—A power house will be installed in the hotel to be erected by the Alexandria Hotel Construction Company, to cost about $1,000,000. Severance & Van Alen, 372 Lexington Avenue, New York, are architects.

NEW YORK, N. Y.—The Long Island Lighting Company, 50 Church Street, is arranging a fund of $1,000,000 for extensions and improvements.

NEW YORK, N. Y.—An appropriation has been granted by the Board of Estimate for the installation of a new fire signal system in the Bronx.

NEW YORK, N. Y.—The New York Central Railroad Company will receive bids until March 22 for lead-covered cable and copper wire, etc. W. C. Bower, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—Hugh L. Cooper & Company, 101 Park Avenue, consulting engineers, have submitted a proposition to the International Joint Commission, Toronto, Ont., for the construction, by private interests, of a power dam and hydro-electric generating plant on the St. Lawrence River, near Morrisburg, Ont., to cost about $75,000,000, including transmission system. Other plants are to be constructed later to provide an aggregate of 100,000 hp.

OLEAN, N. Y.—A power house will be built by the Vacuum Oil Company, 61 Broadway, New York, in connection with extensions to its local oil plant, to cost about $1,000,000.

BLOOMFIELD, N. J.—A power house, 65 ft. x 165 ft., will be constructed by the Clark Thread Company, 260 Ogden Street, Newark, N. J., at its new bleaching plant to be erected at Bloomfield, to cost about $200,000. The equipment will include two 500-hp. boilers and a 500-kw. generator, with auxiliary equipment.

LIVINGSTON, N. J.—The Morris & Somerset Electric Company, Morristown, has been granted a franchise to install a street-lighting system in Livingston.

PATERSON, N. J.—A power house will be installed in the factory to be erected by the Paterson Industrial Development Company, 5 Colt Street, to cost about $400,000.

STOCKTON, N. J.—The Eureka Power Company, Yardley, Pa., has applied for a franchise in Stockton. The transmission system will be extended from Lawrenceville, N. J. It is expected to extend the lines to Rosemont, Sergeantsville and vicinity.

ALLENTOWN, PA.—Officials of the Pennsylvania Power & Light Company have organized subsidiary electric companies to operate at Miners' Mills and Plains and have filed application for state charters.

HARRIMAN, PA.—The Eastern Pennsylvania Gas & Electric Company, Bristol, Pa., is considering extending its system to Harriman.

LEHMAN, PA.—The Lehman Electric Company, recently organized, is planning extending its lines to a number of towns in this section.

PHILADELPHIA, PA.—Martin H. Walrath & Son, Park and Glenwood Avenues, will build a power house at their new woodworking plant to be erected on Indiana Avenue.

PHILADELPHIA, PA.—Power equipment, motors, etc., will be installed in the first unit of the four-story mechanical building to be erected by the Public Ledger Company, Independence Square, at Seventh and Sansom Streets, to cost about $2,000,000, with equipment.

PHILADELPHIA, PA.—An electric power plant will be constructed by Albert M. Greenfield & Company, Fifteenth and Chestnut Streets, on property acquired at Fifteenth and Ionic Streets, in connection with an eighteen-story office building to be erected on an adjoining site. The complete project will cost $4,000,000.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Washington, D. C., Navy Department, has awarded a general contract to the Herman Mayer Company, Inc., 105 Walnut Street, for extensions and improvements in the power plant at the local navy yard, to cost $238,889.

BALTIMORE, MD.—The J. L. Gilbert & Brother Lumber Company, Eastern and East Falls Avenue, will erect a power house at its new plant in the Union Stock Yard district. A site of 9 acres has been acquired.

BALTIMORE, MD.—The Board of Awards, care of Richard Gwinn, city register, City Hall, will receive bids until March 22 for 300,000 ft. of six-way, multiple vitrified conduit. Charles F. Goob, City Hall Annex No. 1, is chief electrical engineer for the commission.

HAGERSTOWN, MD.—The Council is considering the erection of a new municipal electric plant to replace the present station, for which bonds were voted several months ago.

SPENCER, W. VA.—The Council plans the construction of an electrically operated pumping plant, in connection with new sewage-treatment works. C. E. Collins, Drexel Building, Philadelphia, Pa., is engineer.

ATHENS, W. VA.—The Council is preparing plans for the erection of an electrically operated pumping plant in connection with a new waterworks system. C. E. Collins, Drexel Building, Philadelphia, Pa., is engineer.

WASHINGTON, D. C.—The Bureau of Supplies and Accounts, Navy Department, will receive bids until March 28 for 100 battery-charging panels for the Washington and Puget Sound Navy Yards (Schedule 9505); also for 60,000 lb. of grain magnesite for lining and relining of electric furnaces at the Philadelphia Navy Yard (Schedule 9503).

WASHINGTON, D. C.—The office of the chief signal officer, United States Army, will receive bids until March 21 for 300 cranks for generators, 120 folding cranks for generators and 105 generators. (Proposal 10017-28 CP.)

North Central States

DETROIT, MICH.—The Detroit Sand Lime Brick Company, 507 Vinton Building, will build a power house in connection with its new plant at River Rouge, for which bids will soon be asked.

PONTIAC, MICH.—A power house will be erected by the Corodium Sand Lime Brick Company, recently organized, at its new local plant.

DAYTON, OHIO—Motors and other electrical equipment will be installed in the new baking plant to be erected by the Holland Bread Company, Toledo, Ohio, on South Ludlow Street, to cost about $225,000. A. E. Craig is manager.

OTTAWA, OHIO.—The installation of a municipal electric-lighting plant in Ottawa is under consideration.

TIPPECANOE, OHIO.—An election will soon be called to submit to the voters the proposal to issue $60,000 in bonds for rebuilding and enlarging the municipal electric light plant and water works.

VAN WERT, OHIO—An electrically operated pumping plant will be installed at the proposed sewage-disposal plant and sanitary sewerage system, for which plans are being drawn.

LEACH, KY.—A power plant will be constructed by the Great Eastern Refining Company in connection with its new local oil refinery, to cost about $250,000.

EAST CHICAGO, IND.—The installation of a street-lighting system on Forsythe Avenue is under consideration by the Board of Public Works.

INDIANAPOLIS, IND.—Bids will be received by the Board of Sanitary Commissioners, Sanitary District of Indianapolis, City Hall, until March 30 as follows: (a) Three 400-hp.-each water-tube boilers, equipped with super heaters, soot blowers and appurtenances; (b) three chain-grate stokers with accessories; (c) three steam turbine blowers, 16,000 cu.ft. per minute capacity each; (d) two steam turbine-driven generators, 500 kw. each, including separate excitation units; (e) five surface condensers, approximately 750 sq.ft. cooling surface each, complete with air and condensate pumps; (f) one switchboard of six or more panels, with instruments; (g) mechanical equipment for sludge removal for concentrate thickener tanks; (h) mechanically operated weir gates and weir control for fine screen clarifiers; (i) four drilled wells, 12 in. diameter and approximately 88 ft. deep, fully cased and equipped with well screens as provided. Charles H. Hurd, 1403 Merchants' Bank Building, Indianapolis, is consulting engineer. Jay A. Craven is president of board.

LAFAYETTE, IND.—The Northern Indiana Gas & Electric Company has tendered a proposal to the receiver for the property of the Lafayette Public Service Company. Permission has also been asked of the Public Service Commission.

MATTESON, ILL.—A power house will be erected by the Mid-West Box Company, 111 West Washington Street, Chicago, in connection with its new local plant, to cost about $300,000. K. I. Herman is in charge.

PEORIA, ILL.—Preliminary plans are under way for the erection of a new power house in Peoria for the Illinois Traction System, to cost about $500,000.

MADISON, WIS.—Plans are being prepared by the Wisconsin River Power Company for the erection of a 33,000-volt transmission line from Dane to the Beaver Dam, 35 miles long, and also an outside substation at Columbus.

MILWAUKEE, WIS.—The American Hide & Leather Company, Fourteenth Street, is completing plans for the erection of a one-story power house, in connection with the rebuilding of its local tannery, comprising four buildings, to cost about $600,000. Lockwood, Greene & Company, 38 South Dearborn Street, Chicago, are architects and engineers.

CLARKFIELD, MINN.—The Council is having plans prepared for an electric distributing system. C. L. Pillsbury, 1200 Second Avenue, Minneapolis, Minn., is engineer.

GRANITE FALLS, MINN.—The Council is considering plans for extensions and improvements in the municipal electric system.

DAVENPORT, IOWA—The Tri-City Railway & Light Company has arranged for a bond issue, part of the proceeds to be used for extensions and improvements. Frank T. Hulswit is vice-president.

EAGLE GROVE, IOWA.—The Council is arranging for a special election to vote bonds for the erection of a municipal light and power plant.

COLUMBIA, MO.—The Board of Trustees, University of Missouri, has awarded a general contract to Collins Brothers, 536 Rialto Building, Kansas City, Mo., for the erection of a power house, to cost $150,000.

JEFFERSON CITY, MO.—The Jefferson City Light, Heat & Power Company contemplates extensions and improvements in its electric system to cost about $75,000, including the installation of new boilers, stokers and extension of transmission line.

KENNETT, MO.—The Caruthersville & Kennett Light & Power Company is planning for extensions and improvements in its plant and transmission system to cost about $100,000. The lines will be extended to Rector, Ark., and vicinity.

ST. CHARLES, MO.—A special election will be held on March 25 to vote on a bond issue of $250,000 for municipal improvements, of which $175,000 will be used for the construction of a municipal light and power plant.

DEVILS LAKE, N. D.—The Midwest Power Company has tentative plans under way for the construction of an addition to its power plant, including the installation of new machinery. R. W. Dyson is manager.

WOOD LAKE, NEB.—Bonds to the amount of $29,700 have been voted for the construction of a municipal electric light plant and waterworks system. The town has been without electric service since the plant of the Wood Lake Electric Light & Power Company was burned down about six weeks ago.

PARSONS, KAN.—Bids will be received by the City Commissioners until March 28 for pumping machinery, electrical equipment, etc., for waterworks system, including a 3,000,000-gal. crank and flywheel opposed-type pumping engine; 1,000 gal. and 1,800-gal. motor-driven centrifugal pumps and electrical equipment for the Neosho River pumping station; 1,400 gal. and 2,100-gal. motor-driven centrifugal pumps; two 180-kva. engine-driven generators; two 150-hp. water-tube boilers, with accessories and electrical equipment. Burns & McDonnell, 402 Interstate Building, Kansas City, Mo., are consulting engineers. F. W. Frye is city clerk.

WICHITA, KAN.—The Kansas Gas & Electric Company has arranged for a bond issue of $8,000,000, a portion of the proceeds to be used for extensions and improvements to its system. F. G. Sykes is vice-president.

Southern States

GREENVILLE, N. C.—The Board of Water and Light Commissioners has plans in progress for the installation of a new street-lighting system. E. E. Williams is superintendent.

RALEIGH, N. C.—The Carolina Power Company, recently organized by officials of the Carolina Power & Light Company as a subsidiary, has plans under way for the erection of a power dam, 1,000 ft. long and about 100 ft. high, on the Pee Dee River, near Babin, N. C., and hydro-electric power plant, with maximum capacity of 35,000 hp. The cost of the project is estimated at 2,000,000 and will include a transmission line to connect with the present 100,000-volt system of the parent organization. Charles E. Johnson is president of both companies.

WENDELL, N. C.—The North State Power Company is planning for the rebuilding of the portion of its power plant destroyed by fire March 5, with loss estimated at about $25,000.

SUMMERVILLE, GA.—The Summerville Cotton Mills are planning for the erection of a hydro-electric power plant on the Chattanooga River for mill and general commercial service. John D. Taylor is president of the cotton mills.

WEST POINT, GA.—The West Point Manufacturing Company is considering the construction of a hydro-electric power plant on the Chattahoochee River, near the site of its present station.

FERNANDINA, FLA.—A special election will be held April 4 to vote on a bond issue of $37,000 for extensions to the municipal electric plant, ice plant and waterworks, of which about $20,000 will be used for the electric plant.

EUPORA, MISS.—The Council has engaged Xavier A. Kramer, Magnolia, engineer, to prepare plans for extensions in the street-lighting system, to cost about $25,000.

CUMBERLAND, TENN.—The Cumberland Power Company has closed a contract with the Tennessee Power Company, Parksville, for power supply, and will build a transmission line about 50 miles long to connect with the Tennessee system. A local substation will be constructed. The entire work is estimated to cost about $125,000. G. S. Nunamaker is vice-president. Cumberland has not a postoffice.

BEEVILLE, TEX.—The Beeville Electric & Ice Company contemplates the construction of an addition to its power plant, to cost about $30,000.

HUGO, TEX.—The Hugo Ice & Light Company is planning to erect a transmission line, about 17 miles, to the Fort Towson section, to cost about $32,000. J. C. Meadors, 1302 Southwestern Life Building, Dallas, Tex., is engineer.

DALLAS, TEX.—Improvements contemplated by the Dallas Power & Light Company include the erection of a cable from the main power plant up Trinity River to Commerce Street to the Jackson Street station, to cost $53,000; installation of a motor-generator set in the East Dallas power station, $41,500, and the erection of an electric transmission line to Trinity Heights to connect with the line of the Texas Power & Light Company.

Pacific and Mountain States

PORT MOODY, WASH.—The Thurston & Flavelle Company contemplates the construction of a power plant and the installation of motors and other electrical equipment in the various departments of its lumber mill, to cost about $60,000. Port Moody has not a postoffice.

BETZEN, ORE.—The Monroe Shingle Company is planning to rebuild at once its shingle mill, destroyed by fire last year. The plans include a power plant and equipping the entire plant with electrically driven machinery. The cost is estimated at about $100,000. Betzen has not a postoffice.

FAIR OAKS, CAL.—The Carmichael Irrigation District has rejected all bids submitted for electrically operated pumping machinery for its irrigation system. New bids, it is understood, will be asked for at an early date.

MODESTO, CAL.—The directors of the Modesto Irrigation District have authorized C. A. Hilton, president, to execute contracts with the Sierra & San Francisco Power Company for a right-of-way for an electric transmission line to the drainage pumping stations to be installed by the district.

RICHMOND, CAL.—The Galena Signal Oil Company, Franklin, Pa., will build a power house in connection with its new oil refinery, to cost about $500,000. Charles A. Miller, superintendent of the Franklin refinery, is in charge.

SAN BERNARDINA, CAL.—The Santa Fe Railroad Company, Kerckhoff Building, Los Angeles, will build a power plant at its shops, to cost in excess of $75,000.

SAN LEANDRO, CAL.—The Council is planning for the extension of the ornamental street-lighting system on Estudillo Avenue. R. W. Goodwin is the city engineer.

TAFT, CAL.—The City Trustees are planning for the installation of an ornamental street-lighting system on North Fourth, North Fifth and Center Streets. E. M. Lynch is city engineer.

VENICE, CAL.—Extensive improvements are contemplated by the Southern California Edison Company to its local system, including the erection of a new substation and extension of transmission lines running out of Culver City to the other bay district cities. The program calls for an expenditure of $383,000 in the Santa Monica Bay district.

Canada

BRANDON, MAN.—The City Council and the Brandon Board of Trade have petitioned the Manitoba Legislature to make an appropriation at the present session for the extension of the hydro-electric lines to Brandon.

CAMPBELLTON, N. B.—The Town Council is considering placing all electric light and power wires underground.

FORT WILLIAM, ONT.—Arrangements have been made whereby the Hydro-Electric Commission will supply electricity from the Nipigon plant to the Consolidated Elevator in Fort William. The contract calls for the delivery of between 500 hp. and 600 hp.

KOMOKA, ONT.—The installation of an electric light and power distribution system at Komoka, to cost about $33,000, is under consideration. A. Purcell, 190 University Avenue, Toronto, is engineer.

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The Business of Radio

ONE short busy year ago there were some forty thousand radio receiving stations in this country. Today about one million people have installed wireless sets and are listening to the broadcasting, picking up bits of "commercial code" and taking the time from Arlington. In all the spectacular history of electricity there is no such story of phenomenal success.

The knowledge that the air was full of mysterious messages from distant ships fired the imagination of the American small boy. Radio became a juvenile fad. The broadcasting idea followed. Nightly now in all these countless homes a silent, unseen audience of young and old enjoys this service of music, lectures, sermons and news. Weather and crop reports are being sent out. Other ambitious innovations are in process. The President some day will talk direct to every household in the land. Such is the vision of radio.

NOW what is this to mean to the electrical business? The bulk of the apparatus and equipment will be made by electrical manufacturers. But who will distribute it? Who will retail it? Who will guide the evolution of this new opportunity? Will it grow great as another bond between the people and electrical men or as a thing apart?

The department store and the sporting-goods merchant first sensed the appeal and saw the profit. Wireless receiving sets, therefore, made their appearance in these shops, as a novelty. They sold immediately and the speed with which the market spread outstripped the factories. And when the bulk of the electrical dealers awoke, department stores were stocked and selling. The manufacturers were committed to them for months ahead. It was only by accident or good fortune then that other electrical dealers were enabled to provide their customers with this, for a time the most popular article of electrical merchandise.

The budding radio business is now being organized into a working system. The controlling company announces that one hundred and fifty jobbers will be appointed to provide distribution. The electrical trade, they say, will be favored. And the electrical jobber is now scrambling to get up on the wagon.

But radio distribution means more than warehouses. It means constructive selling. It means the education of dealers. It means creative merchandising. It means progressive policies that are co-operatively sustained. The job must be done right.

THERE are many problems ahead in the development of radio—how to support broadcasting, the policing of the air. But the question that bulks biggest to the electrical man is this: Are we going to keep the radio *business* within the industry or let it slip away?

Valère Alfred Fynn

Designing engineer and inventor who has contributed largely to the development of the single-phase motor.

ONE of the underlying reasons why the electrical industry has been able to maintain its growth is that electrical apparatus and equipment are constantly being improved. To the designing engineer, therefore, must go a considerable share of the credit for the growth and development of the industry. In the list of designing engineers there stands out the name of V. A. Fynn, a consulting engineer of St. Louis, whose work relates to improvements of the alternating-current motor, especially the single-phase motor. He has taken out about 300 patents in nine different countries, about one-third of them having been granted in the United States, and as a result of his wide experience he has come to be recognized as an authority on patent matters.

In all probability his most important achievement was the solution of the problem of speed regulation of single-phase motors, published by him in 1905—a solution theretofore considered almost impossible. This he followed by a long series of inventions in this field, the development of a number of new motors and the improvement of existing types.

Mr. Fynn was born in Ireland April 11, 1870. He received his mechanical and electrical engineering education at the Swiss Federal Polytechnic in Zurich. The first three years after leaving college were spent with the Swiss manufacturers Brown, Boveri & Company in design, testing and erection work. Then, in 1895, he became chief electrical engineer for Easton, Anderson & Golden of London. During the four years he was thus engaged he designed and developed a line of alternating-current machinery, discarding the smooth-core armature then popular in England and substituting therefor armatures with slotted cores. Next he became chief engineer and soon afterward partner in the English firm of Rosling & Apperby. About this time he designed a unity-power-factor, single-phase commutator motor, which was built and operated in 1902. In 1903 the consulting engineering field claimed him. He set up offices in London, making a specialty of supplying designs to manufacturers and advising them in special work. His single-phase motors were manufactured by the Elektricitäts - Gesellschaft Alioth of Switzerland, France, Germany, Italy and Spain and the General Electric Company of England. In 1904 and 1905 he invented the induction and also the conduction self-excited, single-phase, adjustable-speed motors, and in the two following years he brought out a polyphase conduction adjustable-speed motor with phase compensation and a single-phase squirrel-cage motor with a high starting torque and unity power factor. In 1908 he came into close contact with the Wagner Electric Manufacturing Company of St. Louis, which took out licenses under almost all of his numerous patents and employed him in 1909 as consulting engineer. During the twelve years this connection lasted he devoted all his energies to it. He has since gone into independent consulting work again.

Mr. Fynn's work has always been characterized by originality. His perseverance and fundamental theoretical knowledge have enabled him to tackle successfully what others said could not be done. The originality of his theories is clearly evident in his frequent contributions to electrical literature both before British and American electrical engineering bodies and in the technical press. He is a fellow of the American Institute of Electrical Engineers and a member of the British Institution of Electrical Engineers.

Editorial Comment

Electrical World, March 25, 1922

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Number 12

Get Ready for the Fishing Now

AN OLD-WORLD proverb says, "When you are not fishing you should be mending your nets." It is a bit of very practical advice which the central-station executive can use to good advantage now—the net in this case being his sales department. During the last few years of general business depression the utility selling organizations of the country have been badly demoralized. Some have been actually and totally abandoned; many have been cut to the bone; most have been reduced in size and support; all have been discouraged and weakened by protracted exposure to gloom and restricted opportunity. Now come the good tidings of better times.

There is a lot of mending to be done. More men and better men must be added to the selling staff and organized. Better and more productive policies must be devised and developed. Selling activity must be increased and extended. For there is business to be had right now—lots of it. More and more business lies ahead. But it is selling that sells, and waiting longer to get ready to begin only wastes good weeks that might as well be filled with profit and achievement. When the fish begin to run there won't be time to mend these nets.

The Actual Status of Financing Costs

ACCORDING to Samuel Insull, utility companies have not been so seriously damaged by the high cost of financing as many had been led to believe during the period of high prices. In a recent address, published in this issue, Mr. Insull submitted figures showing that the permanent cost of financing from the sale of senior securities for three of the Insull property groups averages less than 1 per cent. His remark that a business able to pay its stockholders a fair dividend and not able to stand such an increase as the result of the world upset could not be considered very stable is extremely pertinent.

Probably the greatest single handicap on business recovery today is the way in which the entire world has run wild in expenditures in the past few years. Industrial concerns have sunk tremendous sums in the construction of new plants at prices that were at the highest possible point. Extravagant expenditures have been made to care for business that at best could last only a few years. Personal expenditures by nearly every class of individuals have been on an impossible scale. The necessity of writing off the inflated values thus created has not only been a serious problem but will be a drag on business for some years to come.

Mr. Insull's utterance suggests the thought that utilities in general have to a very large extent been protected from the effects of inflation within the industry itself. Some of the experiences of the war were difficult and trying, particularly when the other fellow was making enormous profits and enjoying a perfectly good time. However, those hardships and annoyances may have been vastly less unpleasant than the payment that is being exacted from the business world today. The position of public utilities at the present time, following a few arduous years, is a gratifying one, and the hardships of the past must not be allowed to cloud the sky and hide the sun of new opportunity. There is some danger of this unless the ill-timed and ill-founded calamity howling that is being indulged in by a comparative few is brought to a halt.

Is the Coal Buyer Never to Have Peace?

THERE will be a coal strike. Of that there can be little doubt. The operators are unhappy over their small profits and are content to let it come. The miners feel that they have nothing to lose, because their living has been squeezed down to the bone. The radical element is in command. The public believes that we must pass through a series of psychological steps to bring the minds of the workers to a recognition of the unavoidability of a revision of the wage scale downward. The one charge that the workers have been able to make is that the operators have not been scrupulous in keeping to their contracts. But they will strike.

The time will come, we hope, when the people of America will realize that constant strife and disorganization in this great basic industry is a public menace and a common responsibility. The unending succession of strikes and lockouts, with the never-stopping talk of labor trouble, interferes with the peace of the home and the prosperity of business. Some day, some way, some authority will have to go into the inner heart of this distracted industry, uncover the sustaining causes of this costly chronic national affliction, and allow the curative influence of a little sunlight to heal this running sore.

One thing is patent to all thinking men, and that is that the economic status of the coal miner as he exists under the conditions of today is hopeless. You cannot look for contentment in a class of labor that is employed in some cases only 160 days in a year, no matter what the wage. For the sound of the inflated daily wage lures to the mines an oversupply of labor which gluts the market, and because too many men are put to work the intermittent employment cuts down the actual income of the worker below the living wage. The individual miner has too much money for a day's work, but too many days when there is no work. The result is discontent, dissension and waste.

The coal consumers of the electrical industry are in no immediate danger. Warning was ample, and there are comforting reserves of coal both at the power stations and the manufacturing plants. There are large waiting stocks at the mines. But what of the future? Is the coal buyer never to have peace? It is time that large industry groups, such as the public utilities, began to make an organized demand upon the coal operators, upon the coal trade, upon labor and upon the government to put an end to this impossible situation by establishing a reasonable degree of economic security in the coal fields.

Ideal Procedure Established for Creating National Standards

THE procedure followed in conducting the recent conference on overhead-crossing specifications and also adopted for carrying out any necessary revisions therein should meet with universal approval and should serve as a precedent for creating any future national standards. The principal and essential feature of the procedure was that an opportunity was given to all interests to be represented in proportion to their scope. Another requirement, often overlooked, was that the purpose of the conference was announced sufficiently in advance to enable the representatives attending it to prepare an adequate presentation of their constituents' respective points of view. The practicability of the procedure was evidenced by the fact that a unanimous conclusion was reached without delay, despite the fact that considerable differences of opinion had existed prior to the conference.

In future conferences or committees of this kind it cannot be urged too strongly that the essentials just alluded to be observed. Furthermore, such arrangements must be made by the industries concerned that their constituents' opinions will be crystallized and made available to their representatives in the conference or committee. Equipped with this information and not bound by an unyielding attitude, conference committees should not have the difficulty in coming to an agreement that is usually experienced. Besides, the results of the conference will in this way be more nearly in conformity with the desires of the interests involved.

A Tale of Two Kittens and Its Application

PRIMARY school readers contain a short poem more remarkable for its wisdom than for its poetry. It is illustrated by a picture of a housewife sweeping two kittens out into the snow and begins thus: "Two little kittens one stormy night began to quarrel and then to fight." As for the rest of the poem we do not now recall it, but it does not matter. The housewife, exasperated by the antics of the kittens, seizes a broom and sweeps them out into the night. While the storm rages the kittens pass the time seeking shelter and trying to keep warm, each wondering all the while whether it will survive with all its nine lives intact. The tale has an application to the case of the lighting and telephone companies. In the large majority of cases the individuals concerned want to find an amicable solution of the inductive-interference and joint-use problems. Unfortunately there are some to whom the possible short-sighted advantage to be gained by insisting on fancied or so-called legal rights is of more importance than the mere matter of service to the public.

Back of all the bickering and sidestepping that is being done by individuals lies the simple fact that the one thing which must be accomplished is the greatest possible measure of service of all kinds with the lowest possible cost. Any fight which does not have as its ultimate aim the accomplishment of these two results is worse than foolish. The two branches of the industry have no rights to quarrel about except the right of each to help find the way to an amicable settlement of their mutual problems. The public is going to referee that fight, and if the contestants lose sight of the public rights they will both find themselves in an extremely unpleasant position. One of the results that may come is the forcing of lines under ground to eliminate both unsightly pole lines and in some measure the troubles due to inductive interference. The whole problem is a business one, but the "business" does not consist of a battle of wits to see which contestant can "do" the other. It lies in the ability of both to help each other to give the greatest possible measure of service with the least possible jangling.

The Analysis of Distribution Costs

WE PUBLISH in this issue the first report of the systematic investigation that has been made into the cost of distributing electrical supplies. A careful analysis has been made of the sales and operating expenses of five of the leading jobbing houses over a period of six months. The figures have been bulked and present a study of the cost of warehousing and selling electrical material, classified under a large number of heads. The development of these statistics has been policed by a committee of ten electrical manufacturers and certified to by an accounting firm of eminent standing. These findings can, therefore, be accepted as authentic and as typical of the best practice of the electrical jobbing industry as at present organized.

Any examination of this consolidated summary brings the inevitable conclusion that the electrical jobbing industry is suffering from a disease that must be fatal if a cure is not speedily found and applied. Many of the basic commodities sold through the jobbers' warehouse—the bread-and-butter business—are clearly costing more to handle and sell than they pay in profit. Many of the leading specialties appear in an even worse light. The number of bills sent out is appalling. The average total operating expense is very high. The average selling price per unit shipped is very low. The jobbers of this country are in the red. Here are some of the reasons.

In pondering these figures and the interpretation, however, one thing should be kept in mind. We must have distribution, and distribution must cost money no matter who is performing it. It is, after all, just a problem of getting the goods from the factory to the consumer, and whether the manufacturer sends them all the way, or whether the consumer or the retailer goes after them, or whether the manufacturer ships to a wholesaler who gathers a complete assortment of all lines and presents them conveniently to the local buyer, makes no difference. It is just distribution and it entails expense. The question is, which way is the most economical?

If the apportionment of the costs of distribution, as at present organized, is not in balance with the sharing of the profits among the several interests involved, then there must be a redisposition of those costs and profits or else the system must break down. This analysis of jobbers' costs is the first step. It demonstrates statistically what has been well known through physical finance, that the jobbers are losing too much money distributing electrical supplies. Now the industry should go the rest of the way and find out what it is costing the manufacturer and the retailer to contribute their respective functions to the scheme of distribution. Then, on the basis of a full knowledge, the real problem can be worked out. And the real problem is to determine which *is* the most economical way to distribute electrical supplies of the various kinds, to locate present sources of waste and loss, and to perfect a set of policies that will prosper each rightful agency of distribution and at the same time provide a free market for all worthy goods and a full service to the public.

High Quality and Mass Production Possible with Electric Annealing

THE production of "quality" material under accurately controlled conditions is the service that usually "puts the electrical idea across" to the operator and owner of annealing ovens in a well-planned installation like that described by Alan Dauch elsewhere in this issue. When such high-grade work is duplicated over and over for fifteen months without a single rejection or overheating, the argument in favor of doing such tasks electrically is indeed a strong one; but when such a performance is accomplished at fuel cost (or its equivalent) no higher than would have been required by non-electric methods, it is clear that the electric oven has won the day.

The installation described anneals steel wire with as low an energy consumption as 115 kw.-hr. per ton on a twenty-four-hour cycle, which is equivalent to 230 pounds of coal on the assumption that one kilowatt-hour can be generated from two pounds of coal. A well-designed and efficiently operated coal-fired annealing furnace would consume from 225 pounds to 250 pounds of coal for annealing a ton of wire under similar conditions. Even on a ten-hour cycle, this installation has been running around 185 kw.-hr. per ton. Such figures are convincing, and when accompanied by references to the collateral benefits of electric heating constitute a challenge to advocates of the older combustion methods.

To anneal thousands of tons of product without one rejection means an accuracy of control difficult to approach except electrically. Over and over one sees in studying electric heating applications that the ability to repeat on *quality* of batches of work handled is of an importance not easily exaggerated from the producer's standpoint. Mass production means economy here as elsewhere, and certain particulars of the installation described by Mr. Dauch are of much interest from the standpoint of saving heat units in cooling one charge by absorbing them into the charge undergoing preheating, keeping down heat waste and cutting labor costs to the quick by the use of well-designed handling equipment and automatic temperature-control apparatus. It is no longer necessary to disturb a charge before heating is complete, since the even action of the electric oven surpasses that of the combustion type formerly used. In both electrical and mechanical lines the reader will find this installation well adapted to its work, and its record of reliability and economy of operation is extremely gratifying.

Induction-Generator Station Has Wide Field of Application

TO KEEP down investment and operating costs is one of the first essentials of successful development and utilization of small water powers. In work of this kind many things can be eliminated which engineers have become used to specifying as a matter of course in large plants. By using induction generators in certain cases, for example, a surprising amount of hydraulic and switchboard equipment, considering the size of the plant, can be omitted, and the attendance necessary to maintain good service can be kept within very reasonable bounds even where full automatic equipment is not provided.

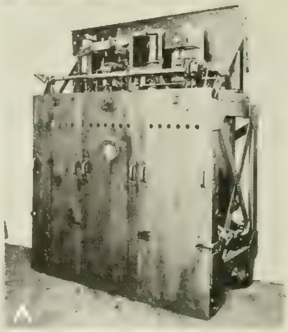
An interesting development by induction generators near Lee, Mass., which is interconnected with the Pittsfield Electric Company's Silver Lake steam plant, is described elsewhere in this issue. The development consists of two stations so situated on two watersheds as to permit operating one shed against the other, with resulting high economy in the use of runoffs. One plant has a head of 437 ft. and the other of 68 ft., the first having three 300-hp. and the second two 200-hp. induction generators installed with direct-connected waterwheels. Excitation current is furnished by the Pittsfield generators, and the governing problem, as the careful reader of the article on the Lee development will see, received close attention.

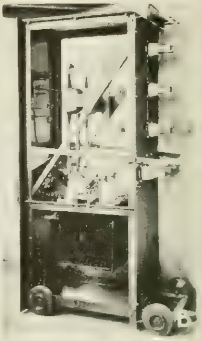
The behavior of induction generators above synchronous speed is a primary point of interest in plants of this type, and the working out at Lee of the governing arrangement and standardization of operating methods described will appeal to the engineer investigating this subject or operating induction-generator installations elsewhere. In normal operation the load on the induction generator is the only governor desired, but in case the excitation current is lost or the circuit opened, the runaway speed must be held down to safe limits. The governor equipment here installed closes from full-open position in from one and a quarter to one and a half seconds, and this means that the runaway speed of the motor dies down to within 2 per cent of the synchronous speed within ten or fifteen seconds. The governor supplies enough water to the wheel to maintain the motor at a slight overspeed, so that the resumption of loading as a generator is prompt after the circuit is closed and excitation current restored. Governing by deflection works out nicely, and the range of governor adjustment enables the operator to handle the plant most effectively under the different conditions that arise in daily operation.

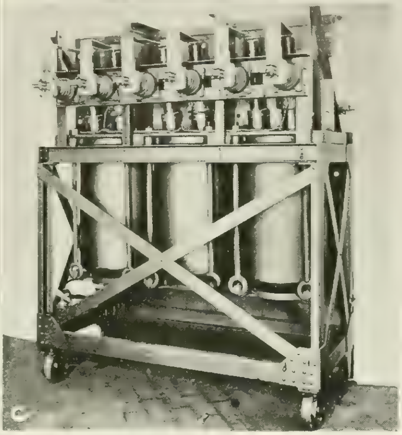
The use of circuit breakers equipped with relays set for an overload of about 20 per cent and designed for a maximum time element of eight seconds (although about two seconds suffices) meets the condition of the motor's coming upon the line at slightly above its full-load speed as a generator. A very simple schedule of operating attendance suffices, and as it was not expedient to invest the money required for full-automatic service, simplification of equipment and moderate labor cost went hand in hand.

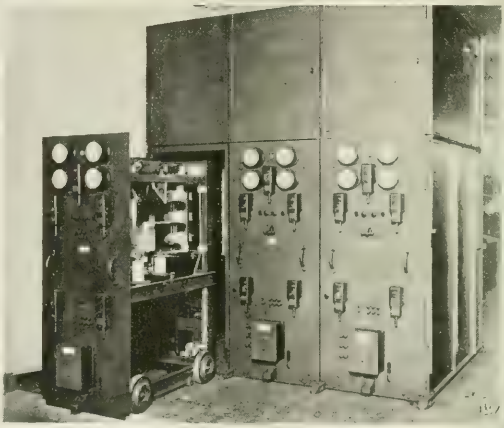
Altogether the various problems described appear to have been solved most creditably, and the test results given bear out the opinion that induction-generator plants intelligently installed have a real field in the conservation of scattered hydraulic resources in many parts of the world.

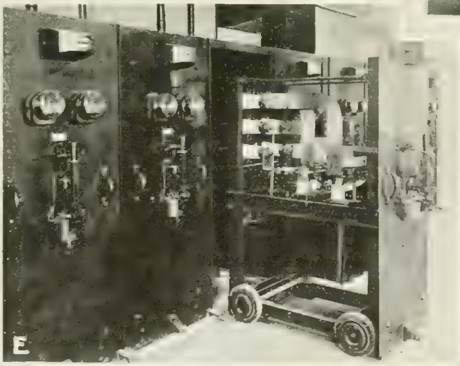
Truck-Type Switchboards Supplanting Permanent Structures in New Generating Stations and Substations

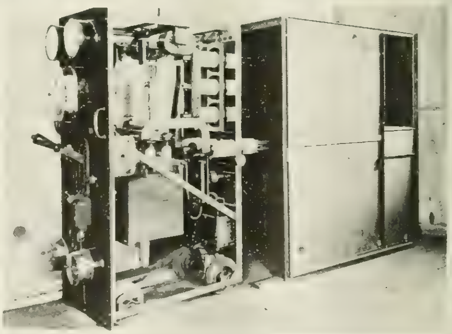












TRUCK-TYPE switchboards have been used for several years in this country and much longer abroad for consumers' services and industrial plant installations, but it is only recently that they have been applied to any extent inside generating stations and substations. Three recent examples are the Hell Gate station and Ninety-seventh Street substation of the United Electric Light & Power Company and the South Meadow station of the Hartford Electric Light Company. In both generating stations the trucks are used for station service; in the substation they are used exclusively. Among their characteristics are safety to life and equipment, compactness, interchangeability, ease of installation, inspection and repair, and the fact that the trucks come ready for immediate use. Illustrations A and C show the front and back of a truck-type circuit breaker used by the United company, while E shows the type used by the Hartford company. Other types of trucks for central-station service are shown in B, D and F.

Inductive Interference Is Basically a Technical Problem

Other Problems Grow Out of Lack of Complete Control of Forces—Control Within Power and Signal Circuits Must Be Developed—Cost of Control Measures an Important Factor

THE inductive-interference problem so called is primarily a technical one. Its legal, business and public-policy phases are the outgrowth of the action of electrical forces that are susceptible of control only through the channels of technical research and the methods of design and arrangement of both telephone and power systems that will be the outgrowth of that research. It would be almost impossible to enumerate all the problems that must receive a technical solution. Part of them are known; many of them will only be revealed by further study and the developments of years yet to come. It is possible, however, to state the fundamental elements of these problems.

SOME BASIC CONSIDERATIONS

Because the effects that have been embarrassing to the electric transmission or the signal companies have taken the form of troubles on signal circuits, some of the elementary facts involved have been lost sight of. Inductive interference has come to mean the inductive effects that are observable as the result of operating signal and power circuits parallel to each other. It will be instructive, therefore, to consider the nature of the circuits that are involved. Two electrical circuits placed side by side will react on each other if each is energized by a varying electric current. The reactions will obviously vary in strength as the currents causing the reactions vary. In metallic circuits the reactions can be counteracted to a degree by proper transpositions. If the circuits are of the ground-return type—that is, of the kind using one wire and the earth to form the two sides of the circuit—such control measures are impossible and there is no really practical way in which the reactions between circuits can be effectively controlled. The familiar cross-talk in the ordinary type of ground-return telephone circuit is an illustration of this type of interference and the difficulty of controlling it. The ground return makes the circuit sensitive to the influence of a paralleling circuit and invites induction. This is true regardless of the nature of the circuits. To counteract this difficulty as between circuits of the same character, the signal circuits in some classes of important commercial service have been made metallic and elaborate transposition systems have been worked out to counteract the inductive effects on each other from the minute currents used in these types of circuits. Some classes of signal circuits are inherently more sensitive than others, since requirements in the art have tended to make them more and more sensitive. Signal circuits with their connected apparatus are therefore inherently sensitive. They can be made more sensitive to inductive influences from outside sources, or by adopting measures within the signal systems themselves they can be rendered less sensitive.

A power circuit is not sensitive to the inductive influence of paralleling circuits unless the effects reach values that are beyond the practical range that such effects now reach. This is because the magnitude of an induced current in a power circuit is ordinarily of such small value that it cannot have an appreciable effect on the current regularly carried for service purposes. In place of being sensitive to induction from outside sources, therefore, the power circuit exercises an inductive influence on other circuits which it may parallel. The extent of this influence is dependent on the character of the power circuit itself and the apparatus connected to it. On the other hand, it is possible so to construct the power circuit as to increase or decrease its influence on neighboring circuits. For example, the use of a circuit with one wire and the ground forming the two sides of the circuit will increase the inductive influence of the circuit on neighboring circuits. The use of apparatus of certain characteristics in connection with power circuits can have the same effect.

It is therefore evident that both signal and power circuits possess characteristics that must be controlled in any practical solution of the inductive-interference problem. In the case of the signal circuits the characteristic to be brought under control is its sensitiveness to inductive influence. In the power circuits the tendency to influence other circuits inductively must be controlled. Around these two facts as a basis the technical considerations are grouped.

PRESENT STATUS OF PROBLEM

The California inductive-interference rules are the most definite that have yet been worked out. Other states have adopted rules, but they have based their work almost altogether on that of the California committee, which was a joint committee in which were represented all the interests involved. A review of the final rules recommended by that committee, in so far as they affect physical property of communication and power systems, shows that the avoidance of parallels, discontinuities, material and workmanship, transpositions, suitability of apparatus, methods of operation to reduce interference, balance of circuits and operating rules and records covering abnormal conditions are presented in a mutually corrective form. There is a decided tendency, however, particularly in the matter of transpositions and operating rules and records covering abnormal conditions, to generalize as far as the communication system is concerned and be more specific regarding the power system. Specific rules as to the arrangement and spacing of power circuits, the avoidance of high-frequency components in rotating machinery, transformer connections, the use of rectifiers, switches, fuses, electrolytic arresters and special instruments, records of neutral current, operation of transformers at overvoltage, and care in operating matters are included, but apply to power systems only.

One rule relating to the selection of apparatus in the communication system calls, as far as practicable, for insuring an accurate balance of series impedances and admittances to earth of the two sides of the circuit. This rule is general in character.

Fundamental Problems to Be Considered

In mentioning the California report it is not intended to discuss the merits or demerits of the remedies specified. It is certain that the work of the committee was well done and that the electrical industry cannot afford to lose the value of that work. It is intended to point out definitely that the treatment of the subject is almost entirely one-sided, and that in the rules proposed the specific requirements are devoted largely to the power system, with general statements as to the measures required on the part of the communication system. This suggests four questions requiring serious technical consideration:

1. What measures for the control of the sensitiveness of signal circuits to inductive influence, both as between themselves and in their relation to paralleling power circuits, can be applied to the circuits and inside signal circuit plant that will not unnecessarily restrict the service they give or prevent legitimate development of that service to the best interests of the public?
2. What will the costs of such measures mean in the cost of signal service to the public?
3. What measures can be adopted within power systems to control the tendency to influence inductively other circuits, either of their own type or signal circuits, without unnecessarily restricting the service they give or preventing legitimate development of that service to the best interests of the public?
4. What will the cost of such measures mean in the cost of power service to the public?

Taken together, the four questions suggest a fifth that forms the final of the purely fundamental questions on which all of the technical research work must be based. It is: "With the problem worked out as indicated in these four questions, how can the control measures within each of the systems be co-ordinated with the measures in the other system to insure the greatest possible efficiency of both classes of service with the minimum of restrictions on either and on the future development of both?"

Development of Control Requires Time

The form of the questions might indicate that a large number of detail problems must be worked out, set down and balanced in reports before it is possible to arrive at the solution of any one of these problems. This is not only untrue, but an unpractical way of looking at the situation. The electrical industry, while in general beyond its pioneer state, is in a period when development along many lines will be more rapid than it has ever been because some of the fundamental research work that was necessary during the early development period is done. The industry has a broader, surer foundation on which to build, and development will proceed correspondingly. The two phases of the industry that are concerned principally in the problem are in a state of flux that will allow of no certain prediction of conditions a few years hence. It is not at all impossible that many ideas of the problem prevalent today will not fit the conditions of tomorrow. The technical work must therefore proceed a step at a time, building on the foundation of current practice and co-ordinating the present facilities of both signal and power systems to give the best possible service. The work will therefore be concerned with a comparatively few problems at any one time, but over a period of time the list may present a bewildering and kaleidoscopic change.

Of the immediate detail problems that the technical men must face, the one in need of most attention is that presented by the preference for separation suggested in the California rules to prevent inductive interference. The solution is an ideal and, like many ideals, is not approachable because of practical conditions. Country roads and city streets are seldom over a hundred feet in width. The largest mileage is probably 60 ft. or less in width. The separations needed to obtain the ideal solution are far beyond these limits. While certain classes of circuits of extreme importance, such as heavy toll leads, steel-tower transmission lines and similar construction, must, for other reasons, seek private rights-of-way, the solution as a general one is impracticable for either class of service, except when, as in the case of some classes of service, the circuits can or must follow a railway or similar right-of-way. These cases are restricted in number.

In the final analysis of the problem the electrical industry must face the possibility of all highways being used to give the public it serves the services that it has to offer. That public will not be satisfied if the industry simply says that it cannot do the job. Some way must be found to do it efficiently and therefore economically and effectively. The services that the electrical industry has to offer the public are too vital as factors in progress to permit of any hint of failure. Technical men have not failed in other and even bigger tasks. They cannot fail in this one.

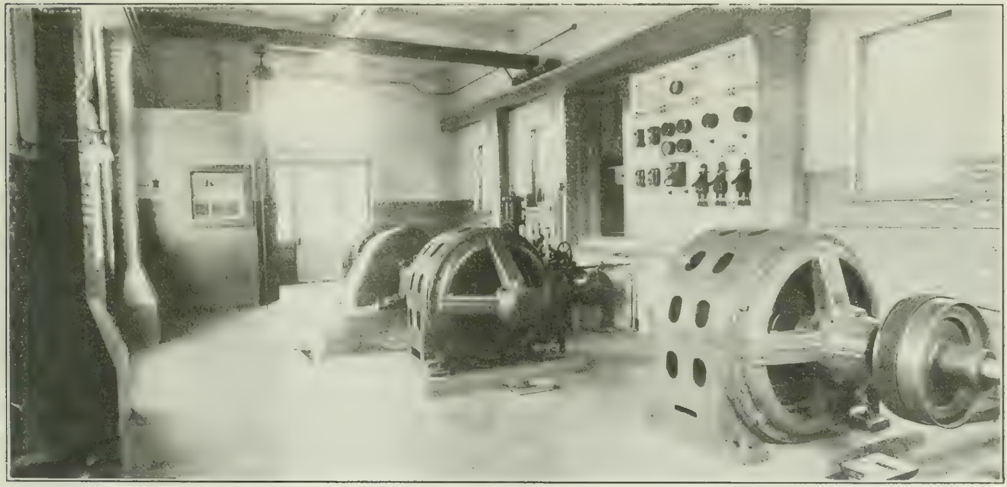
Progress of Electrical Interconnection in Great Britain

THE great "electric chain," which is the ultimate objective of the British Electricity Commissioners, seems likely to make an early start in Lancashire. An important scheme is on the point of completion there which will have the result of connecting up the wide industrial area between Accrington and Preston and embracing the busy manufacturing districts en route. The Blackburn Corporation has put the finishing touches to its new station at Whitekirk—the first superstation since the war—the total cost of which is more than £750,000. The proposal now is to authorize a large electrical extension at Accrington on the one hand and Preston on the other, the two towns being connected up with Blackburn's new works by special cables the cost of which is to be borne by Blackburn and Accrington and by Blackburn and Preston respectively.

There is more in the scheme than meets the eye, for it means that, with the exception of a small stretch, there will be a connected cable established between Colne, on the Yorkshire border, and Preston, at the mouth of the Ribble. Blackpool has a project which, if carried through, would result in the cable being extended to the west coast. This move has advanced beyond the theoretical stage. Definite schemes are already in operation, and before the end of the year it is expected that mills, workshops, dwelling houses and even agricultural areas will be in a position to obtain power for either machinery or lighting. The cable between Blackburn and Preston is to cost £138,000.

Use of Small Water Powers Simplified by Induction-Generator Plant

Quick Run-Offs and Stored Water Alternately Utilized by Two Stations of This Type Which Are Connected with Nearby System –Methods of Handling Design Problems and Results of Tests



SIMPLICITY AND SEMI-AUTOMATIC FEATURES OF THIS STATION REMOVED ECONOMIC BARRIERS TO DEVELOPING 900 HYDRO-ELECTRIC HORSEPOWER NEAR LEE, MASS.

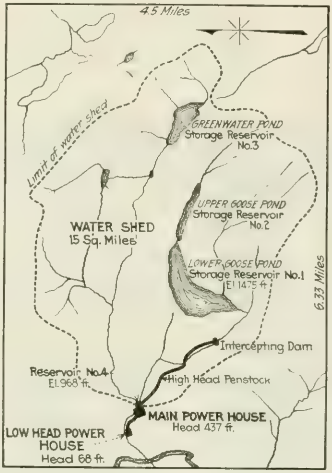
NUMEROUS, widely scattered small water powers exist in the United States which have remained unutilized up to the present time because of the expense of developing the power, operating the plants and transmitting the energy to a market. These economic obstacles can be removed to a great extent, as has been pointed out before by various engineers, notably Dr. C. P. Steinmetz, by installing automatic induction-generator stations and tying them in with a larger station or system. Recently a practical application of this suggestion has been made by the Tayford Company, Inc., near Lee, Mass., where two induction-generator stations are interconnected with the Lee and Pittsfield electric service systems.

A watershed with a total area of about 15 sq.miles (39 sq.km.) is utilized, the two generating plants, operating under gross heads of 437 ft. (133 m.) and 68 ft. (20 m.). The former or main head is associated with a pond representing about 225 days of storage, and the latter head is utilized below the first station and in hydraulic series with it. The flow from the high-head wheels discharges into a small reservoir of negligible storage, and this tailwater and the water from the lower portion of the drainage area are combined and used at the lower power house. There are in reality two watersheds, one of which is operated against the other.

During spring flows and after rainstorms a quick run-off is received from the lower shed and is used at the lower-head station. At such times this station does the greater part of the work, the wheels at the high-head plant being partly shut down, thus saving water in the ample storage above. Under the reverse condition, the low-head plant supplies a small amount of power and the high-head station does most of the work, drawing on storage. This stored water when released from the high-head wheels supplies the major portion of water required to run the low-head station. In the latter case the high-head plant does about 75 per cent of the work. To suit the above conditions, the low-head station was developed to about 400 per cent of its average horsepower capacity.

The high-head station is served by a 7,300-ft. (2,225-m.) machine-wound wooden penstock ranging from 24 in. to 28 in. (60 cm. to 71 cm.) in diameter. From the intercepting dam, where it originates, the penstock drops gradually for about one half its length, then rises to within 50 ft. (15 m.) of the elevation of its intake, and then drops away, gradually at first and finally more rapidly where it runs down hill to the power house. At its high midpoint is installed a 10-in. (25-cm.) air vent running up the side of the mountain. From the lower end of the penstock a steel header connects through three 10-in. (25-cm.) inlets to three 350-hp. Pelton waterwheels, designed for 410 ft. (125 m.) net head. These units are of the single-runner type with two nozzles each and deflector control. Directly connected to the wheels are three General Electric induction generators each rated at 300 hp., 600 r.p.m. (synchronous speed), three-phase, 2,300 volts, 60 cycles. The rotors are of the squirrel-cage type. To guard against a runaway speed in case of lost excitation a speed-limiting governor acts on the deflector of the water jets, thus limiting the speed to a few per cent above the synchronous value when the line is de-energized. As a result no severe jolts are caused when the line is re-energized. The necessary exciting current is furnished by synchronous steam-turbine units in the Pittsfield Electric Company's Silver Lake plant, which is tied into the Lee asynchronous stations by a trunk line.

The low-head station contains two 200-hp. wicket-gate-type turbines directly connected to two 200-hp. induction generators, which are otherwise similar to the machines in the high-head station. The low-head plant is fed by a 42-in. (106-cm.) wood-stave continuous penstock, 1,650 ft. (502 m.) long.


4.5 Miles
Limit of water shed
GREENWATER POND Storage Reservoir No.3
UPPER GOOSE POND Storage Reservoir No.2
WATER SHED 15 Sq. Miles
LOWER GOOSE POND Storage Reservoir No.1 El 1475 ft.
6.33 Miles
Intercepting Dam
Reservoir No.4 El. 968 ft.
High Head Penstock
MAIN POWER HOUSE Head 437 ft.
LOW HEAD POWER HOUSE Head 68 ft.

RUN-OFF WITHIN THIS WATER SHED IS ECONOMICALLY UTILIZED BY TWO INDUCTION GENERATOR STATIONS

In considering the type of equipment to use it was recognized that operating costs should be reduced to the minimum and that the class of labor required should be non-technical. Equipment not easily mishandled and at least semi-automatic was necessary. It was felt that an automatic synchronous generating station for a plant of this size would require too many relays and too much auxiliary apparatus needing technical attention and adding greatly to the cost of installation. The induction-generator plant appeared best for the situation, and experience has justified the choice.

The length of penstock and head involved led to a selection of the Pelton type wheel with deflector hood for use with the induction generators in the high-head station. The question of preventing dangerous racing in case of losing the excitation current influenced the solution of the governing problems. With an induction-generator floating on a single circuit of a distributing company, it is possible for the motor to lose its exciting current much more frequently than a synchronous generating unit will lose its total load at a multi-circuit station. It appeared important that the overspeed governor should operate from full open to full closed positions in as short an interval as possible. This quick operation of the governor, except as it deflected the water jet, would involve grave water hammer on a 7,300-ft. (2,225-m.) penstock even in case relief valves were connected with the governor or other precautionary measures used. Hence it was decided to get along without the possible higher efficiency of the Francis type of wheel and use an impulse wheel with deflector hood cutting into the jet as an arrangement less likely to give trouble.

In normal operation the load on the induction-generator is the only governor desired, and at any time the load being carried determines its speed, so long as the circuit on which it floats is closed. It has been found that with a synchronous speed of 600 r.p.m. and a full-load speed of 585 r.p.m. the motor will generate its full rating at a little below 615 r.p.m. Experiments to ascertain this fact were made during the early construction at Lee, as available data seemed scarce. The synchronous speed of the motor was determined by bringing the motor up to a speed that would move a watt-hour meter disk neither forward nor backward. It was found that this point could be determined within one or two revolutions per minute by accurate adjustment. By increasing the speed the motor would take on load as a generator in consistent ratio with the increased speed.

The governor used is the Pelton type F, which in this installation closes from full open position in from one and a quarter to one and a half seconds from the time of throwing out the circuit breaker. This means that the runaway speed of the motor dies down to within 2 per cent of the synchronous speed within ten or fifteen seconds. The governor supplies enough water to the wheel to maintain the motor at a slight overspeed, and thus it is ready to take on load again as soon as the circuit is closed and excitation current restored. A slow opening of the governor follows. The essentials of the governor here are quick action from full to no load and an easy possible adjustment of the governor by hand to vary the speed at which it will operate by 5 or 10 per cent outside the theoretical speed for which the governor is designed. This is necessitated by fractional changes in the frequency on the line upon which the induction-

PERFORMANCE OF THE GENERATING UNITS AT LEE (MASS.) INDUCTION-GENERATOR PLANT WITH DIFFERENT ADJUSTMENTS OF WATERWHEEL NOZZLES

Units Nos. 1 and 3 are rated at 300 hp., 2,300 volts, 600 r.p.m. (synchronous speed), whereas No. 2 is rated at 250 hp. All of the waterwheels are identical in design.

Condition of Nozzles		Unit No.			Unit No.			Unit No.			Unit No.			Unit No.		
Needle Nozzle	Plain Nozzle	1	2	3	1	2	3	1	2	3	1	2	3	1	1	3
		Kw.			R.P.M.			Amp.			Average Voltage			Power Factor		
½ turn	closed				593	594	593	17.5	16.5	17.6	2,135	2,110	2,110			
1 turn	closed		16.4			594			17.6			2,120				
2 turn	closed	39.5	45	44.1	596	595	595	24.2	23.1	23.1	2,135	2,140	2,135	44	53.7	52
3 turn	closed		70.7			597			28.1			2,140			54	
4 turn	closed	87.7	91.5	92.5	598	598	599	33	31.9	32.5	2,155	2,160	2,165	71.5	68	77
5 turn	closed	103.5	109.5	111	599	599	600	35.2	35.8	36.2	2,190	2,170	2,175	78	75.5	84
6 turn	closed	119	124.5	126	600	602	601	40.2	39.6	39.6	2,170	2,150	2,150	79	82	84
closed	open	118	118	116.2	600	602	601	38.5	39.6	38.0	2,170	2,150	2,170	81	86.5	81.5
2 open	open					...										
4 open	open	204	204	206	604	610	605	59.5	62.5	62.5	2,205	2,210	2,215	77.5	86	86.5
5 open	open	216	216	217	605	610	605	65.5	64.5	65	2,205	2,215	2,195	86.5	87.5	88
6 open	open	226	228.5	224.5	606	612	606	68	68	67	2,210	2,215	2,200	87	87.5	88
8 open	open	234			606			71			2,220			86		
10 open	open															
11 open	open	240	240	238	607	614	608	73	70	70	2,220	2,225	2,215	86.5	89	89

generator is floating and by the need of setting the governor for the speed required to take on loads.

The governors include a dash-pot mechanism which is controlled by a milled wheel clearly visible in one of the accompanying illustrations. By adjusting this wheel the water can be entirely deflected from the waterwheel buckets, or the speed can be brought up to 10 per cent above synchronous value. This is one of the essential requirements of the governor.

The lower nozzle of two of the units in the high-head plant is not equipped with a valve but the upper nozzle of all three units has a needle valve. The lower nozzle of the second unit can be cut off by an 8-in. (20-cm.) geared cut-off valve if desired, so that the middle unit can be run at less than 50 per cent capacity with rated efficiencies. Thus the plant can be operated at any point from zero load to full capacity and units arranged for any load so that a consistent efficiency can be obtained for various load conditions. The generators are directly connected to the waterwheels by flexible couplings of the pin and leather bushing type which allow the generator to center itself in its field and also permit the waterwheel runner to center itself with respect to the water jets.

The accompanying table gives the results of some tests on these units. The data show that at synchronous speed and with theoretically no power produced or consumed, about 17.5 amp. excitation current was required. This current increased at a decreasing rate as the machine output grew larger. The similarity in results for all three machines is notable. For low flows No. 1 unit developed less power that the corresponding units owing to a bent spindle of the needle nozzle. When No. 2 unit, which includes a generator which was designed as a 250-hp. motor based on the 40-deg. rating, was operated at the rating of the other two machines, namely, 300 hp., the speed rose some six points above that of the other machines for the same load. In other words, the slip at 20 per cent overload as a motor is converted into a corresponding increase in speed as a generator. The increase of power factor with load is also of interest.

The design of circuit breakers for this class of work gave the engineers of these plants something of a problem. If a motor to be operated as an induction generator is thrown upon the line below synchronous speed, the machine first takes current from the line to come up to synchronous speed as a motor, the motor driving the waterwheel for the time being. Under these conditions there is a rush of current from the line corresponding to the starting of an induction motor under load, and the line is subjected to a temporary surge with clearly apparent effect on lighting service. On the other hand, if the motor is thrown upon the line at exactly synchronous speed or very slightly above it, no effect is evident and no change of speed is audible. When thrown upon the line at considerably above synchronous speed the hum of the generator drops to a much lower pitch, and if this speed is too high, the breaker will at once release. A no-voltage-release switch would be inapplicable, since if the line voltage were lost through opening of the circuit, the breaker would be released and the generator would not take load upon closing of the outside circuit.

THE GOVERNOR CONTROL IS AN IMPORTANT FEATURE OF THIS INDUCTION-GENERATOR STATION

By equipping the breaker with an overload release or an inverse-time-limit relay, which will withstand the shock of the motor's coming upon the line at slightly above its full-load speed as a generator, satisfactory results are attained. These relays are set for an overload of about 20 per cent and are designed for a maximum time element of eight seconds, although about two seconds is all that is required. The switchboards of the two plants are equipped with Westinghouse apparatus, such as oil switches, meters and watt-hour meters.

The operation of the plants is simple. By opening one of the waterwheel nozzles the set is brought up to synchronous speed (determined merely by sound), and the line switch is then closed. This brings the machine quickly to synchronism. The second nozzle is then opened, oversynchronizing the set to an amount required by the load. Considered in more detail, the waterwheel is brought up to synchronous speed by a careful adjustment of the milled wheel on top of the governor which holds the speed at, say, 600 r.p.m. After the machine has taken its load the milled wheel is turned until the governor is entirely backed off the wheel. Then the milled wheel is screwed down to a point where the governor will just take hold and finally back again about three-quarters of a turn. This amount of leeway has been found to be just sufficient at this plant to allow for fluctuations in frequency, and does not cause the deflector to intercept the jet except in case of loss of magnetizing current.

LOW-HEAD INDUCTION-GENERATOR STATION DEVELOPING 400 HP. NEAR LEE, MASS.

Although provision is made to control and read the load conditions of the low-head station at the high-head plant, there is no co-ordination of operation between these induction-generator stations and the steam station with which they are connected electrically. The steam-station operator can always ascertain if the induction-generator stations are on the line by the exciting current which they draw. The only way in which the steam station can interfere is through the radical fluctuation in generator speed and corresponding frequencies, which would have to be instantly imitated at the induction-generator stations. Compensation for such action can be gained by adjustment of the milled governor wheel previously mentioned. In case a transmission line is going to be de-energized the induction-generator station attendant is notified.

The two induction-generator plants are being successfully operated with two mechanics and a general supervisor who is called upon when necessary. The day shift of the day operator is broken so as to extend his period for a considerable part of the day without involving continued periods at which the plant receives no attention. The night operator leaves the plant at 8:30 a.m. The day operator comes on at 10 a.m., leaves at noon, returning at 1:30 p.m. and remaining until 6 p.m. He returns at 7 p.m., leaving at 10:30 p.m., and the night operator takes charge at midnight. The total labor cost of operating the plants is $2,500 per year. In severe winter it is probable that about $100 extra labor will be required in connection with plant heating, removal of snow and ice.

The data for the above article were obtained through the courtesy of Henry W. Taylor, consulting engineer and erector of the plant, 154 Nassau Street, New York City, and Arthur Palme, Pittsfield, Mass.

Electric Transportation Equipment Equivalent to 500 Men

THE transportation capacity of the equipment shown in the accompanying photograph is easily sufficient to equal the working powers of 500 men in the local movement of material. The Quartermaster's Intermediate Depot at Boston, built during the world war to expedite shipment of supplies overseas, was also designed to permit the commercial utilization of these facilities under suitable agreement with the United States government. The present equipment of the Base consists of one lifting-platform "Automatic" tractor, two flat-platform Yale industrial trucks, two Elwell-Parker lifting-crane tractors and twenty-two Baker R. & L. tractors, with several hundred trailers. In handling material through the storehouse and wharf shed, each 1,638 ft. long, eight and three stories high respectively, and the pier shed, 900 ft. long and three stories high, this equipment, supplemented by electric cranes, constitutes a means of expediting local transportation equaled in few installations thus far made.

ELECTRICITY TAKES PLACE OF MEN IN HANDLING MATERIALS

A Study of Jobbers' Sales and Costs

An Analysis of the Sales and Operating Expenses of Five Jobbing Houses Made Public by the Electrical Supply Jobbers' Association

By **EARL E. WHITEHORNE**
Commercial Editor Electrical World

THE Electrical Supply Jobbers' Association has just made public a six months' analysis of sales and operating expenses covering five of the foremost jobbing houses of the country. The figures appear in the accompanying table. Late in 1920 the jobbers' association made an appropriation for an investigation of the cost of doing business, and five of the largest, most efficient and representative houses were designated for study. These five houses are widely scattered so that the influence of varying local conditions is well provided for. A two months' test was taken and the results were analyzed. Some of the facts presented were so unexpected and so disconcerting in their inference that a number of manufacturers with whom these conditions were discussed questioned the possibility of their being accurate. So it was suggested that a committee of ten leading manufacturers be appointed to police the investigation, and to establish its authenticity beyond question, the accounting firm of Niles & Niles was retained to have supervision over the organization and conduct of the work, checking and certifying to all figures.

The consolidated summary presented here embraces total figures classified and segregated under forty-one different heads, being the leading lines of materials or groups of similar character. It shows the net sales of each class by these five houses for this period of six months, dividing them into sales and material carried through the warehouse and also direct shipments from the factory, and it shows the percentage of the total sales represented by each class of goods. Against this it spreads out clearly the character and extent of the operating expenses involved in the selling of each line and the percentage of the selling price that is eaten up. It gives some most pertinent statistics as to the number of bills and credit memos that are made out in the course of selling these goods, the number of items on the bills, the average amount of these items, the number of units shipped and called for and the average selling price of these units shipped and called for. These figures do not include any overhead charge for interest on investment.

SURVEY MADE UNDER ADVERSE CONDITIONS

A little study of these figures will develop some startling comparisons. Before making these deductions, however, it is well to bear in mind a few of the conditions under which this survey was made. In the first place these figures were obtained in the first six months of last year, which was a period of extreme depression and low volume of business. They are therefore conservative, but it was agreed that it would be better to make the test at such a time rather than to have the slightest possibility of doubt that they might show conditions better than they really are. The report therefore undoubtedly shows higher costs than it would have in 1920, yet the industry faces a good many years of falling market, and though the improvement of business both in volume and in character is already manifest, a conservative attitude toward the cost and value of sales is justified.

The important consideration is that though these figures might show some variation in different times and as applied to different houses, the relative values would remain the same. The comparative costs of selling different classes of material would stand true, and this is the most valuable lesson in the whole analysis. In short, it shows which kinds of electrical materials are the most economical to sell and the most expensive to sell and in this way points out which classes of business are the most profitable. Out of this must come the realization that certain lines must be sold in some other way by the present distributers, or through some other channel of distribution, for obviously a line that cannot be sold by the jobber, as at present handled, without a direct loss on every item sold cannot be permanently distributed that way. Such a conclusion is inevitable.

OPERATING EXPENSES EAT UP PROFIT

Attention is called, for instance, to item No. 1, which is wiring devices. This is one of the prime staples that have always been looked upon as part of the bread and butter business. About 80 per cent of it passes through the warehouse. It totals 6.66 per cent of the total sales. But the operating expense included in handling these wiring devices figured 20.59 per cent, and every jobber and every manufacturer of this material knows that there is not this much profit for the jobber in this line. In other words, every time a socket or a switch was sold out of those houses they lost money. A third of a million dollars was bulked in sales of wiring device, and they made out 17,858 bills and credit memos to take care of it. All this work and all this business and they lost money over it, in not one house but five, and not for one month but six.

Heating devices stand as a line which has been pushed hard, backed by tremendous pressure of publicity, supported by great dealer interest and a growing popularity. These five jobbers sold $167,467.93 worth of heating devices, almost $25,000 worth a month each, and it totaled 3.37 per cent of their whole sales. But it required 10,337 bills and credit memos to handle it, and because a good many parts are sold the average selling price per unit was only $3.31, and it cost 25.95 per cent of the selling price for operating expenses, and nobody made a cent on the business because there is not that much gross profit in the business.

In the same way flashlamps, batteries and cases bulked 0.63 per cent of the business, but it cost 29.21 per cent to sell, which is more than it pays. And porcelain knobs, tubes and cleats, 0.92 per cent of sales, cost 31.70

A Consolidated Summary of Sales, Operating Expenses and Statistical Data by Commodities Based on a Study of Five Electrical Jobbing Houses Located in Different Sections of the Country*

AN ANALYSIS EMBRACING THE SIX MONTHS ENDED JUNE 30, 1921

		Net Sales				Operating Expenses												
		Warehouse and Called For	Direct	Total	Per Cent of Total	Financial and Accounting	Per Cent to Sales	Selling	Per Cent to Sales	Warehouse	Per Cent to Warehouse and Called-For Sales	Total	Per Cent to Sales	Bills and C M Issued, Number	Items on Bills and C M Issued	Average Amount of Items on Bills and C M Issued	Units Shipped and Called For	Average Selling Price of Units Shipped and Called For
1	Wiring devices	$268,405.61	$63,028.18	$331,433.79	6.66	$17,191.68	5.19	$30,139.81	9.09	$20,907.03	7.79	$68,238.52	20.59	17,858	41,183	$8.05	165,768	$1.62
2	Rubber-covered wire and lamp cord	255,980.89	135,006.89	390,987.78	7.86	9,064.89	2.32	23,245.00	5.95	12,522.86	4.89	44,832.75	11.47	7,832	15,287	25.58	33,977	7.53
3	Weatherproof wire	83,165.80	122,060.78	205,226.58	4.13	2,831.68	1.38	8,212.60	4.00	3,121.81	3.75	14,166.09	6.90	1,506	2,508	81.83	4,561	18.23
4	Bare copper wire	12,261.47	49,651.61	61,913.08	1.24	744.48	1.20	4,418.99	7.14	554.79	4.52	5,718.26	9.24	292	341	181.56	547	22.42
5	Rigid conduit	123,211.92	45,480.24	168,692.16	3.39	3,225.02	1.91	8,383.15	4.97	7,798.92	6.33	19,407.09	11.50	2,352	5,938	28.41	31,118	3.96
6	Other conduit fittings	41,039.59	7,818.00	48,857.59	.98	4,348.41	.90	8,397.86	17.19	7,555.30	18.41	20,301.57	41.55	4,445	13,379	3.65	71,183	.58
7	Porcelain knobs, tubes and cleats	39,301.94	6,609.96	45,911.90	.92	1,807.79	3.94	6,701.54	14.60	6,044.60	15.38	14,553.93	31.70	1,809	4,309	10.65	90,810	.43
8	Conduct-type fittings	66,948.08	10,219.62	77,167.70	1.55	5,791.14	7.50	9,602.12	12.43	7,855.85	11.73	23,249.11	30.13	5,489	18,010	4.28	59,765	1.12
9	Large "Mazda" lamps											†75,199.46	12.20					
9	Large "Mazda" lamps	591,150.37	25,249.86	616,400.23	12.39	13,842.42	2.25	38,026.47	6.17	18,536.75	3.14	70,405.64	11.42	12,065	23,478	26.25	58,872	10.04
10	Flashlights, batteries and cases	24,867.43	6,393.80	31,261.23	.63	2,684.50	8.59	4,110.81	13.15	2,337.30	9.40	9,132.61	29.21	3,403	6,683	4.68	17,018	1.46
11	Fans	104,745.08	12,446.89	117,191.97	2.36	2,176.84	1.86	9,429.27	8.05	4,496.58	4.29	16,102.69	13.74	2,059	2,773	42.26	5,562	18.83
12	Inclosed fuses	18,194.80	5,216.61	23,411.41	.47	1,484.20	6.34	2,910.89	12.43	1,368.39	7.52	5,763.48	24.62	1,658	3,193	7.33	11,480	1.58
13	Renewable inclosed fuses	29,266.27	1,701.91	30,968.18	.62	1,585.61	5.12	3,287.18	10.61	2,238.62	7.65	7,111.41	22.96	1,526	3,531	8.77	15,913	1.84
14	Flexible metallic conduit	39,714.68	4,255.37	43,970.05	.88	1,204.31	2.74	2,922.63	6.65	2,147.28	5.41	6,274.22	14.27	1,183	2,380	18.47	7,652	5.19
15	House goods	20,112.30	9,391.94	29,504.24	.59	2,104.47	7.13	3,564.10	12.08	2,124.83	10.56	7,793.40	26.41	2,585	4,470	6.60	15,240	1.32
17	Tools	11,775.45	5,522.46	17,297.91	.35	1,492.76	8.63	2,578.88	14.91	1,557.43	13.23	5,629.07	32.54	1,474	2,672	6.47	4,010	2.94
18	Metal molding and fittings	8,036.33	3,278.26	11,314.59	.23	684.82	6.05	2,113.24	18.68	1,133.14	14.10	3,931.20	34.74	698	2,208	5.12	6,515	1.23
19	Watt-hour meters	7,245.17	22,615.59	29,860.76	.60	614.31	2.06	2,369.58	8.03	474.69	6.55	3,485.58	11.67	430	581	51.40	602	12.04
20	Non-metallic flexible conduit	49,353.44	2,076.72	51,430.16	1.03	1,269.51	2.47	4,565.35	8.88	2,775.61	5.62	8,610.47	16.74	1,193	2,280	22.56	7,919	6.23
21	Tape—rubber and friction	26,935.92	10,074.66	37,010.58	.74	1,771.08	4.79	3,694.86	9.98	2,358.76	8.76	7,824.70	21.14	2,067	4,245	8.72	30,404	.80
22	Street-lighting fixtures and parts	7,860.84	27,193.38	35,054.22	.70	841.26	2.40	4,908.27	14.00	549.07	6.98	6,298.60	17.97	667	956	36.67	3,243	2.42
24	Safety switches	27,886.57	18,664.87	46,551.44	.94	1,760.12	3.78	5,069.97	10.89	1,908.00	46.84	8,738.09	18.77	1,841	3,225	14.43	7,190	3.88
25	Dry batteries	49,981.58	8,651.96	57,633.54	1.16	1,635.61	2.84	3,948.00	6.85	2,085.75	4.26	7,669.36	13.31	1,806	2,352	24.50	12,924	3.79
26	Miniature lamps	53,209.51	1,913.81	55,123.32	1.11	2,207.71	4.01	6,778.90	12.30	2,164.13	.07	11,150.74	20.23	2,522	5,190	10.62	11,577	4.60
27	Carbon lamps	8,008.48	4,942.90	12,951.38	.26	579.72	4.48	1,304.04	10.07	1,151.63	.38	3,035.39	23.44	762	1,018	12.72	8,127	.99
28	Pole-line hardware	48,290.84	44,659.71	92,950.55	1.87	2,983.28	3.21	11,231.50	12.08	6,535.59	3.53	20,750.37	22.32	2,499	4,805	19.34	66,691	.72
30	Wood cross-arms	27,754.76	25,018.00	52,772.76	1.06	1,010.32	1.91	4,843.32	9.18	5,190.97	18.70	11,044.61	20.93	707	1,294	40.78	24,162	1.15
31	Glass insulators	25,197.83	19,085.30	44,283.13	.89	1,021.52	2.31	4,372.15	9.87	2,471.28	9.81	7,864.95	17.76	839	1,256	35.26	19,166	1.31
32	Bare iron, steel wire and strand	12,827.77	4,858.71	17,686.48	.36	519.79	2.94	2,822.41	15.96	1,300.87	10.14	4,643.07	26.25	559	848	20.86	2,599	4.94
40	Specialties miscellaneous	32,369.42	6,433.77	38,803.19	.78	1,367.08	3.51	7,117.67	18.34	1,535.89	4.74	10,020.64	25.82	1,465	2,051	18.92	3,817	8.48
41	Washing machines and parts	237,556.47	15,704.60	253,261.07	5.09	5,118.32	2.02	33,451.31	13.21	9,152.25	3.85	47,721.88	18.84	4,608	5,792	43.73	9,285	25.58
42	Ironing machines and parts	38,138.51	9,545.83	47,684.34	.96	846.56	1.78	20,622.32	43.25	3,922.85	10.20	25,391.73	53.25	559	629	75.81	505	75.52
43	Vacuum cleaners and parts	105,706.02	2,056.99	107,763.01	2.17	2,280.78	2.12	15,043.24	13.96	3,102.65	2.94	20,426.67	18.96	1,900	2,514	42.87	5,902	17.91
44	Electric ranges and ovens	58,877.95	32,313.36	91,191.31	1.83	2,101.63	2.30	14,434.31	15.83	4,497.67	7.64	21,033.61	23.07	1,751	2,367	38.53	2,420	24.33
45	Heating devices	143,818.28	23,649.65	167,467.93	3.37	8,760.39	5.23	23,819.95	14.22	10,879.70	7.56	43,460.04	25.95	10,337	15,769	10.62	43,386	3.31
99	Miscellaneous	70,406.90	79,670.14	150,077.04	3.02	7,716.95	5.14	11,492.50	7.66	8,070.16	11.46	27,279.61	18.18	8,135	15,951	9.41	50,464	1.40
	Automobile accessories	304,912.18	35,205.68	340,117.86	6.84	8,378.61	2.46	49,800.13	14.64	13,849.92	4.54	72,028.66	21.18	8,167	15,141	22.46	19,685	15.49
	Lighting fixtures	347,139.61	32,358.93	379,498.54	7.63	14,845.74	3.90	69,048.31	18.19	37,877.03	10.91	121,771.08	32.09	13,046	24,088	15.75	44,659	7.77
	Apparatus sales	164,601.94	173,837.92	338,439.86	6.80	6,794.06	2.01	29,836.58	8.82	14,747.25	8.96	51,377.89	15.18	4,276	6,975	48.52	11,293	14.58
	Sundry commodities	137,180.72	138,782.59	275,963.31	5.54	6,864.62	2.49	38,575.80	13.98	9,858.42	7.19	55,298.84	20.04	5,757	12,261	22.51	39,092	3.51
	Total	$3,722,438.72	$1,252,647.45	$4,975,086.17	100.00	$153,553.99	3.09	$537,222.01	10.80	$248,761.62	6.68	$939,537.2	18.88	144,487	283,931	$17.52	1,025,103	$3.63

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*Compiled by the sub-committee of the committee on accounting and statistics of the Electrical Supply Jobbers' Association, 411 South Clinton Street, Chicago.

†This amount includes $4,793.82 outgoing transportation, which generally is not considered operating expense, but should be added to these expenses to obtain total cost of handling this commodity.

per cent to handle, which is more than it is worth. And metal molding and fittings, totaling 0.23 per cent of the sales, cost in all 34.74 per cent to handle. "Other conduit fillings" cost 41.55 per cent to handle. Fuses cost 24.62 per cent and 22.96 per cent to handle. Lighting fixtures cost 32.09 per cent to handle and ironing machines and parts 53.25 per cent, with washing machines and parts at 18.84.

Spends One-Half of What He Receives

As a result, when any one of these five jobbers sells an ironing machine—and it is substantially the same with other jobbers—he is spending one-half what he gets in operating costs without a living chance to make a cent. On a five-million-dollar business here, 144,487 bills and credit memos were made out, there were 288,931 separate items on the bills, 1,025,103 separate units of material had to be gathered and shipped, and the average selling price of all these units shipped and called for was $3.63! The average operating expense on the entire business figures 18.88 per cent of the selling price.

It is a good thing to know the facts even when they hurt, and these facts certainly are of that kind. They present a problem of vital import not alone to the jobber but to the manufacturer and to the contractor, dealer and central station. These goods must be distributed, but palpably they cannot very much longer be distributed by these methods and on existing policies if the jobber cannot make money doing it this way.

Italy Confronted by Great Power Shortage from Lack of Snow

THE industrial zone in northern Italy is threatened with an unprecedented power shortage. The shortage will reach its peak on April 1, but, reports to the Department of Commerce say, it has been serious since early in December. An abnormally small snowfall in the northern mountains last winter and the intense cold which prevailed throughout the summer in the upper mountain levels, hindering the snow from melting, have caused the streams which are relied on for power to fall to very low levels.

In an effort to develop new sources of water power it has been proposed to tap the southern end of Lake Lecce. At that point, it is estimated, 2,000,000 kw. could be developed without lowering the level of the lake to the point where hardship would ensue. Work already is under way looking to the emptying of Lake Castel into the Val di Toce. This development is expected to produce 5,000,000 kw. An estimate also has been made showing that 500,000 kw. could be developed by drawing off water from Lake Varese without lowering the level of the water more than 50 cm. It is believed that an additional 2,000,000 kw. could be obtained if Lakes Monate and Comabbio were connected with Lakes Maggiore and Amone by means of siphons across intervening hills.

The power shortage has become so serious that curtailments already have been made of the supply for less essential uses and it may become necessary to suspend all electro-siderurgical operations—highly developed in Italy—and supplant electric traction with steam locomotives on the Milan-Varese railway. Restriction of the use of electric lighting in homes to two hours daily is under consideration. One industial plant has rigged up a battery of farm tractors to furnish power for some of its generators.

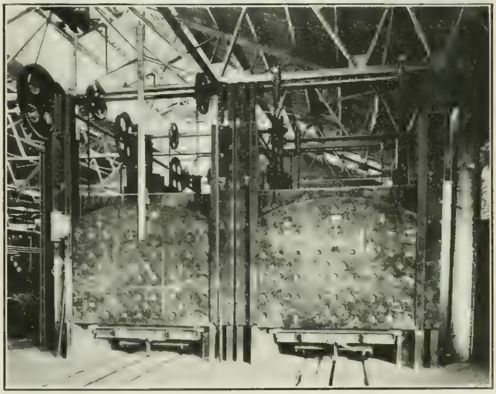
It is reported that beginning Feb. 1, 200,000 kw.-hr. of electrical energy was daily being diverted to northern Italy from Switzerland, in order to overcome to some extent the crisis arising from the electric power shortage. In view of the fact that Switzerland also is suffering from low water this action merely indicates to what extent the shortage in Italy has affected her economic status.

17.4 Lb. of Steel Annealed per Kilowatt-Hour

Several Thousand Tons Turned Out Without Single Rejection or Overheating—Inherent Troubles with Fuel-Fired Ovens Have Been Overcome

By Alan S. Dauch
Engineer George J. Hagan Company

SEVERAL thousand tons of annealed steel wire have been turned out of the electric furnace used by the Fowler & Union Horse Nail Company, Buffalo, N. Y., during the past year and a quarter without a single rejection or overheating and with as low an energy consumption as 115 kw.-hr. per ton. All of the inherent troubles of the fuel-fired equipment replaced by the electric furnace have been overcome and the latter is relied upon exclusively. No fuel-fired equipment is held in reserve.



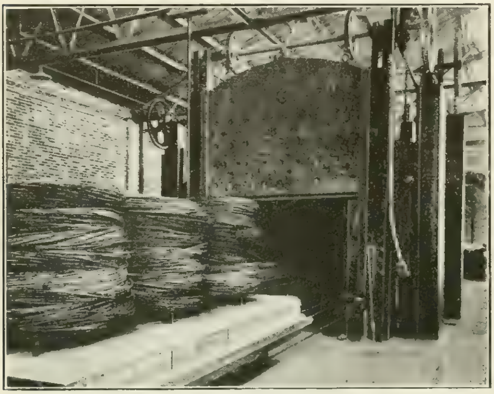
PREHEATING CHAMBER IS ALONGSIDE COOLING CHAMBER WITH FULL SIDE OPENING BETWEEN TO ALLOW INTERCHANGE OF HEAT

The product which is being annealed consists of $\frac{3}{8}$-in. (9.5-mm.) steel wire from which horseshoe nails are made. The wire is delivered to the furnace on cars in coils weighing approximately 250 lb. (113 kg.), the charge per car being approximately 7,500 lb. (3,400 kg.). The cars are loaded and unloaded by an electric hoist.

The charge remains in each of the three chambers composing the regenerative furnace for a period of three hours. The heating chamber is maintained at a temperature of 1,360 deg. Fahr. (773 deg. C.). The complete cycle of operation is as follows: A cold charge is first placed in the preheating chamber, where it absorbs heat from the cooling charge. After a three-hour period this charge is taken out of the preheating chamber and placed in the heating chamber, where it remains another three hours. At the end of this time the charge is carried into the cooling chamber, where it radiates heat to a new cold charge in the preheating chamber. The furnace thus delivers one 7,500-lb. (3,400-kg.) charge of annealed wire every three hours.

The labor cost attendant upon this large installation is surprisingly low. This cost is represented by the time of two men for a seven-minute period to operate the mechanical equipment for moving the cars and furnace doors and also to load and unload the cars. This operation occurs once every three hours.

When operating ten hours per day the furnace turns out a ton of annealed product with a power consumption of 185 kw.-hr. When operating on a continuous twenty-four-hour production a decidedly lower energy consumption per ton is effected, the results obtained from heats on a twenty-four-hour cycle not exceeding 115 kw.-hr. per ton of wire annealed. Converted to a fuel basis on the assumption that one kilowatt-hour can be generated from two pounds (0.9 kg.) of coal, the energy consumption is equivalent to 230 lb. (104 kg.) of coal. A well-designed and efficiently operated coal-fired annealing furnace would consume from 225 to 250 lb. (102 kg. to 113 kg.) of coal for annealing a ton of wire under similar conditions. It is, therefore, apparent that the fuel costs of the two types of annealing equipment would be virtually the same. There is, however, a decided advantage in favor of the electrical equipment from the standpoint of labor for operation, floor space, maintenance and quality of product.



CARLOAD OF COILS IN FRONT OF HEATING CHAMBER

The wire annealed in this furnace has proved to be superior in quality to that previously obtained from the fuel-fired equipments. Besides, the oxidation is less than in the case of the fuel furnaces. The annealed wire receives from twelve to fifteen cold-working operations without any further heating. Owing to the uniformity of the anneal obtained in the electric furnace, the upkeep cost on roll and die equipment has been materially reduced. In a large measure the die settings for the various cold-working operations have been standardized so that it is not necessary to change adjustments to meet variations in the temperature of the wire. With the electric furnace it is assured that all the coils in a charge are annealed uniformly, whether they are taken from the bottom of the charge or from the top. With the previous combustion equipment it was frequently necessary to remove the charge before the bottom coils were fully annealed in order that the coils at the top should not be overheated. This necessitated that the bottom coils be again introduced into the furnace for reheating, a procedure which was very unsatisfactory both from the standpoint of direct monetary loss and from the standpoint of plant operation.

The outstanding feature of the installation is its absolute dependability with respect to continuity of production and quality of product. This, in conjunction with the economy of operation and absolute freedom from adjustments and repairs, has conclusively demonstrated that the electric furnace is both commercial and practical and possesses merit of a high order for industrial heating processes on a large scale.

The electric annealing equipment, which is of the regenerative-car type, consists essentially of three furnace chambers, each 12 ft. (3.6 m.) long, 7 ft. (2.1 m.) wide and 4 ft. (1.2 m.) high. One of the chambers is employed for heating, one for cooling and one for preheating. The heating chamber and cooling chamber are set in tandem with a common door between, while the preheating chamber is placed alongside the cooling chamber with a full side opening between them to allow of a free interchange of heat from the hot to the cold charge.

The electric heating units, which are installed in the heating chamber only, consist of heavy nickel-chromium ribbon suspended on the side walls by means of special refractory insulators. There is a total heating capacity of 180 kw., the elements being designed for direct connection to the 440-volt, three-phase power service of the plant.

The automatic temperature-control equipment consists of a standard General Electric heater panel which is actuated by means of a Leeds & Northrup two-point control instrument. This instrument has a temperature scale from 200 deg. to 2,000 deg. Fahr., recording both the temperature of the heating unit and the charge and functioning as a controller as well. Neither the temperature of the ribbon nor that of the charge can exceed a predetermined value.

The furnace cars, which are 12 ft. long (3.6 m.), 6 ft. (1.8 m.) wide and 30 in. (0.75 m.) high, are of the swivel truck type and are heavily insulated. On both sides and ends of each car are sandseal troughs so that the furnace can be sealed when in service. The cars are moved into and out of the furnace by means of a special conveyor mechanism which was designed by the engineers of the Fowler & Union Horse Nail Company. The conveyor proper consists of two massive endless chains which are installed parallel to each other, entirely below the floor level, one being placed beneath the car track through the heating and cooling chambers and the other beneath the car track through the preheating chamber. The conveyor chain is provided with steel dogs spaced at car length intervals, which engage lock-bar pins on the furnace cars. Lock bars are provided at both ends of the cars so that either end may be engaged as required. The conveyor drive is at the extreme end of the furnace room. The control levers for the conveyor as well as the air valves for operating the five furnace doors are all installed on a control pulpit. From this point the operator can raise or lower any or all of the furnace doors and move the cars in or out at will.

This furnace was designed and installed by the George J. Hagan Company.

Economics of the Public Utility Business

The Capital Requirement—The Cost of Money—Conditions that Save Money—Some Mass Economies—Where the Money Comes From—Selling Junior Securities to Customers

By SAMUEL INSULL
President Commonwealth Edison Company, Chicago

IT IS difficult for any utility man to view his own business both close up and in panorama and to carry a clear vision not only of the details of his individual local enterprise but also of the great industry of which it is a part. Particularly is this the fact when it comes to the economic aspects in which interdependent relationships are so complex and manifold. Yet a true picture of the whole is essential to balanced thinking by the central-station executives. Mr. Insull, in a recent address before the Chicago Chapter of the American Institute of Banking, sketched this graphic presentation of the economics of the utility business. In spite of unavoidable condensation it gives a well-rounded conception of the active elements involved that should be organized into the mental background of every man who seriously makes the public service his study and his work. There is encouragement and inspiration in this record of progress and achievement.

THE economics of public utility business might be expressed in just one word — interest. At least 50 per cent of the expenses of operating local public utilities is the interest on the investment in the business. It is a business that turns its capital very slowly indeed. On an average, the local public utilities in a state having as great a density of population as the State of Illinois can turn their capital only about once in five years. That is to say, for every new dollar's worth of business we require on an average five dollars of new capital.

It takes, on an average, about 50 per cent of the gross revenue to pay operating expenses, depreciation and reserve—a little over 50 per cent perhaps, probably nearer 55 per cent—and consequently it leaves about 45 per cent for interest on securities, dividends to stockholders and the necessary reserves in the shape of surplus or other reserves to provide for a rainy day. In a business having such a heavy interest charge, and having such an amount at, say, 6 per cent interest, to be earned before any profits can be said to have been obtained, credit cannot be maintained unless proper rates are maintained, and that is the great fundamental requirement of such a business.

It is perfectly natural that during a period such as we have gone through, dating really from 1914 up to the last six months, such institutions should suffer during the general uprise in prices of all commodities and labor. It was a physical impossibility for a utility commission to meet the situation and deal with it as promptly as the increase in costs became evident. Such bodies have been used for a period of years for regulating our prices downward. During the period prior to the great war the tendency of our costs had been downward for a variety of reasons, and for the commissions to switch around and do justice to the utility when for some years previous their main job had been to do justice to the customers of the utility was a pretty severe wrench on them and also on the public mind. But, looking at it from the experience of the last few years, I think those various regulatory bodies rose to the occasion in a remarkable way and rendered great service not only to the investors but to the customers of the utilities by regulating prices upward and so preserving the credit and earning capacity of practically all of the utilities that come before them with a proper case.

Fortunately for us, the peak of money cost has passed, the peak of labor cost has passed, the peak of material cost has passed, and the peak of investment cost has passed; but even while these various things were at their very highest and while we were paying the highest possible prices for money, the damage that was being done to us and to the investment of our owners was far less than it seemed to be at the time we had to pay such high prices for money.

Take, for instance, the case of the Commonwealth Edison Company. This company paid during the war as high as 9 per cent for money, practically 60 per cent higher than it had been in the habit of paying. The total money put into the business from senior securities up to the start of the war had cost 5.23 per cent. Similar securities sold during the war cost 6.68 per cent. Some of those securities, as I stated, were sold at such a high price as to cost the company a little more than 9 per cent; and yet if you take the entire effect of war financing and average the cost of the money put into the business both prior to the war and during the war—that is, from senior securities—the total increase in cost was only 0.79 per cent, an amount that is simply negligible.

WAR TIME MONEY COST WAS NO TEST OF STABILITY

If a great institution like the Commonwealth Edison Company, that is able to pay its stockholders a fair dividend, 8 per cent, could not stand as a result of the greatest cataclysm the world has ever seen an increase of a little over three-quarters of 1 per cent in the cost of its money, it could not be considered a very stable business.

The effect of war-time financing on the Public Service Company of Northern Illinois, when you average the cost of the money prior to the war and during the war, only showed an increase of 0.83 per cent. The permanent increase in the cost of money obtained from senior securities in the Middle West Utilities Company is less than with the Public Service Company, or only 0.81 per cent.

I mention these figures to show what a negligible quantity is involved in the war financing of the local public utility business, and I do not think those figures would vary very much in any part of the country in institutions of similar development and similar credit engaged in the public utility business. I think they are a pretty fair example. I think the Commonwealth Edison Company's figures would compare with those of New York, Philadelphia and Boston. I think the Public Service Company's figures would compare with any of the suburban properties surrounding any of those cities. I think the Middle West Utilities Company's figures would compare with any reasonably well-operated and conservatively capitalized holding company run by persons who understood the business.

Conditions that Save Money

As a matter of fact, while the cost of money has increased on the face of it, the figures we have been able to work out with relation to the operation of our various properties indicate that the cost of money has really gone down materially. The governing question in connection with public utility economics and public utility finances is the investment per unit of maximum demand. For instance, if that investment is $500 and money averages, we will say, 6 per cent, why that is $30 a year. If that investment is $250 and money happened to average 8 per cent, why that interest charge would be $20 a year, and that is exactly what is going on in local public utility business.

There have been a number of reasons for that reduction in the investment per unit of maximum demand. When I first went into the local public utility business here in Chicago the investment was only used about 20 per cent of the time. That is, we had a load factor of 20 per cent. The average use of our investment, expressed in a proportion to the maximum use of our investment—that is, the average use twenty-four hours a day 365 days a year—was only 20 per cent of the time when figured against our maximum demand. That situation changed from year to year so that at this time our investment is used about 45 per cent of the time. That is, the relation of the average use to maximum use figures out a 45 per cent average use. So that our capital average used to be idle about 55 per cent of the time, and it is in an effort to change that condition that we are able to affect the cost of money and other overhead permanent costs that are dependent upon the total capital invested and not dependent upon the average use of that capital.

Less Reserve Found Possible

There are a great many things that go to help us in doing that. For instance, our losses, that is the unaccounted-for energy that we manufacture at this plant, is around 10 per cent, perhaps a little more than that. Twenty-five years ago it was 30 per cent. Then, owing to the difficulties in obtaining apparatus or men to install that apparatus during the war, owing to shortness of labor and manufacturing establishments being used for war purposes instead of for purposes of peace, we were compelled to run our plants with less reserve than we did prior to the war. Prior to the war we carried about 33⅓ per cent reserve. During the war we ran at from 15 to 18 per cent reserve. In other words, we put 15 per cent more of our capital into actual use. Necessity compelled us to do so, and in doing so we learned that it was perfectly safe to run our business on less reserve.

Moreover, there have been a great many other things that have tended to bring more of our capital into use. A great deal of our work takes far less money, because the investment on customer's premises is much less than half of what it was twelve or fifteen years ago. That is partly owing to improvements in devices and partly owing to the fact that our customers use more energy on their premises for the dollar invested in putting them in a position to take that energy. Another thing that has helped us is the building up of proper depreciation accounts and reserve accounts that have been reinvested in plant and distribution systems. Those have tended to arrest the increased cost of money, because, fortunately, any money obtained in that way and put into plant does not have to pay the banker interest.

There is some advantage in being in a business whose fixed capital is put into permanent plant and whose merchandise on hand, subject to rapid variation in value, and whose receivables together form a negligible quantity, so far as total investment is concerned. One of the reasons why the banking interests have had little or no trouble with utility investments is the fact that if their entire accounts receivable and merchandise on hand disappeared, it would not affect their capital investment 15 per cent. That is one of the fundamental reasons of lack of trouble with them.

Each Dollar Used Many Times

There are other factors that go to increase the economies. Take the ordinary operations of the human being. Let us assume he is on the top floor of one of our office buildings. He burns light over his desk. He cannot do that and go down in the elevator at the same time, and he cannot go down in the elevator at the same time that he is riding on the street car; and he cannot ride on the street car at the same time that he is cooking his dinner by electricity in his kitchen in his flat. And yet all those operations use energy and they use it at different times. So that the dollar invested serves its purpose again and again and again, and you have concentration of investment and diversity of use.

When I first went into the business of electricity all we did was to use the electricity for light, and as a result our investment was only used about 20 per cent of the time, as I have stated. Today it is used for all those different purposes, and in this city we use it, as I said, 45 per cent of the time. If you will go further west, where instead of depending upon the black fuel of Illinois they depend upon the white fuel of the waterfalls of the Sierra Nevadas, you will find in Montana, or if you go further west along the slope of the Pacific, that energy is used for so many different purposes because it can be bought so much cheaper that the load factor is 60 or 70 per cent, or 50 to 60 per cent more use of the investment than we are able to get in this particular location.

Balancing Industries

We produce 70 per cent of the ice that is used in the city of Chicago by supplying the electric energy to run artificial ice plants. Flats and residences use electricity in the winter in a community like Chicago; they use very little indeed in the summer. The use of electrical energy by ice manufacturers is negligible in the winter. So the investment that supplies the householder with light and heat in the winter supplies him through his ice man with refrigeration in the summer. We get a double use of the investment. That has affected us to such an extent that whereas 80 per cent of our energy used to be put out in the winter and only 20 per cent in the summer, at this time 47 per cent of our energy is supplied to our customers during the summer months and only 53 per cent of our energy is supplied to our customers in the six winter months. We are getting closer and closer to a point where, owing to the great diversity of demand, the chances are that our investment, less that which we hold for reserve, will be employed all the time.

Some Mass Economies

Some day all of the steam railroads wherever there is density of population are going to be electrified. There may be a relatively small amount of territory where that will not be possible. When that is done there will be a saving of around 250,000,000 tons of coal a year, the difference between producing power under the uneconomical conditions governing a steam engine on a railroad track and its production in very large volume with a highly economical steam plant. The central electric stations of the United States produce 42 per cent of the energy used in the United States for all forms of power, including manufacturing and the railroads, and only consume 12 per cent of the coal used for these purposes. The steam railroads use 160,000,000 tons of coal per year at this time and the manufacturing plants use 145,000,000 tons of coal per year, while the central stations use only 40,500,000 tons of coal per year but turn out one-third more energy in the form of horsepower than is used by either one of these other two great industries. The central stations require an average of only 1½ lb. of coal per horsepower-hour, while 7 lb. or 8 lb. per horsepower-hour is required for the steam railroads and the manufacturing plants. That expresses in a few words the real economics of the electric light and power business.

Where the Money Comes From

Now comes the question, "If you do $130,000,000 of business a year, and you get 8 per cent or 10 per cent increase a year, and it takes five dollars of new capital for every dollar of new gross business to enable you to function, how do you raise the money?"

The war has taught us one very important thing. A man who has to raise a million dollars a week has found it very hard during the war-time period. So he has had to go to a new source to raise money. We have had to go to the customers of our properties to take our junior securities, and it was the very best thing that ever happened to us. We have increased the stockholders of the Commonwealth Edison Company from 5,000 or 6,000 on Armistice Day to 25,000 or 26,000 at the present time.

Of the $40,000,000 or $50,000,000 new money that is needed by the group of properties that I am operating around Chicago and in fourteen other states, we expect to get somewhere between 40 per cent and 50 per cent of the money required from our own customers each year. Last year we sold $18,000,000 worth of preferred and common stock to them. This year we are selling at the rate of $25,000,000 of preferred and common stock to them. In a recent issue of increased stock to the stockholders of the Commonwealth Edison Company we had to have a corps of more than 100 persons to explain to the small stockholder what his rights were and how he should go about taking advantage of those rights, as there was a certain profit in his preserving his rights. And while it introduces some problems in corporate management, it introduces absolute security and an absolute permanency of our investment.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Engineering Enrollment in Harmony with Economic Conditions

To the Editors of the Electrical World:

Any theories advanced to account for the decrease shown by the survey of the Electrical World in the number of electrical engineering students must be purely speculative, for fluctuations during short periods, as between successive years, cannot prove anything or even definitely establish a trend. Whatever may be the reason for the fluctuations, a downward trend in engineering enrollment would seem to be in harmony with economic conditions.

Engineering employment, at least so far as concerns additional employment, depends largely upon industrial expansion, and there is little expectation of any further such expansion for some time to come. Increase in the output of most central stations for a year or so will not be due to the development of new or expanding industries and will not call for any material increase in their engineering forces.

Although I am an optimist, I believe that for a time at least the output of engineers is likely to exceed the demand. Consequently a temporary decline in the enrollment of engineering courses should not foreshadow any handicap to the future progress of the electrical industry.

Herbert A. Wagner,
President.

Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

Industrial-Plant Voltages in Pennsylvania

To the Editors of the Electrical World:

The article on "Industrial Load in Pennsylvania" in the issue of the Electrical World for Dec. 31, 1921, brings out the wide variety of voltages in use in the industrial plants of Pennsylvania. It cannot be said, however, that this lack of standardization is common to all public utilities of the Keystone State. In alternating circuits the Duquesne Light Company provides as standard the following: 110 volts, single-phase; 110-220 volts, single-phase, three-wire; 220 volts, three-phase; 440 volts, three-phase; 2,300 volts, three-phase; 11,000 volts, three-phase, and 22,000 volts, three-phase—all 60-cycle.

We have, however, on the circuit some customers who are using voltages different from these standards, as, for instance, electric furnaces employing from 80 volts to 100 volts, single-phase, two-phase and three-phase, the smallest one only using single-phase. These people, however, furnish or own electrical equipment and buy power from us on a standard voltage. In direct current we have a limited zone where 500 volts is furnished for elevator work.

It is absolutely necessary that the utilities standardize on some fixed sales voltages. I know certain utilities which will furnish almost any voltage, phase or condition that any of their customers want. Possibly those who handle their business in that way know where they are going. We certainly do not.

Duquesne Light Company, C. S. Cook,
Pittsburgh, Pa. General Manager.

Factors Affecting Electric Hoisting

To the Editors of the Electrical World:

In the article entitled "Factors Affecting Installation of Electric Motors for Hoists," appearing in the Jan. 28 issue of the Electrical World, I find two mistakes in formulas which you will probably desire to correct. In the second paragraph on page 171 is a formula reading Hp. $= WV/53{,}000e$. This should be Hp. $= WV/33{,}000e$. On page 172 the second long formula which covers the case when a skip is capsized should read

$$P = (L + C) \cos \theta + \frac{(L + C) \sin \theta \times 25}{2{,}000}$$

A plus sign has been omitted between the two elements.

Freyn, Brassert & Company, Gordon Fox.
Chicago, Ill.

Jobbers Must Do Their Part in Co-operation with Manufacturers

To the Editors of the Electrical World:

I have been strongly impressed by a letter on this topic in your issue of Feb. 18. The old-line jobber who actually buys goods for stock, keeps them moving, takes his cash discounts and covers his field thoroughly is the manufacturer's best friend and deserves the utmost co-operation. Few manufacturers can economically conduct their own distribution of goods, and the jobber came into the distribution system for good reason to do substantial service.

But co-operation is not co-operation if it is not mutual. If the manufacturer is really to accord full protection to his jobber, the latter must help by actually keeping an adequate stock and covering his territory completely. Moreover, he must not hesitate to keep headquarters informed of the extent of his distribution so that the latter may know, when an inquiry comes in, whether it is from a jobber's legitimate customer trying to sneak in at the back window, from a new concern which should at once be referred to the jobber, or from some one who, for reasons good or bad, does not want to do business with that particular distributing house.

It is the failure to keep the manufacturer thus informed that is the chief cause of many misunderstandings. For example, within the writer's knowledge the following sequence of events occurred: A manufacturer reached a distant state via two large and reliable jobbers who claimed between them to cover the territory. Somehow the distribution was not satisfactory, for inquiries came in from consumers very frequently. These were referred to the nearer jobber of the two with the request that the factory should be informed what dealers were actually carying goods in the vicinity concerned. Both jobbers replied that they did not know, despite the fact that any of their traveling men could have told them where he had been selling the article in question. After many months and repeated appeals the manufacturer was in no better position to know whether anybody in that state was buying the stock which he sold to the two big jobbers. The only person to whom he could direct inquirers with any certainty of finding the goods was an enterprising dealer with whom he had in despair established direct relations.

Quite at the Antipodes from these jobbers but just as undesirable is the jobber who never intends to buy and carry any real stock but writes the factory to ship "⅓ doz. P.X. 41144" to John Doe, Pogree Hollow, Del., "and charge the same to our account." It is quite needless to speak of the semi-jobber, the demi-semi-jobber and the blighter who buys on thiry days and, after four months and many reminders, sends a trade acceptance at ninety days, entirely useless as an asset unless full responsibility is accepted by indorsement.

The point is that jobber and manufacturer should get together, play with their cards on the table, and establish a firm and definite relationship, if the consumer is to have a fair show to get the goods he wants.

Boston, Mass. Aristides.

The True Inwardness of Pacific Coast Engineering

To the Editors of the Electrical World:

The first editorial in the March 4 issue of the Electrical World says that "the engineer on the Pacific Coast, as we have often intimated, has the courage of his convictions and an inclination to do things first and inquire into their possibilities afterward."

I think this is not a proper statement. Before the decisions were made which led to the adoption of a 60-cycle, 60,000-volt grounded system in 1898 to 1900 more than a year's time was taken in study and tests. The decisions in the light of today are correct, but we did not make them until we had given the matter very long and careful study and had facts to support us. The recent decisions on insulators, shields, regulations, etc., are based on several years' constant study and tests, and not made on meager information as your editorial would indicate.

The main point is that when we have made a thorough study and made our decisions we have been backed up by the company officials. They do not ask, "Has any one else done this thing you propose to do?" but ask, "Are you sure you are right from an engineering and economic standpoint?" Furthermore, I think one of the main reasons for our advance in water power and electric transmission is that we have our minds on water power, whereas the Eastern engineer has his mind largely on steam power. In other words, necessity largely forces the Western engineer to do things that seem bold to Eastern men.

F. G. Baum,
San Francisco, Cal. Consulting Engineer.

Organization Chart that Correlates Work

To the Editors of the Electrical World:

The Utah Power & Light Company is receiving inquiries regarding the article entitled "Organization Chart that Correlates Work" which appeared above my name in your Feb. 4 issue. I have also received a letter from that company, the closing paragraph reading as follows: "We are calling this matter to your attention since undoubtedly you will wish to have a correction appear in a later issue."

May I ask that you call attention to the fact that I am not connected with the Utah company, but with the one indicated below?

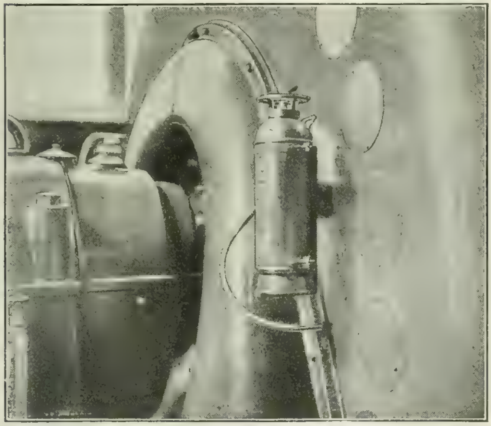
R. A. Hammack,
Superintendent of Distribution.
The Denver Gas & Electric Light Company,
Denver, Col.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Liquid Extinguishers Effective for Quenching Generator Fires

THE use of liquid fire extinguishers permanently installed on generators has been found effective in quenching fires which originate in these generators on the system of the Pacific Gas & Electric Company of San Francisco. Four 3-gal. extinguishers are mounted on each generator, as shown in the illustration, and arranged for easy connection to perforated tubing placed within the generator housing, where the liquid may be directed against the coil ends.



PERMANENT TUBING IN GENERATOR HOUSING SPRAYS LIQUID ON BURNING COILS

This tubing consists of four semi-circular copper pipes, two placed at each end of the machine inside the end casings with a T connection in the center of each to admit the liquid. Their ends are closed, the tubes being drilled with small holes directed radially toward the coils of the stator windings. The extinguishers are pivoted in place at the four corners of the generators. Normally these are in an upright position with the hose attached, but in case of fire the extinguishers may be inverted by rotating them on pivots and the hose can be attached to the copper tubes by means of a snap connector.

Prior to the general use of these extinguishers a failure occurred in the insulation of one of the generators on the system of the Pacific Gas & Electric Company, and although the generator was at once separated from the bus, the fields killed and the air dampers closed, the fire burned for more than one-half hour, although seven liquid fire extinguishers were emptied into it through the openings in the frame. The fires were not extinguished until the velocity of the rotor was decreased to the point where there was very little windage. The damage was found to be confined to the end of the coils, but more than 50 per cent of the complete set was ruined.

After equipping the generators with the fire-fighting system as described, another and similar fire occurred in another generator. One minute after the extinguishers were placed in operation no smoke was issuing from the generator and not one coil, except those adjacent to the arc, was damaged. It has been found that the liquid has no material deteriorating effect upon the insulation. FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Electric Oven Reduces the Cost of Vulcanizing Rubber

BY ADOPTING ovens for vulcanizing set-in rubber brushes the J. S. Costello Brush Company, St. Louis, Mo., has been able to eliminate the investment in steam equipment and the operating expense connected therewith. Although the usual method of heating in vulcanizing work has involved the use of steam, the company in undertaking the manufacture of set-in rubber brushes as a new department felt that this was unwarranted and determined to eliminate the trouble and expense attending the operation of a small steam plant.

Accordingly it secured a standard box-type electric oven which had a chamber 53 in. deep, 28 in. wide and 35 in. high. This was built with double doors, with 3 in. of sheet-insulating material on all sides, and so arranged, with rack rests placed every 3 in. on the inner wall, that as many as eleven racks or brushes may be handled at one time. Ten-kilowatt, 220-volt direct-current heating elements are placed at the bottom of the oven in a chamber 12 in. deep. Air is admitted to the oven through two openings below the door and is discharged at the top of the oven. Two Taylor automatic temperature controllers enable the oven to operate at two distinct temperatures.

In the manufacture of the brushes the hair is first immersed in a rubber compound which contains a high percentage of volatile liquid and then baked for about six hours at a temperature of 150 deg. Fahr. On the following day the rubber compound is baked or vulcanized for a period of six hours at a temperature varying between 275 deg. and 300 deg. Fahr. This variation of temperature is due to the fact that some of the materials handled require lower temperatures than others. It was found that precise temperature values and close temperature control was very essential in this work.

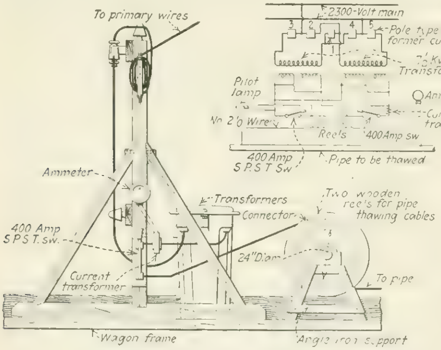
When this oven was first placed in operation it was discovered that the control apparatus permitted a temperature fluctuation as great as 30 deg.; consequently more precise instruments had to be installed. Also, the draft through the oven was too strong, owing to the fact that the oven discharge vent leads directly to the building chimney. Naturally, this draft prevented uniform distribution of heat, and brushes in certain sections of the oven were burned while others were incompletely baked. This trouble was eliminated when the stack opening was reduced and light metal baffles were placed on the racks. Better circulation was also obtained and the temperature variation was reduced to less than 10 per cent. Since an automatic control and alarm clock cut-off was installed, the oven requires very little attention and turns out satisfactory work.

James W. Carpenter,
Industrial Heating Engineer.
Union Electric Light & Power Company,
St. Louis, Mo.

Portable Pipe-Thawing Apparatus that Limits Current

By winding the two secondary leads of an electric pipe-thawing outfit in opposite directions on reels having a common steel shaft it is possible to obtain an adjustable reactance for limiting the current employed. Portable apparatus involving this feature has been used very successfully by the electric department of the city of Calgary, Alberta, Canada.

The outfit consists essentially of a wooden frame for supporting the leads attached to the electric service circuit, two 7½-kw. transformers and two reels having a steel shaft. The details of construction are indicated by the accompanying illustration, which also shows the electrical connections. Five 2,300-volt pole-type cutouts are attached to the top arm of the frame. When plugs 2, 3, 4 and 5 are inserted, the primaries of the transformers are connected in parallel and 110 volts is impressed across the secondary terminals. If plugs 1, 3 and 5 are inserted, the transformers are connected in series and 55 volts is impressed across the secondary terminals. In the secondary circuit are a pilot lamp and an ammeter, the former indicating whether the circuit is closed and the latter guarding against overloading of the transformers. For a short job all the wire is unreeled, but for a long job seven or eight turns are left on the reels to limit the current.



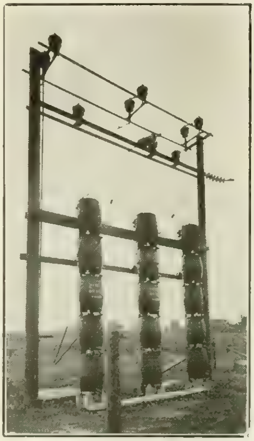
OPPOSITELY WOUND SECONDARY LEADS ON REELS HAVING STEEL SHAFT LIMIT PIPE-THAWING CURRENT

The foregoing information was obtained from J. N. Lightbody, engineer of the electric light and power department of the city of Calgary.

Field Editor Electrical World.
San Francisco, Cal.

Water-Barrel Lightning Arresters Give Satisfactory Service

Water-barrel lightning arresters installed on 60,000-volt circuits of the Ontario Power Company of Niagara Falls have been giving very satisfactory service, the one shown having been in use since May, 1914. A series of five barrels and disconnecting horn-gap set at 5 in. are used per leg. The barrels are kept filled with river water, and when the temperature drops to freezing in the fall they are removed and carborundum resistors inserted in their place. The electrodes are 3-ft. x 3-ft. x ⅛-in. copper approximately 23 in. apart. The bottom electrode is supported on a copper stud which protrudes through the bottom of the barrel and in turn supports the top electrodes of the barrel immediately under it. To prevent flashover at the surface of the water the stud is protected by a high-grade porcelain tube which rests on the top electrode. The barrels are insulated one from the other by pin-type porcelain insulators. Each barrel has a resistance of approximately 334 ohms at a temperature of 13.5 deg. C.



THESE LIGHTNING ARRESTERS PROVE SATISFACTORY ON 60,000-VOLT CIRCUIT

Water-barrel arresters are also in service on 12,000-volt and 30,000-volt lines, using two and three barrels respectively, with horn-gap settings of ⅜ in. and 2½ in. series with the barrels. Another horn gap is in parallel with the barrels, being set at ⅝ in. and 2¼ in. respectively for the voltages named. In the fall these barrels are removed, leaving the two horn gaps in series to ground, which gives very satisfactory protection for the winter months.

No investigations have been made to ascertain the extent to which these water-barrel arresters will drain steep-wave voltages from the line, but, speaking generally, their performance in this regard appears to be fully as satisfactory as the electrolytic arresters. This statement is based on the fact that equally satisfactory protection is being obtained on two parallel 60,000-volt lines, one equipped with water barrels and the other with electrolytic arresters. During line surges the discharge at the horns is approximately of the same nature as that at the horns of the electrolytic arresters, but possibly not quite so snappy. This would indicate more or less power current, but it is never of sufficient value to cause an interruption or make any great disturbance on the line. The discharge capacity of the water barrels is approximately 40 amp. at 64,000 volts, or about 2,500 kva.

While the barrels have flashed over occasionally, we have had very little trouble with them. According to the paper read by Dr. E. E. F. Creighton at the midwinter convention of the American Institute of Electrical Engineers on "Deviations from Standard Practice in Lightning Arresters," it would appear that we are operating *in spite* of the water-barrel arresters. However, regardless of figures, it must be kept in mind that the arrester shown has been in service for the past six years and during that time we have not lost a piece of apparatus in our plant that is connected to this line. The same thing is true of the 30,000-volt lines protected with water-barrel arresters. H. M. KING,

Electrical Supervisor.

Ontario Power Company of Niagara Falls,
Niagara Falls, Ontario.

Operating Costs Cut by Running Boilers at Proper Ratings

MODERN furnaces and boilers are capable of being forced over peaks to a far greater extent than older equipment, and where the character of the load permits this means that substantial savings can be realized over banking. The most desirable rating at which to operate boilers depends upon the labor requirements, duration of peak, effect of forcing on fuel consumption and maintenance, amount of coal required for banking, etc. For a given plant the relations between forcing, banking and fuel consumption can be reduced to tables and graphs which are useful in establishing boiler-operating schedules for different conditions. An example of this method of analysis, as used by the Edison Electric Illuminating Company of Boston, was given in a paper by I. E. Moultrop and R. E. Dillon before a recent joint meeting of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

With modern equipment no appreciable increase in labor is necessary for operating at higher ratings. One fireman can handle a row of several boilers, and the running of additional units will not substantially increase his work. It is usually difficult, on the other hand, to operate at very low ratings without burning holes in the fire, and for this reason and other considerations it was found best in this installation to do some forcing on the dayload runs.

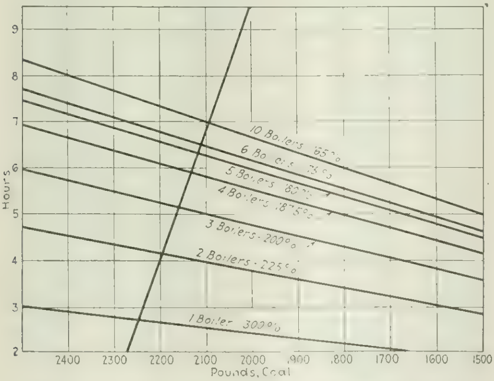


FIG. 1—BASIS FOR DETERMINING WHETHER TO BANK OR FORCE BOILERS

The steep diagonal, or banking line, indicates the amount of coal required to bank and bring one boiler up to steaming service when the duration of the peak is that indicated on left-hand scale (based on banking twenty-four hours minus duration of peak). The group of lines intersecting the banking line represent the coal loss when operating different numbers of boilers above their economical ratings for the periods shown on left-hand scale. Hence the intersections with the banking line indicate the conditions when there is an equal loss in fuel whether banking or forcing is employed.

Whether boilers shall be forced over the peak or whether additional boilers shall be banked for it is a problem affected by the duration of the peak and the type of equipment available. Much depends on how long a given high rate of forcing can be maintained without the fires getting out of condition. Much higher rates can be employed for short periods than would be practical for longer times. The extent of high forcing and the period used affect the maintenance costs, which mount rapidly with high rates for protracted periods. There is a point at which the loss due to extra fuel burned by forcing equals the loss from carrying additional boilers banked for the peak. This point is shown in Fig. 1, the intersection of the steep diagonal line with less-inclined lines expressing the fuel losses resulting from forcing a given number of boilers at a given percentage rating over a stated period.

LOSS OF COAL CAUSED BY FORCING BOILERS ABOVE THEIR ECONOMICAL RATING

The figures at the right indicate the amount of coal which would be saved per hour if one more boiler were added to each group so all units could operate at 150 per cent of rating. For example, if ten boilers are operated at 165 per cent of rating to carry a certain load, 300 lb. more coal per hour is being burned than if eleven boilers were operated at 150 per cent rating.

No. of Boilers in Service	Rate of Forcing (Per Cent of Rating)	Extra Coal (Lb. Per Hr.)	No. of Boilers in Service	Rate of Forcing (Per Cent of Rating)	Extra Coal (Lb. Per Hr.)
1	300	835 x 1 = 835	5	180	67 x 5 = 335
2	225	265 x 2 = 530	6	175	55 x 6 = 330
3	200	140 x 3 = 420	10	165	30 x 10 = 300
4	187.5	90 x 4 = 360			

This chart indicating the effect of forcing boilers is developed from the table, which shows the losses in pounds of coal caused by forcing different combinations of boilers above their economical rating in order to carry for one hour the load that would be economical for this combination plus one more boiler. The data given are based on actual tests and the fact that 150 per cent rating has been determined to be the most efficient and practical rating at which to operate this set of boilers through the day. The amount of fuel required to force the boilers is determined from the efficiency curves of the units by dividing the product of the horsepower rating times 34.5 lb. of water times the latent heat of steam (aproximately 970 B.t.u. per pound) times the percentage rating by the product of the percentage efficiency of the boiler at the rating named into the calorific power of the fuel (about 14,300 B.t.u. in the cases presented). The difference in fuel consumption between two different ratings is the increased fuel required per hour to operate at the stated degree of forcing.

From the table it appears, for example, that if two boilers of the group studied are operated at 225 per cent rating, 530 lb. more coal per hour is required than if three similar units are run at 150 per cent rating. Tests show that it requires 1,500 lb. of coal to bring one of these boilers from banked to steaming service and 35 lb. of coal per hour to maintain the boiler banked. The steep diagonal in Fig. 1 shows the total amount of coal required in banking for a period of twenty-four hours minus the duration of the peak. Thus, assuming a four-hour peak for illustrative purposes, the banking period becomes twenty hours and the coal consumption is 20 times 35, or 700 lb., plus the 1,500 lb. required to bring to steaming service, or a total of 2,200 lb. The group of lines intersecting the banking line represents merely extensions of the coal loss data of the table for other periods than one hour, and curve *B* in Fig. 2 shows the points of intersection of Fig. 1 plotted against time. That is, these intersection points indicate the conditions when there is an equal loss in fuel whether banking for a given period is done or whether the particular boiler group shown is forced for the stated period at the rating indicated. From Fig. 2, then, can be determined at a glance the limiting periods at which boilers can be forced without greater fuel losses than would be incurred by banking.

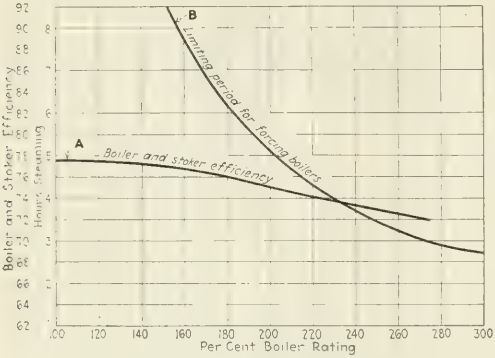


FIG. 2—TYPICAL EFFICIENCY CURVE AND ECONOMICAL FORCING LIMITS OF BOSTON COMPANY'S BOILERS

Curve B shows the intersections in Fig. 1 plotted against time.

Schedules of boiler operation are prepared upon these diagrams as a basis, bearing in mind the duration of peak loads and the variations in the plant load curve. The curves herein shown enable those in charge of plant operation to determine the extent of banking and forcing likely to be required for any given duration and magnitude of peak. Schedule peaks and peaks that occur regularly are cared for by forcing boilers or by holding boilers in bank. Emergency peaks are frequently thrown upon the system with warning for only a few minutes' preparation. Thunderstorms can usually be discounted ten or twenty minutes ahead and hot banks prepared, the fire and air-pressure being built up in the steaming boilers. In such cases there need be no disturbance in absorbing the load, and this is generally accomplished with but a slight decrease in efficiency.

Field Editor Electrical World.

New York, N. Y.

Geared Truck Permits the Moving of Heavy Transformers

When overhauling or repair of an installed transformer becomes necessary it is customary to remove the machine to the repair shop of the plant. To facilitate this transfer large transformers are in all cases equipped with trucks and wheels. To avoid the use of a turntable, transfer trucks are employed along the row of transformers. The actual moving can be done either with some temporary fall-and-tackle arrangement or by means of crowbars inserted into notches provided for that purpose in the wheels.

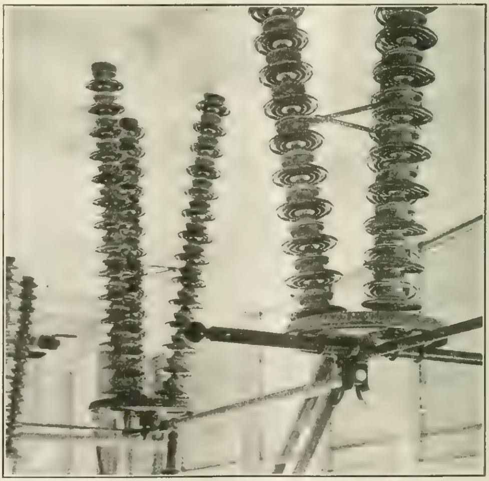
Another very simple method for moving transformers has recently been used on all the transformers in the Ritom power house of the Gotthard tunnel road electrification in Switzerland, built by the Oerlikon works. The transformers are single-phase, 16⅔-cycle, with 12,000 kva. output, and weigh complete with oil about 60 metric tons. The middle of the high-voltage winding is grounded outside of the tank. The machines have four-wheel trucks, and on the truck shafts are fastened large gear wheels which small gear pinions engage. At the two ends of each pinion shaft are attached levers about 5 ft. long with a ratchet head working either way. It is claimed that four men working at the four levers can easily move the entire transformer.

Boston, Mass. Field Editor Electrical World.

Replaceable Units Used in 220,000-Volt Bus Construction

Pillar-type insulators composed of fourteen interchangeable units each have been used by the Southern California Edison Company in the construction of its Big Creek No. 8 station, which was recently completed for ultimate operation at 220,000 volts.

The units of the insulators are made up in the company's shop and consist of standard 10-in. porcelain suspension units having malleable iron fittings cemented to them. The fittings, which are hot-galvanized, are composed of a pin or cap on one end and a flanged union connection on the other. The flanged connections are cast male and female and have four holes for bolting them together.



INTERCHANGEABLE UNITS FOR BUS CONSTRUCTION

Struts are placed between the mid-points of the insulators to increase the rigidity of the pillars, which are arranged as tripods. At the busbar end of the pillars static shields are placed which reduce the unit voltage duty of the lower units to a point where cascading and subsequent flash-overs are suppressed. The shields consist of annular rings of cast aluminum.

Field Editor Electrical World.

San Francisco, Cal.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

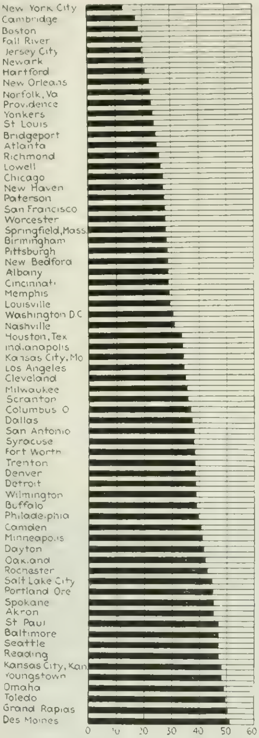
A Broad Study of Home Ownership

The Bureau of Housing Makes an Interesting Report on Conditions Existing in Many Cities — Some Pertinent Deductions for the Electrical Industry

THE Bureau of Housing recently established in the United States Department of Commerce in Washington has been doing some extensive research work in the field of home ownership, in the effort to develop information not only as to the condition of home ownership but as to the trend under modern conditions in urban life. The accompanying chart and table provide material for considerable study and develop some reflections which are a bit surprising.

In the city of New York, the chart shows, the lowest percentage of home ownership prevails shown by any of the listed cities, which embrace the forty-five principal ones. About 12 per cent of the occupants of New York own their own homes. The others obviously are apartment dwellers and occupants of boarding establishments and hotel suites. Des Moines shows the largest percentage of home ownership, with more than 50 per cent of the people owning their own dwellings. It is remarkable, however, that the extent of home ownership does not seem to follow any definite trend based either on the size of the community or on its geographical location. Whereas New York shows the lowest percentage, the neighboring cities of Buffalo and Philadelphia are well down on the list with a percentage of about 40. Rochester, Baltimore and Reading show an even greater proportion of homes owned by the occupants. San Francisco groups with New Haven, Paterson, Worcester and Springfield. Birmingham lists between Springfield and Pittsburgh. Reading has a place between Seattle and Kansas City.

The table, showing the trend in home ownership in the different cities between the years 1900 and 1920, also presents some very interesting phases of this situation. Conditions in New York are practically stationary, while in Philadelphia within the last twenty years there has been an increase from 22.1 to 31.9 per cent. In other words, home ownership in the city of Philadelphia has almost doubled. In Cambridge, Mass., however, home ownership has fallen off somewhat, owing to the increase in the construction of apartment houses. Boston has also decreased slightly. Jersey City has fallen off, as have New Orleans and Richmond. Los Angeles has decreased in home ownership by 10 per cent and Akron by 9 per cent. There are other similar cases. But, by and large, there is an almost universal trend toward a greater proportion of home ownership in spite of the general belief that we are becoming a nation of cliff dwellers congregated in large urban centers.



SHADED PORTION SHOWS PERCENTAGE OF HOMES OWNED

This analysis of present conditions should be distinctly encouraging to the electric industry. The war has been an element of influence, undoubtedly, because profiteering by landlords during the war period increased to a degree the purchase of homes by families that formerly had rented. Across the country, however, there is a clear indication of a healthy progressive increase, with which must develop a greater interest in household equipment and property improve-

HOME OWNERSHIP COMPARISONS FROM BUREAU OF CENSUS STATISTICS, CITIES OVER 100,000

City	Total Homes 1920	Per Cent Owned 1920	1910	1900
New York	1,278,341	12.7	11.7	12.1
Cambridge	25,293	17.6	18.9	21.2
Boston	164,785	18.5	17.1	18.9
Fall River	26,399	19.7	17.8	18.0
Jersey City	67,288	19.7	20.2	20.0
Newark	93,274	20.2	20.0	21.1
Hartford	30,813	20.8	21.5	21.8
New Orleans	85,188	23.1	23.1	22.2
Norfolk, Va	26,732	23.2	20.3	17.0
Providence	54,726	23.5	20.8	21.0
Yonkers	22,126	23.5	23.5	23.4
St Louis	190,640	23.8	25.0	22.8
Bridgeport	31,994	24.6	22.1	23.1
Atlanta	49,523	24.7	24.7	18.6
Richmond	39,191	25.9	24.0	22.3
Lowell	25,034	26.1	22.4	22.9
Chicago	623,912	27.0	26.2	25.1
New Haven	36,257	27.0	25.5	26.6
Paterson	32,186	27.4	24.0	23.2
San Francisco	123,349	27.4	33.0	24.1
Worcester	39,230	27.7	24.4	24.9
Springfield, Mass	30,361	27.9	29.4	33.3
Birmingham	43,040	28.1	29.7	13.8
Pittsburgh	130,274	28.3	28.0	26.7
New Bedford	26,858	28.6	25.3	27.9
Albany	28,097	28.7	26.9	26.3
Cincinnati	106,239	28.7	23.2	20.9
Memphis	42,369	28.9	25.2	18.8
Louisville	60,490	29.8	26.6	26.4
Washington, D. C.	96,194	30.3	25.2	24.2
Nashville	30,220	31.9	30.6	26.0
Houston, Tex.	33,932	34.2	31.4	31.7
Indianapolis	81,256	34.5	33.0	33.7
Kansas City, Mo.	82,056	34.7	36.2	24.2
Los Angeles	159,476	34.7	44.7	44.1
Cleveland	182,692	35.1	35.2	37.4
Milwaukee	106,101	35.5	36.4	35.9
Scranton	29,768	35.5	37.6	37.9
Columbus, Ohio	58,913	36.6	35.7	31.2
Dallas	36,754	36.9	36.0	33.2
San Antonio	36,405	37.8	40.8	38.0
Syracuse	41,558	37.9	39.7	37.4
Fort Worth	25,052	38.1	34.7	38.0
Trenton	25,319	38.1	31.2	26.2
Denver	61,916	38.3	36.2	28.0
Detroit	218,973	38.3	41.2	39.1
Wilmington	24,488	38.3	30.4	27.1
Buffalo	116,201	38.6	34.2	32.9
Philadelphia	402,946	39.5	26.6	22.1
Camden	26,645	40.5	29.2	25.7
Minneapolis	91,843	40.9	40.4	28.7
Dayton	38,138	41.9	38.1	38.0
Oakland	55,793	42.0	46.7	41.9
Rochester	68,247	42.5	42.1	37.8
Salt Lake	28,216	44.3	45.1	40.0
Portland, Ore	67,045	44.6	46.3	31.4
Spokane	27,178	44.6	51.3	37.2
Akron	44,195	44.7	50.4	53.7
St. Paul	54,409	46.1	41.2	29.9
Baltimore	166,857	46.3	33.7	27.9
Seattle	80,048	46.3	44.9	31.6
Reading	25,202	46.6	39.6	37.1
Kansas City, Kan	25,009	47.6	46.1	33.7
Youngstown	28,699	47.8	40.7	45.1
Omaha	44,499	48.4	33.8	27.7
Toledo	57,951	49.4	44.3	43.0
Grand Rapids	33,703	50.2	47.9	41.4
Des Moines	31,644	51.1	45.6	38.5

ment. This will react inevitably in an expanded market for electric service and the more extensive use of electrical appliances.

Repeat Orders for Preferred Stock from Customer Owners

POWER companies which sell their securities to customers for any length of time soon face the question: How often will an average customer buy preferred stock? Some interesting figures on this question have been compiled by the Central Maine Power Company, which has sold stock regularly for nearly fourteen years and intensively for the past four years.

This company finds that 24 per cent of its stockholders have bought stock twice or oftener. Here are the figures:

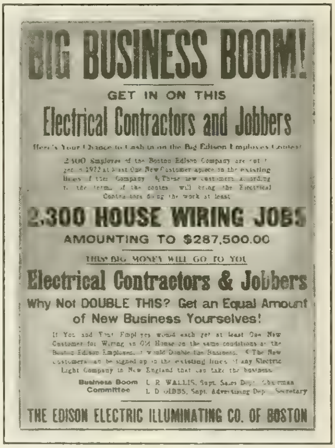
Stockholders who have bought twice	16 per cent
Stockholders who have bought three times	4.5 per cent
Stockholders who have bought four times	1.9 per cent
Stockholders who have bought five times	0.8 per cent
Stockholders who have bought over five times	0.9 per cent

Two stockholders have bought twelve times in four years.

Salesmen of this company plan to call on stockholders at least twice a year.

Extension of Boston Business Boom

THE Edison Electric Illuminating Company of Boston is further extending its campaign for new customers by distributing the accompanying poster to New England jobbers and electrical contractors in its territory. Three thousand of these posters have already been mailed and the effect of the co-operative drive for the wiring of old houses is already being felt. Widespread interest among the employees of the company in the contest for new customers is rewarding those in charge of the campaign. At a recent department head conference it was agreed that the securing of a new customer must include the wiring of the house in which he lives and that house must be on the existing lines of the company, that is, within one span of wire from the company's service lines. As stated in the Electrical World for March 4, ten special prizes will be awarded. In the contest those employees having ready access to the public, such as those in the sales department, application department and district manager's department, except clerks in these departments not in immediate contact with the public, are ineligible for prizes. Bureau and department heads are also ineligible.



BIG BUSINESS BOOM!

GET IN ON THIS

Electrical Contractors and Jobbers

2,300 HOUSE WIRING JOBS

AMOUNTING TO $287,500.00

Electrical Contractors & Jobbers

Why Not DOUBLE THIS? Get an Equal Amount of New Business Yourselves!

Business Boom Committee

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

POSTER SENT TO JOBBERS AND DEALERS

A Conference of Executives from Scattered Territories

PUBLIC utility organizations which operate properties in widely scattered territories are more and more bringing their men together for conferences, as shown in this group of executives, district managers and engineers of the Union Power & Light Company at a recent meeting in Omaha, Neb. This company, which operates in South Dakota, Nebraska and southern Iowa, has made a practice of holding an annual convention for the discussion of problems arising within the organization and to afford an opportunity for the interchange of ideas. Plant operating problems, the securing of new business and public relations were part of a well arranged program in addition to entertainment features.

GROUP OF UNION POWER & LIGHT COMPANY EXECUTIVES

What Other Companies Are Doing

Easton, Pa.—The number of meters on the lines of Pennsylvania Edison Company increased slightly more than 2,000 during the year 1921. This represents an increase of 20 per cent in the number of customers. The power requirements of the manufacturing plants in and near Easton are increasing, indicating renewed industrial activity in this section.

Binghamton, N. Y.—During the first two months of this year the Binghamton Light, Heat & Power Company showed a net gain in meters connected of 248. Twelve new power customers were added, their demands varying from one to thirty kilowatts.

St. Paul, Minn.—In patroling the high-tension lines of the Northern States Power Company good use is made of a dog-team patrol driven by Bert L. Baker, a full-blooded Pottawatomie Indian. This outfit has been in service for more than a month during a time when many of the roads have been impassable to ordinary traffic and without this dog-team patrol it would have been impossible to have sent out a "trouble shooter."

Providence, R. I.—Forty-five per cent more meters were secured on house and store-wiring contracts by the Narragansett Electric Lighting Company from Jan. 1 to March 5 this year than for the same period last year, and the campaign is still on to make 1922 a notable twelve months. Ten solicitors are in the field and with liberal financing by the company and close co-operation with contractor-dealers of demonstrated reliability they are accomplishing this in a territory at present sustaining the adverse effects of widespread textile labor troubles.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

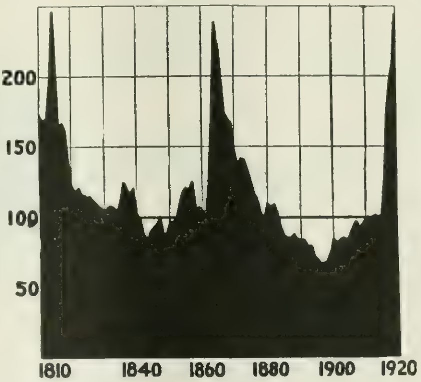
Spare Parts Should Be Purchased from the Original Manufacturer

By F. H. Daniels
General Manager Sanford Riley Stoker Company
Worcester, Mass.

TO OBTAIN the best service from manufactured devices embodying extensive engineering design and close supervision in their production, spare parts should be purchased from the maker of such equipment. This is a principle which I believe should be more carefully presented to the purchaser of electrical and other machinery in order to build up a more appreciative point of view as to the importance of care in the replacement of parts.

Some users of stokers, for example, turn to local foundries when spare parts are needed to replace wornout pieces of the equipment. The local foundries make up patterns for these parts or pour castings from patterns built in some shop in the neighborhood, and deliver parts which vary greatly in quality for the required work in comparison with spare parts produced by the original makers of the apparatus. Not infrequently low cost is allowed to run away with accuracy in work of this kind, and as a result, the user replaces the original parts with inferior material of an incorrect design.

Wholesale Prices



THE present economic disturbance is but repeating the history of both the Napoleonic and Civil War experiences. This curve shows just how wholesale prices advanced and then receded.

Even if the user of the apparatus succeeds in getting a perfect copy of the old part, which is by no means always the case, such a practice perpetuates the use of old designs after important improvements have been made by the equipment manufacturer. Where the buyer turns to the original manufacturer he gets the benefit of the latter's advice in reference to any changes in design. In a well-conducted manufacturing organization the engineering department is constantly working to improve the product and the detailed material and parts that are embodied in it. Field representatives, including sales engineers and construction men, are reporting to the home office important information bearing upon performance, and this information influences the designing work of the company and may result in particular instances in very important improvements in what are considered by the user minor parts of the apparatus.

These improvements tend to prolong the life of the parts and to increase the efficiency of service, under actual operating conditions where even small changes in equipment may yield far-reaching gains. A spare part which must be replaced because of wear or breakage should not be looked upon merely as a casting, because it really represents a great deal of thought and accumulated experience which the manufacturer desires to place at the disposal of the purchaser. In the long run, therefore, the equipment buyer best serves his interests if he avoids cutting corners in attempting to save small sums on replacement items and goes directly to the original maker of the equipment for parts needed to maintain the product in high-efficiency service. This policy is probably pretty thoroughly understood and practiced by the manufacturers of machinery themselves, but the trouble comes from the fact that they do not convey this bit of reasoning with sufficient care and attention to their customers. There is a widespread belief that users of machinery are penalized in the purchase of parts because the manufacturer thinks that the part cannot be obtained elsewhere and therefore that he can bear down heavily on the price. So occasionally we find the case where the user tries to beat the price by a call on his local foundry. It may pay well, therefore, if this point is impressed upon all users by the manufacturers who sell the apparatus, by the engineers or contractors who install it, and by the central-station companies, which are vitally interested in the satisfaction that it gives in service.

The Secret of Appliance Campaign Selling Is Right Methods

By Christian J. Litscher
President C. J. Litscher Electric Company,
Grand Rapids, Mich.

AS FAR as our experience has shown, this whole matter of whether or not the jobber can sell appliances profitably gets down to a question of methods. He can if he does it right. He can't if he does it wrong. And the most popular ways of doing it wrong seem to be, first, the handling of appliances through a jobbing house just as staples are handled with no real pioneering and merchandising support, and, second, the spasmodic campaign selling which too often starts too much and finishes too little.

In the merchandising of major appliances I find that the high-pressure campaign of one or two weeks seldom, if ever, results in any particular benefit to the dealer, and I have come to the conclusion that good old-style plugging at the selling of a given article overshadows the value of one or two weeks' high-speed selling. We have in the past two years run a good many of these campaigns in developing our electrical dealers. This may have been necessitated by inefficient advertising or indisposition on the part of the dealer—our regular salesmen, who are supposed to be good salesmen, have failed in a good many cases to make sales while on the ground—but the plan leaves a bad taste in the mouth and very often discourages the regular salesman to the point where he loses interest in the sale of major appliances. He gives as his reason, as a rule, that if a high-pressure salesman could not put it over, he, with his inexperience, could not be expected to be successful. Furthermore, specialty salesmen, when they do sell for a dealer, very often, in order to close the sale, make promises which come to light later and sometimes are contrary to good business practices.

Our merchandising plan now calls for the education of the dealer and giving him the opportunity of buying his own experience. This method undoubtedly will not be quite so productive in immediate sales, but the writer believes it is the policy that in the long run will win out. In the smaller towns we find that very few of the dealers really know a great deal about the merchandise they are selling, and we believe the first requisite in local selling is to know the merchandise. We have therefore spent the last four months on ironing machines, having demonstrations in the dealer's store, not so much to educate the people of the town and demonstrate the machine as to educate the dealer himself in the possibilities of the machine and what it really can do.

It Only Requires a Little Confidence

CONFIDENCE
HEY, COME OUT HERE AND LET THE SUN THAW OUT YER FEET.
OPTIMO
MOST OF US

Courtesy of the Dry Goods Economist

A TIMELY suggestion to help put business into its regular stride. More confidence in the present and in future prospects will bring more business than any amount of brooding over the depression which has passed.

We are trying to give the factory for which we distribute a real distribution; that is, we are taking our towns regardless of size and trying to get a dealer established in each community. While in a great many cases the dealer does not sell so many machines as the quota which somebody might figure out from the number of meters connected, we feel that to be represented in every town is the prime consideration and then it is up to us to develop the dealer so that he will do the selling himself rather than depend on our specialty man. From a jobber's standpoint we would very much prefer to have a hundred customers selling twenty machines a year in a hundred different towns than twenty customers selling a hundred machines in twenty towns. Then when we lose a customer we have not lost so much, and, furthermore, it gives us a steady business rather than a spasmodic business.

Frankly, I am through with high-pressure campaigns and am going to continue in the distribution of merchandise in the good old-fashioned way, keeping in mind at all times that a proper analysis of every town properly followed up is better than a "once-over," no matter how intensive the selling may be. With the proper education of the dealer, the proper study of the town and a quality appliance, the selling can be done successfully and profitably, and the jobber can make it a satisfactory business. To my mind the answer to the jobber on appliances is simple—he needs right methods of pioneering and merchandising, and nothing else will do.

The Value of a Perpetual Inventory

TO A large degree success and profit in any business is dependent upon the maintenance and turnover of a balanced stock of material and supplies. Some of the advantages to be gained by manufacturers, jobbers and dealers through a perpetual inventory or stores control have been analyzed by the Fabricated Production Department of the Chamber of Commerce of the United States.

For those companies which are not satisfied that their material and stock investment is at an efficient minimum, which suffer periodically from shortages of supplies, which are unable to make monthly profit and loss statements, or fret at the prospect of the annual physical inventory, and are not adequately conserving their material investment by giving it the best of physical care, to such the perpetual inventory is recommended.

This alone will provide for:

1. Sufficient material to meet production requirements so that production shall at least not be checked by a lack of necessary material.
2. A minimum investment in inventories, which is of supreme importance at the present time.
3. An orderly and accessible arrangement of material and the physical safeguarding of material from the elements and theft.
4. The elimination of the burdensome and inaccurate annual physical inventory.
5. A monthly closing by giving the amount and value of material on hand at any time.
6. Is an invaluable record in case of fire loss.
7. A safeguard against the accumulation of obsolescent material.

When capital is in the form of cash, it is carefully protected, its receipt and disbursement safeguarded, its custodians held to a strict accounting, but once this capital is converted into materials there is a tendency to become lax, to lose sight of the value of the investment, to husband the capital less diligently and to tolerate practices that are wasteful, inefficient and needlessly expensive. The perpetual inventory will go far in correcting these conditions.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Squirrel-Cage Induction Motor.—J. T. TAKEUCHI.—The author explains the details of a squirrel-cage induction motor in which the stator winding is connected in extended delta at starting and reconnected in delta when the motor reaches its full speed. The general theory of starting the motor for this device is given, with experimental results and construction data.—*Journal of Institute of Electrical Engineers of Japan*, January, 1922.

Repair-Shop Prices for Rewinding Induction Motors.—Prices for rewinding industrial motors in two sections of the country, Detroit and Los Angeles, are given Special cases are not included in the article, so that in using these prices as checks against costs in any particular instance due allowance must be made for repairs to other than standard designed motors.—*Electrical Review and Industrial Engineer*, February, 1922.

Lamps and Lighting

Pathological Effects of Radiation on the Eye.—F. H. VERHOEFF and LOUIS BELL.—A study made by the authors on the various effects of light on the eye. The general conclusion regarding the effect on the human eye of radiation from practical illuminants is that no sources commercially employed for such a purpose are to be regarded as dangerous. The most ordinary care to insure comfortable vision is sufficient for complete security against all possibility of injury from radiation.—*Transactions of I. E. S.*, Vol. XVI, No. 9.

Factory Lighting Design.—J. R. COLVILLE.—Illumination layouts for various sizes of factory bays are given in this paper, which can be used by the practical man in much the same way as the building contractor uses standardized plans obtained from the architect. The designs can be applied directly, or with only slight alteration, to a wide variety of industrial interiors. Thirty drawings are given for bays varying in size from 12 ft. x 16 ft. to 25 ft. x 25 ft. and with a height ranging from 8 ft. to 19 ft. In each case data are given on the location and number of units per bay, the mounting height and the approximate average foot-candles at the work. Correction factors are also given for any obstruction such as comes from benches placed next to wall. A very extensive table covering all kinds of industries recommends the minimum number of foot-candles necessary for satisfactory lighting.—*Bulletin of National Lamp Works, No. 42.*

Generation, Transmission and Distribution

Hydro-Electric Plant at Buitreras, Spain.—F. REGARD.—An elaborate description of the electrical part of an up-to-date European hydro-electric station of 6,000 kva. rating, transmitting at 52,000 volts. All switches have remote magnetic control, overload time relays and simple lightning arresters, consisting of choke coils, water resistors and horns. To the high-voltage busbars is connected a dissonating arc-quenching coil (Petersen coil). Generators, switches and transformers are installed on the first floor, buses on the second floor and lightning arresters on the top floor.—*Brown-Boveri Mitteilungen*, January, 1922.

Operation of Oil-Burning Steam Power Plants.—C. H. DELANY.—To improve conditions and to interest men in the problem of plant efficiency it is essential to devise some means of comparing the performance of a plant from day to day. For this purpose the author has devised a "plant characteristic diagram." In this the oil consumption is plotted against the kilowatt-hours generated. Each point represents one full day's operation, and while the points as shown are more or less scattered, they form a well-defined line.—*Iron Age*, Feb. 23, 1922.

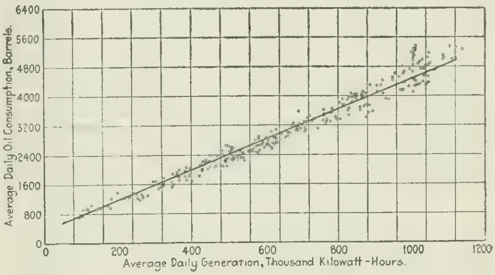


CHART USED IN A SAN FRANCISCO PLANT TO INTEREST MEN IN STATION EFFICIENCY

Traction

Control Equipment of Paulista Locomotives.—P. W. FORSBERG.—Description of the control equipment on the freight and passenger locomotives used on the Brazilian railroad. Among the features emphasized are the regenerative braking system, current collection and methods of accelerating and motoring. The author also gives a diagram of wiring connections.—*General Electric Review*, March, 1922.

Electrification of the Klarälfvens Road.—E. WIST.—The high cost of coal and the abundance of available water powers were responsible for the complete electrification of this 171-km. road. The system chosen was 16,000 volts, single-phase, at 16⅔ cycles, which is the standard system adopted by Swedish roads. As, however, the special power house for this road cannot be finished for a few years, the road is being operated temporarily at 12,000 volts and 25 cycles, available from an existing power house at Krakerud, with an output of 12,500 hp. Catenary suspension, with a 40-sq.mm. carrier cable and a 65-sq.mm. profile wire on steel poles, was used throughout. Every 1,500 m. a tightening point is provided with 500-kg. weights. At present fifteen A. E. G. locomotives of type 1C1 are used on the line, the same type being used for freight and passenger service. The engines weigh complete 40 metric tons and develop a pull of 4½ tons at 25 km. per hour. They are designed for a high speed of 60 km. per hour.—*Elektrotechnik und Maschinenbau,* Jan. 15, 1922.

Installations, Systems and Appliances

Manufacture of Synthetic Cast Iron in the Electric Furnace.—W. L. MORRISON.—A description of an installation for the manufacture of synthetic cast iron at Portland, Ore. Methods for carbonizing, the detrimental effect of excessive dry slags and the effects of aluminum upon cast iron are discussed. In conclusion, comparative cost of manufacture for various load factors are enumerated in table form.—*Chemical and Metallurgical Engineering,* Feb. 15, 1922.

The "Cyc-Arc" Process of Automatic Electric Welding.—L. J. STEELE and H. MARTIN.—This process of automatic welding has solved some of the problems of welding two pieces of metal of widely different sections by direct means and of welding dissimilar metals that have widely different melting points. The article discusses the evolution and development of this process, the automatic timing and control apparatus, various results of welding experiments and tests, metallurgical considerations and practical applications. Special machines for supplying power for direct-current welding are described. The article also considers the use of alternating current for the '"Cyc-Arc" process of electric welding.—*Journal of Institution of (British) Electrical Engineers,* January, 1922.

Electrophysics and Magnetism

Mathematical Theory of Induced Voltage in the High-Tension Magneto.—FRANCIS B. SILSBEE.—Three different circuits, representing in simplified form the essential features of the high-tension magneto, are developed and equations for the electrical performance of each are given. It is shown that by the insertion of proper electrical constants in these equations the resulting performance will be substantially the same as that of an actual magneto. Methods are suggested for the experimental determination of these constants, and the agreement between this theory and observed results is shown in certain cases.—*Scientific Papers of the Bureau of Standards, No. 424.*

Polarization Phenomena in X-Ray Bulbs.—S. RATNER.—Discussion of a procedure by which an X-ray bulb may be polarized, with the results of some experiments carried out on such a bulb.—*Philosophical Magazine* (London), January, 1922.

Units, Measurements and Instruments

The Tele-Compass.—With the use of two selenium cells, mounted above the compass dial and illuminated from underneath, it is possible to build a remotely indicating compass which is of great use on airplanes. The two selenium cells are arranged as the two branches of a Wheatstone bridge with a galvanometer as zero indicator. As long as the pilot flies in the predetermined direction the galvanometer will indicate zero.—*Industrie Electrique,* Jan. 25, 1922.

Theory of the Grassot Fluxmeter.—R. B. BURROWES.—The Grassot fluxmeter is a moving-coil, permanent-magnet instrument for measuring flux linkage in any circuit. In a theoretical discussion the author considers such questions as the back movement of the coils to the zero position, the non-synchronous movement of the coil with the flux changes, and the time constant of the throw and its independence of reactance and resistance. He proves that kinetic energy is proportional to the square of the throw.—*Electrician (London),* Feb. 3, 1922.

Use and Construction of Current Transformers.—V. CANDIE.—A descriptive paper on modern types of current transformers manufactured by the French concern Société la Métallurgique Electrique and written by an engineer of this firm. Oil-insulated types for medium current capacity and high voltage and air-insulated models for voltages up to 30,000 and very high current, using straight copper bars as primary windings, are described. Characteristic curves of ratio correction, accuracy in relation to load and phase distortion are given. The very important question of short-circuit-proof construction of current transformers is not even touched upon.—*Revue Générale de l'Electricité,* Feb. 11, 1922.

Telegraphy, Telephony and Signals

Imperial Wireless Telegraphy.—A report of the Wireless Telegraphy Commission of England making recommendations regarding the sites and apparatus for the stations of the "imperial wireless chain." It includes a description of the development of high-power thermionic sets, the cost of valve renewals, the choice of wave length, transmitting antennas, masts and towers, the methods of reception and the design of receiving stations.—*Electrician (London),* Feb. 3, 1922.

The Future of Radio Telegraphy.—CAPT. JOHN G. QUIMBY.—A résumé of the progress made in the use of radio telegraphy, with its application to navigation and transoceanic flights. In particular, the article recounts the developments of the radio compass and the possibilities of its use for surface craft. The author gives two methods for plotting radio bearings, followed by several examples.—*Proceedings of the United States Naval Institute,* February, 1922.

Miscellaneous

Electric Water Heaters.—A. GÖTTERT.—The paper describes a number of constructions of electric water heaters using either the principle of electrode heating or that of water-immersed resistance-heating units. The former can be used only on alternating-current circuits, as otherwise electrolytic action would take place. A combination water faucet and electric switch is used for the resistance type, to avoid running dry. Where a cheap rate for energy during the night hours is obtainable, a small electric heater connected to a well heat-insulated hot-water-storage tank is recommended. If properly insulated, the heat efficiency of such a storage system may be as high as 96 per cent. Additions of time switches and thermostatic control will avoid useless boiling and waste of current.—*A. E. G. Mitteilungen,* November and December, 1921.

Effect of Moisture on the Thermal Conductivity of Soils.—G. B. SHANKLIN.—It has been appreciated for many years that the presence of moisture in the surrounding soil is of assistance in dissipating the heat generated within an underground cable. This article shows that the relative thermal conductivity of various types of perfectly dry soils, such as sand, clay, gravel, etc., covers a range of only one to two, while the addition of moisture increases the range to five times or more that of dry soils.—*Journal of the A. I. E. E.,* February, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

Jewett Receives A. I. E. E. Nomination for President

AT THE meeting of the board of directors of the American Institute of Electrical Engineers held in New York, March 17, the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31, 1922, was presented. As required by the constitution of the Institute the board then selected by ballot its list of "directors' nominees," with the following result:

For president—Frank B. Jewett, New York, N. Y.

For vice-presidents—District No. 1, G. Faccioli, Pittsfield, Mass.; District No. 3, W. I. Slichter, New York; District No. 5, R. F. Schuchardt, Chicago; District No. 7, H. W. Eales, St. Louis; District No. 9, H. T. Plumb, Salt Lake City.

For managers—H. M. Hobart, Schenectady, N. Y.; Ernest Lunn, Chicago; G. L. Knight, Brooklyn, N. Y.

For treasurer—George A. Hamilton, Elizabeth, N. J.

The election ballots, including the names of the directors' nominees and all other eligible candidates, will be mailed to the membership prior to April 1.

Public Service Commission May Penalize Inadequate Service

IT IS within the power of a public service commission to order a refund to consumers where a public utility corporation fails to provide adequate service.

This question was determined on March 20 by the Supreme Court of the United States in affirming the decision of the Supreme Court of Oklahoma in the case of the Oklahoma Natural Gas Company vs. State of Oklahoma. The decision was handed down by Justice McKenna, without dissent.

The Oklahoma Public Service Commission ordered a refund to domestic consumers of 8 to 25 per cent on gas bills in Oklahoma City for two months when the supply of natural gas furnished by the company proved inadequate.

Hearings on Muscle Shoals Project Concluded

HEARINGS before the military affairs committee of the House of Representatives on the disposal of the government project at Muscle Shoals have been concluded. All but two of the members of the committee expect to accompany the party of senators which will leave Washington March 25 on a special train to visit Muscle Shoals. The committee does not expect to begin the consideration of the project in executive session until after its return.

It is understood that Representative Kahn, the chairman of the military affairs committee, whose influence with the committee is a dominating one, is opposed to the acceptance of the Ford offer. He is understood to have reached this conclusion after having heard all the evidence laid before his committee. He entered the hearings rather favorably disposed toward the acceptance of Mr. Ford's offer.

The Republican steering committee of the House also is understood to be opposed to the Ford offer, but a new element has been injected into the situation, it is said, by the attitude of the Republican Congressional Committee. This committee is said to be convinced that failure to accept the Ford offer will entail serious political consequences at the congressional elections this fall. As a result it is understood that an effort will be made to influence the House to accept the Ford offer, particularly if it can be amended so as to come under the federal water-power act, and provided that a certain portion of the power will be made available for public utility purposes.

Hoover's Colorado Commission Favors Boulder Dam

ALTHOUGH the construction of the Boulder Canyon dam for the control of the Colorado River and the development of power would be an entirely feasible project from an engineering viewpoint, Secretary of Commerce Hoover, who is chairman of the Colorado River Commission, which is holding meetings in the West to gather data and sound public opinion on the development of the Colorado River basin, has expressed the opinion that in order to construct this dam under federal control it would be necessary to have legislation passed authorizing the work. Mr. Hoover said that to be sure of such legislation being passed it would be necessary to institute a campaign of education throughout the United States and crystallize public sentiment in favor of so large a program. He added that the difficulty of passing this legislation might be reduced because of the changing public viewpoint in regard to great reclamation projects.

Last week the Colorado River Commission held a two-day meeting in Phœnix, Ariz. At this meeting representatives of the several states concerned and of many smaller interests were represented and presented their views on the development and control of the river. No definite action is expected to be taken by the commission, which will hold meetings in several Western centers. Following the Phœnix meeting the commission visited the site of the proposed dam in Boulder Canyon, near Las Vegas, Nev.

After inspecting the Boulder Canyon dam site the party visited the Imperial Valley to get a first-hand impression of its needs for flood protection and then went to Los Angeles, where meetings were held Monday and Tuesday of this week. At these meetings discussion revolved around a proposed twenty-year holiday from litigation over the division of water and power between the states in which the basin lies. The important question of power development has been laid aside pending a solution of the problem of water rights.

Reclamation Service Report on Colorado River Completed

THE report on the problems of the Imperial Valley in California and vicinity, as required by act of Congress, has been made by the Reclamation Service. This supersedes the report made Nov. 27, 1920. The report recommends federal construction of a reservoir at or near Boulder Canyon, on the lower Colorado River, the government to be reimbursed by leasing the power privileges.

It is further recommended that the states interested may contribute to the cost of the dam and receive a proportionate share of power at cost. The Secretary of the Interior, it is recommended, should have the power to allow the various applicants their due proportion of the power privileges and to allocate the costs and benefits of a high-line canal. It is finally proposed that every development of the Colorado River by the government or others be required in both construction and operation to give priority of right and use (1) to river regulation and flood control, (2) to use of storage water for irrigation, and (3) to development of power.

Drury Government to Investigate Hydro-Electric Power Commission of Ontario

THAT the Ontario government was forced because of the enormous cost of the hydro-electric development at Chippawa and Nipigon to order an investigation of the Hydro-Electric Power Commission was the statement of E. C. Drury, Premier of the province, at a mass meeting called in Toronto Thursday, March 16, by the Federation of Business Men's Associations, the Retail Merchants' Association, the Bond Dealers' Association, the Rotary Club and the Board of Trade. The Premier declared that the Ontario government would insist on getting the facts. "I do not know—nobody knows," he said, "whether the money is being well spent or not; but the people have a right to estimates that are fairly accurate on which to base their judgment before passing on the projects."

In 1918 the engineers of the Hydro-Electric Power Commission estimated that 275,000 hp. could be developed at Chippawa for a total cost of $25,000,000. whereas Mr. Drury said the cost has now exceeded $65,000,000. Likewise at Port Arthur and Fort William, in the western portion of the province, the people were promised cheap power by the Hydro-Electric Power Commission, which erected a water-power plant at Nipigon. The estimated cost of the completed plant was between $4,000,000 and $5,000,000. Up to date over $6,000,000 has been expended and the plant is only partly completed. Power which was sold by a private company at from $15 to $17 a horsepower-year is sold by the Hydro-Electric Power Commission to the public in Port Arthur and Fort William for $21 a horsepower-year, and in addition the commission is piling up a yearly deficit of $300,000. "No business man," Premier Drury said, "would tolerate such estimates, which mount up without justification. Such a system is not a benefit but a burden, and that is why the government is stepping in." The policy of the Ontario government, Mr. Drury maintained, will be to see that the projects of the Hydro-Electric Power Commission throughout the province are directed along sane, sound business lines for the benefit of the people.

The work of the Hydro-Electric Power Commission is the most important undertaking at present under the Drury government, and the Premier said he was determined to see to it that every project was sound from conception to execution. The Chippawa station when completed will be the largest water-power plant in the world. Large sums of money have been spent on it and on other hydro-electric projects. For that reason the Premier was asked by the Toronto business organizations to make a pronouncement respecting the government's policy so that the public might have full and authoritative information.

Important Merger of Waterwheel Manufacturers

ADVICES from San Francisco state that the manufacturing plant and business interests of the Pelton Water Wheel Company of San Francisco have been purchased by the William Cramp & Sons Ship & Engine Building Company of Philadelphia, manufacturer of the celebrated I. P. Morris water turbines. This purchase marks one of the largest mergers of manufacturers of hydraulic equipment and turbines in the country. The Pelton Water Wheel Company will continue to operate under its old corporate name, but with new executive officers. H. B. Taylor, vice-president of Cramp's, will be president of the Pelton company; E. C. Hutchinson, formerly chief engineer for Pelton, vice-president and general manager, and W. B. Moody, second vice-president.

Work Started on New Western States Hydro Plant

THE Western States Gas & Electric Company has started work on the development of a new hydro-electric project in California which, when completed, will make the future purchase of energy from other sources unnecessary and will provide adequately for immediate and future demands for the company's electric service in the Stockton division. Authorization to build the plant was given last fall by the California Railroad Commission. Funds have been provided by the sale in March of an issue of $5,000,000 6 per cent bonds.

The present construction program, which will be completed by 1924, includes the erection of a hydro-electric plant with an initial capacity of 26,000 hp. in the canyon of the South Fork of the American River, above Placerville. Water storage at Twin Lakes will be enlarged to 16,000 acre-feet, the ultimate capacity to which this reservoir may be developed being 25,000 acre-feet.

The generating equipment in the station will consist of two units of equal size, driven by turbines operating under a head of 1,900 ft. A two-circuit steel-tower transmission line will be built from the power house to connect with the present transmission line near Placerville, a distance of about 10 miles, for immediate operation at 60,000 volts. The type of construction is such that the line voltage may be later increased to 110,000 volts.

Conference on Hydro-Electric Development Is Held in Philadelphia

FOLLOWING the practice established last year, a hydro-electric conference was held again in Philadelphia on Tuesday of this week. Eleven papers were presented on timely phases of water-power development and related subjects. Considerable interest was indicated by the large attendance of electrical, civil and mechanical engineers from various parts of this country and Canada. It was announced by the presiding officer, Dr. Arthur M. Greene, Jr., dean-elect of engineering at Princeton, that similar annual conferences are to be held in Philadelphia in the future. The conference was under the auspices of the Engineers' Club of Philadelphia and the Philadelphia Sections of the American Institute of Electrical Engineers, the American Society of Civil Engineers and the American Society of Mechanical Engineers, with the co-operation of the power division of the A. S. M. E.

Seven technical papers were presented, four of them relating to the Queenston-Chippawa power development. The remaining technical papers dealt with a new method of measuring water flow, evolution of turbine design, and the problem of unsteady flow or surges in open channels. Besides these papers there were four general addresses, namely, "Trends in Engineering Education," by Dr. Arthur M. Greene, Jr.; "The Public Utility Industry in the United States," by Samuel Insull; "Relations of Water Resources to the Country's Development," by Nathan Clifford Grover, and "Disposition of Hydro-Electric Power in Ontario" by P. B. Yates. Preceding the afternoon and evening sessions, which were held at the Manufacturers' Club, luncheon was served at the Engineers' Club. An informal dinner was held at the Bellevue-Stratford Hotel between sessions.

Samuel Insull referred particularly to the excellent financial condition in which electric service companies find themselves today compared with other industries, saying that this condition exists despite the troublesome times through which utilities have passed because of the steadily decreasing investment per kilowatt of maximum demand.

After reviewing the major uses to which water must be applied in various parts of the country, such as drinking purposes, irrigation, transportation and power purposes, Mr. Grover suggested that careful consideration be given to the relative importance of these uses in order that water may be used to the maximum benefit of the nation and locality involved.

Motion pictures showing the general features of design and construction of the Chippawa-Queenston hydro-electric plant of the Ontario Hydro-Electric Commission were presented by H. G. Acres, chief hydraulic engineer, and T. H. Hogg, assistant chief hydraulic engineer. The more important phases of the electrical equipment were illustrated by E. T. J. Brandon, chief electrical engineer. It was announced that two of the mammoth 55,000-hp. wheels are now carrying load and that the ultimate development will probably be 600,000 hp., the remaining units contemplated to be rated at 75,000 hp.

Features of one type of 55,000-hp. waterwheels installed were described by F. H. Rogers, who called particular attention to the methods of preventing leakage in these large units and the use of offset guide-vane levers to insure good speed regulation.

The design of propeller-type waterwheels having high specific speed at low heads was cited by L. F. Moody as a transition in the evolution of hydraulic apparatus which is bound to have a decided effect on power-plant design. A 28,000-hp. turbine of this type is being installed on the Hudson River to develop 56-ft. head, it was announced. According to laboratory tests, efficiencies of 86 to 88 per cent will be obtained. The speaker also compared the efficiencies of various types of turbines at different heads and specific speeds, it being brought out that very good efficiencies can be obtained at part-gate with propeller-type turbines having specific speeds of 85 r.p.m. to 144 r.p.m.

The paper by Mr. Yates, manager of the Public Utilities Commission of St. Catharines, Ontario, contained a mass of data on the rates charged residential and power consumers in Ontario and on the operating and maintenance expenses in various municipalities served by the commission. The author concluded by saying that the commission would continue to be a financial success so long as it is kept free from political control.

Prof. C. M. Allen described a new method of ascertaining fluid flow which only involves measuring the time between discharging a small amount of salt solution into a penstock and the moment that maximum water density occurs at some distance along the pipe. The maximum density is determined electrically.

R. D. Johnson presented a theoretical discussion on phenomena accompanying unsteady flow or surges in open channels.

Maintenance of Industrial Equipment Theme of Pittsburgh Section

MAINTENANCE of industrial electrical equipment was the main theme of a meeting on March 15 of the Pittsburgh Section of the American Institute of Electrical Engineers. The program was an innovation by reason of the fact that the discussion was limited to industrial operation. Among the main points in the papers was the consideration of the troubles which occur most frequently in steel-mill and coal-mining equipment. Suggestions for betterment of service were given. Emergency-connection schemes for department stores were also outlined. A. C. Cummins, electrical superintendent of the Duquesne works, Carnegie Steel Company, told of operating troubles and maintenance methods at that plant.

H. J. Nelms, general superintendent of the New Field By-Products Coal Company, Unity, Pa., talked on electrical operation in mines. He enumerated the most frequent electrical troubles and urged that central-station companies place coal mines ahead of any other industry in the matter of continuity of service. He suggested that designers should endeavor to perfect reel cables and that controllers for cutting machines and pumps should be constructed so that a ground on the circuits would prevent the machine from operating.

Mr. Nelms complained that motors of the present day will not carry the same overloads that older motors would handle without trouble. In reply to this Graham Bright, Westinghouse Electric & Manufacturing Company, pointed out that the rating of a motor is closer now to its actual ability than formerly. Competition, he said, prevented a manufacturer from giving a motor the excessive overload capacity which some of the old motors had. Eugene Friedlander, superintendent of the electrical department of the Braddock works, Carnegie Steel Company, said that the man who applies the motor is responsible. He and not the manufacturer is to blame for troubles resulting from insufficient power in a motor.

To Build Six-Million-Dollar Steam Station for St. Louis Supply

THE Union Electric Light & Power Company of St. Louis is about to build a new steam plant to have initially two 30,000-kw. units and an ultimate capacity of probably 240,000 kw. The plant will cost upward of $6,000,000.

The company has purchased about 50 acres of land as a site for the new plant, which will be known as the Cahokia plant, on the Illinois side of the Mississippi River, immediately south of the city limits of East St. Louis and approximately 4 miles from the electrical center of St. Louis.

This power plant is intended to supply the rapidly increasing demands for electrical energy in St. Louis and vicinity, which is mounting beyond the available supply from the large water-power plant of the Mississippi River Power Company at Keokuk, Iowa, and from the company's own present Ashley Street steam-power plant. McClellan & Junkersfeld, Inc., have been engaged as engineers and constructors.

F. W. Smith Traces Alternating-Current Development in New York

MORE than 450 persons attended the luncheon of the New York Electrical League in New York City Wednesday, at which Frank W. Smith, vice-president of The United Electric Light & Power Company, described the development of the alternating-current system in the city of New York. The address was a most interesting and instructive one, tracing as it did the development of alternating-current generation, transmission, distribution and measurement from their commercial inception to the present date. The speaker referred to the time when even alternating-current generation was viewed askance and when there were grave doubts whether the voltages necessary for distribution could be conducted through underground circuits with the necessary reliability.

The illustrations presented showed in a most striking manner the wonderful strides which have been made in alternating-current electric service and led up to the most recent achievement of The United Electric Light & Power Company, namely, the 280,000-kw. (ultimate) generating station at Hell Gate.

As the speaker pointed out, this station not only ranks as a superpower plant, but it is unique in taking its condenser circulating water for each unit directly from the East River, thereby allowing the elimination of expensive tunnels. Among other features are the extensive and almost exclusive use of electric auxiliaries, the use of truck-type switchboards for station service, the isolation of switch and bus phases, the hydraulic sluicing of all ashes from below the boilers to underwater pits, the heat-balance system, the use of oil circuit breakers with the largest rupturing capacity in this country, and the provision of adjacent coal storage amounting to 100,000 tons.

Large Electric Service Expansion in New Jersey

IN THE annual report of the Public Service Corporation of New Jersey President Thomas N. McCarter calls attention to the year's business of the Public Service Electric Company, one of the subsidiaries:

"Overcoming the effects of the industrial depression, which caused a substantial decrease in the use of central-station power, the total revenue derived by the Public Service Electric Company from electric sales for the year increased 3.95 per cent. This net result was due to a growth of 18.49 per cent in sales for commercial lighting. A remarkable feature of the year's business and one which makes for permanency of revenues was a net gain of 45,912 in the number of meters, more than 90 per cent of which increased number were of the 5-amp. type, indicating the largest extension in the use of electricity for domestic purposes that the company has ever experienced in a single year. Average receipts per kilowatt-hour increased from 4.55 cents in 1920 to 5.54 cents in 1921, owing principally to the falling off of heavy power loads which were carried at the lower ranges of the rate schedule."

The net income of the holding company, after charges and taxes, amounted to $3,594,629. This is equivalent, after deduction of preferred dividends, to $9.19 a share earned on the $30,000,000 of common stock, and it compares with net income of $2,218,408, or $5.12 a share, earned in 1920. Details of the report are shown in the following table:

	1921	1920
Operating revenue	$75,311,507	$72,318,087
Other income	2,097,315	2,378,407
Total income	$77,408,822	$74,696,494
Operating expenses	51,769,627	52,638,939
Amortization charges	4,893,956	3,237,529
Net after taxes	$20,745,237	$18,820,026
Subsidiary companies' fixed charges	12,856,151	12,324,889
Public Service Corporation's fixed charges	4,294,458	4,276,729
Net income	$3,594,628	$2,218,408
*Preferred dividends	835,739	681,757
Common dividends	1,200,000	1,199,984
Balances	$1,558,890	$336,667
Miscellaneous debit	107,986	†18,658
Surplus	$1,405,904	$355,325

*Exclusive of that owned by Public Service Electric Company. †Credit.

In the balance sheet of Dec. 31, 1921, investments were shown at $106,739,399, against $107,145,749 in 1920; cash at $148,938, compared with $339,739 in 1920; accounts receivable, $19,766, against $11,237 in 1920; interest and dividends receivable, $166,232, against $157,497; accrued interest, $910,784, against $941,112, and accounts payable, $100,734, against $4,634 in 1920.

In his remarks President McCarter says:

"The company came through the year in a very satisfactory condition. Special attention is called to the amount of $4,893,956 which is plowed back into the properties of the company through the amount set up for amortization charges. In addition thereto a very considerable amount was carried to profit and loss.

"The future is full of promise. If the company is allowed to proceed in its great work of developing the state along the lines of its activities, without undue interference occasioned either by political agitation or unfair and ill-advised regulations, it believes it can perform a most useful service to the people of the state and yield to its security holders a reasonable return upon their existing and future investments."

Oklahoma Commission to Adopt Electric Service Rules

ELECTRIC service rules, including rules for making service extensions, were the subject of informal discussion before a session of the Oklahoma utilities convention at Oklahoma City last week. The discussion was under the leadership of B. P. Stockwell, electrical and gas engineer of the Oklahoma Corporation Commission. The rules were submitted for formal and final hearing before the commission early this week, and it is expected that they will be formally promulgated in a short time.

Public Relations Discussed by Oklahoma Utilities

THE basic eight-hour day is not sacred, the one-man, one-job rule of the unions is wrong if it causes economic waste, and a fair wage which will secure workers the necessities and a reasonable share of the comforts of life is essential. These are three of eight fundamental rules of practice that have been laid down by the Kansas Industrial Court, Judge W. L. Huggins of that court declared before the Oklahoma Utilities Association at Oklahoma City last week.

Judge Huggins said that there are three parties in interest in any litigation before the court, the public being the third, and the public always wins. He denied that the Kansas industrial relations law involved anything in the nature of involuntary servitude, and styled the law a new charter of liberty for labor.

J. H. Gill, in discussing "Co-operation in the Industry," claimed that co-operative moves in the electrical industry are too often founded on the selfish thought of what it will bring the individual, and fail for that reason. No one phase of the electrical industry can go ahead independently, said the speaker, but, if success is to be assured, all must work for the common good with a willingness to put more into the co-operative work than they expect to take out. Mr. Gill made a forceful plea for better relations between utility executives and the members of their organizations and particularly between company employees and the public.

In discussing the same question of public relations, C. A. Shock of Sherman, Tex., told a significant story of the success of a small telephone company based on whole-hearted co-operation in local affairs. This oftentimes led the company officers into unheard-of and astonishing fields but made them an indispensable part of the community.

That individual states never should have had the right to regulate railroad rates was the declaration of Noah W. Simpson of the Public Service Commission of Missouri, when he discussed what experience has taught in state regulation. The recent United States Supreme Court decision denying the State of Wisconsin the right to regulate its own railroad rates, he said, was the best for railways, people, utilities and the commissions, and the speaker did not hesitate to declare that too much of small-town politics had entered into state regulation of railroad rates. Utilities, he said, are entitled to have their cases tried before unbiased bodies and not through the newspapers and by political bodies. The speaker declared that the theory of reproduction cost new as a basis of rate making had never been heard of until the period of war-inflated values. He indicated a belief that as costs become lower such a basis might be the worst possible thing for utilities.

Announcement was made at the close of the convention of the resignation of H. A. Lane, who has been manager of the association since its inception in 1918. Mr. Lane was presented with a watch and chain by the members of the association, who wished him all success in his new position of assistant to Executive Manager Aylesworth of the National Electric Light Association in New York.

Officers for the coming year were elected as follows: President, F. W. Insull, Tulsa; first vice-president, Sherman Mooter, Hanna; second vice-president, J. C. Chestnut, Choctaw. The position of manager was not filled, but O. D. Hall, the assistant manager, was made acting secretary.

New Applicants for Water-Power Permits

THE application of the Louisville Gas & Electric Company covering the proposed development of power at Dam No. 41 on the Ohio River has been received by the Federal Power Commission. The project is expected to develop 25,000 hp., and it is the plan of the company to install equipment capable of generating 75,000 hp. The application is based on the probability that the government will increase the height of the dam by 6 ft. This matter is being studied by the Corps of Engineers, but it has not been determined finally.

The St. Cloud (Minn.) Public Service Company has applied for a preliminary permit covering the proposed development of 10,000 hp. at Rigby, 2 miles above Clearwater. It is planned to install 15,000 hp. for public utility purposes.

The State of Illinois, through its Division of Waterways, 25 East Jackson Boulevard, Chicago, has applied for a preliminary permit to cover a dam and powerhouse in the Fox River near Dayton, Ill. The power is to be used for public utility purposes.

Maxfield, Earnheart, Maxfield & Ward of Batesville, Ark., have applied for a preliminary permit covering the development of power at Government Dam No. 2, on the White River near Batesville. Primary power to the extent of 500 hp. is available at that point, it is estimated. It is the intention to install 1,200 hp. The power is to be used for manufacturing and public utility purposes.

The Grant's Pass (Ore.) Irrigation District has applied for a license covering a power project in the Rogue River just above Grant's Pass, where it is planned to develop power to pump water for irrigation purposes into a high-line canal. The primary power is 500 hp. It is planned to install 1,000 hp.

University of Florida Has Metermen's Course

A SIX-DAY metermen's course is announced by the College of Engineering of the University of Florida, Gainsville, Fla., to be held from April 10 to April 15 inclusive. It will include lectures by electrical engineering instructors of the university, addresses by engineers experienced in meter work, practical laboratory instruction in connections, tests, adjustments and repairs, and exhibits by leading manufacturers, with representatives in charge to explain them. No charge will be made for this course.

Boston Industrial Lighting Exhibit "Sells" $75,000 in Equipment

IT IS conservatively estimated that as a result of the first six months' use of the Bureau for Better Illumination at Boston $75,000 worth of equipment has been bought by consumers in eastern New England which otherwise would not have been purchased during that period. The exhibit is maintained in the Rogers Building, Boylston Street, by the co-operative efforts of the different branches of the electrical industry. More than 2,000 visitors have seen the display, and many delegations of central-station men, contractor-dealers, jobbers and representatives of manufacturers within and outside the industry have studied it.

Among recent lighting installations which have grown out of the display are those of the Grow Tire Company, Dover Stamping Company, Elastoid Fiber Company, Peabody Furniture Company, Newton public schools, Fall River Electric Light Company offices and American Printing Company. The Consumers' League of Massachusetts has indorsed the work, and recently Simmons College, Boston, has requested J. Daniels, illuminating engineer of the exhibit, to lecture upon lighting in its industrial hygiene course. J. E. Wilson, 263 Summer Street, Boston, is secretary of the bureau.

Illinois Utility Operators Discuss Electric Grading and Business Problems

ALTHOUGH public utility problems have increased in number since 1918, the Illinois utilities are especially fortunate in having 500,000 Illinois families as stockholders in their local utility companies, declared John F. Gilchrist in his address at Chicago last week before the joint session of the electric, gas and railway associations of Illinois. He attributed a great part of this faith in utilities to the work of the Illinois Committee on Public Utility Information, which is broadcasting pertinent facts on utility operation.

The Illinois State Electric Association on Wednesday afternoon listened to a discussion on the inspection and grading of electric service by J. Howard Mathews, service engineer of the Illinois Commerce Commission. Mr. Mathews considered fourteen factors which are necessary to grade this service. His first point was continuity of service. Next to continuity, voltage regulation is the most important factor. Handling complaints is another factor of much importance.

G. C. Neff of Madison, Wis., discussed the problems connected with rural electric service, his discussion containing an assumed problem comparing the cost of electric service for urban and rural districts. While all his assumptions were low, the increased cost for the rural customer over that for urban service was $34 per year. One-fourth of the population of the United States live on farms, and since electric service is desired on these farms, Mr. Neff urged that these extra charges be explained to the fullest detail to the farmers before the lines are built.

An investigation by A. C. Hall of St. Louis of the consumption of central-station energy per capita showed that the mining districts had a higher average monthly lighting load than industrial or agricultural towns.

On Wednesday afternoon John Leisenring of the Illinois Traction System presented a paper on inductive interference, discussing it from a construction, a priority and a legal standpoint. W. J. Canada in discussing this question said that the problem was now beyond the stage of mystery, and he urged a closer co-operation between all engineers in solving it.

In obtaining better business O. R. Hogan of the Commonwealth Edison Company mentioned his house-to-house appliance-selling campaign, which led to the sale of 9,000 portable lamps within eight weeks, using electric trucks as distributing points for sales.

The new officers of the Illinois State Electric Association are: President, D. E. Parsons, East St. Louis; vice-president, D. W. Snyder, Bloomington; secretary and treasurer, R. V. Prather.

Supply Manufacturers to Hold Summer Meeting at Spring Lake Beach, N. J.

AT THE meetings of the sections of the Associated Manufacturers of Electrical Supplies held during the week of March 13 it was voted to hold the regular summer section meetings at Spring Lake Beach, N. J., at the Essex and Sussex Hotel during the week commencing June 19. An interesting and varied program is already being arranged, as it is planned to make this the largest and best summer meeting the association has held.

The Fan Motor Section held its regular spring meeting on March 15 at the association rooms in New York. The meeting was an all-day session, nearly all the members being present and much constructive work was planned. The following officers were re-elected for the coming year: Chairman, W. W. Mumma, Robbins & Myers Company; secretary-treasurer, C. C. Remsen, secretary-treasurer Diehl Manufacturing Company. The manufacturers of laminated phenolic condensation products decided at a meeting on March 7 to form a section in the association covering this particular line. D. J. O'Conor of the Formica Insulation Company, Cincinnati, was elected chairman of the section; J. P. Wright of the Continental Fibre Company, Newark, Del., secretary, and J. W. Taylor of the Diamond State Fibre Company, treasurer. E. H. Ott of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., was appointed chairman of the standardization committee of the section. The section has laid out much work along standardization lines. Its next regular meeting will be held in June.

Public Hearing on Underwriters' Branch Circuit Rules

A HEARING will be held in the assembly rooms of the Chicago Board of Fire Underwriters of Chicago, 175 West Jackson Boulevard, beginning at 10 a. m. Tuesday, April 18, by the members of the standing committees on devices and materials and on wiring systems and standards of the electrical committee of the National Fire Protection Association to afford opportunity to all interested to express their views regarding a proposal which has been made to change Rule 23d and related rules of the 1920 edition of the National Electrical Code covering limitations upon maximum load of branch circuits.

The meeting will be in charge of A. Penn Denton, Seventeenth and Oak Streets, Kansas City, Mo., and A. R. Small, 207 East Ohio Street, Chicago.

It is the present plan to arrange for a second publ hearing, probably in New York City, on or about May 15

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

An East Indian High-Head Plant.—An additional 100,000 hp. is to be made available for electrical transmission at the Gersoppa Falls on the Sharvati River on the Bombay-Mysore frontier in India. The development is being made by the Mysore state government. By the erection of a 120-ft. dam above the falls and by building a new power house at a point 150 ft. below the bottom of the falls a drop of 1,000 ft. is obtained. The cost will be £3,000,000.

Safety Council Making a Census of Safety Men. — The National Safety Council is completing a census which will determine the number of persons engaged in safety and industrial health work in public utilities and other industries. This census will enable the council quickly to find speakers on industrial and public safety for any occasion in any locality. It will also serve as a medium to obtain lecturers on accident prevention and industrial health work for colleges and universities.

Electricity and Milking in New Zealand.—In New Zealand, with a total population of 1,097,672, there are 8,806 dairies and farms that use electric milking machines requiring 2 hp. or 3 hp. each, and an annual increase of 16 per cent is recorded. In this fact, a local authority maintains, lies the main justification for much of the hydro-electric development under way in the island, with the projected network of transmission lines; for when all the 35,640 milking centers are equipped the total demand will form a very respectable rural load.

An Electrical Turnstile for Bees.—An ingenious method of counting has been brought to the attention of the Bureau of Standards by a member of the Bureau of Entomology, Department of Agriculture. The device, which is the invention of one of the members of that bureau, consists of a gate to be placed at the entrance to a beehive with a series of telephone message registers attached in such a way that every time a bee goes through the gate its passage is recorded. The device is operated electrically by alternating current. As about 300,000 bees go out during the day on honey-gathering expeditions, considerable electrical energy in the aggregate is needed to operate the recording gate, though the amount of energy expended by the device each time a bee passes is, of course, infinitesimal. An emergency device has also been devised to insure that the counting will continue from an auxiliary source of power in case of the failure of the main power circuit. Thus no bee will be able to leave or enter the hive without being counted.

One More Year of Daylight Saving in France.—A bill passed by the French Chamber of Deputies enacted that daylight saving should go into effect this year on March 25 as usual, but that in 1923 no change in the clock should be made. The vote in favor of discontinuing daylight saving next year was 299 to 229.

International Conference on High-Tension Transmission Systems. — The central office of the International Electrotechnical Commission announces that the verbatim report of the conference on high-tension transmission systems held in Paris last November will be published next month, in French and in English, by the Union des Syndicats de l'Electricité. The price of the report will be 60 francs if ordered before April 1, or at least 75 francs if ordered after that date. Those who wish the report should communicate with Tribot Laspierre, general secretary of the Union des Syndicats de l'Electricité, Boulevard Malesherbes 25, Paris, stating the number of copies required and whether in French or English.

Consolidation of Mining Engineering Publications.—The McGraw-Hill Company, publisher of the ELECTRICAL WORLD, has purchased the *Mining and Scientific Press* of San Francisco and on April 1 will consolidate it with the *Engineering and Mining Journal* under the name of *Engineering and Mining Journal-Press*. These two publications are the leading magazines of the metal-mining industry, the *Journal* having been established in 1866 and the *Press* in 1860. J. E. Spurr, editor of the *Mining Journal*, will be editor of the combined weekly, while T. A. Rickard, editor of the *Mining and Scientific Press*, will be contributing editor, keeping his residence in San Francisco and representing, in particular, the Coast and Western viewpoints. The combined publication will be issued in New York.

The Montefiore Prize Again Announced.—The triennial competition for the prize known as the George Montefiore foundation, which was won last year by Dr. J. B. Whitehead of Johns Hopkins University, is again announced by the Association des Ingénieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, of which L. Calmeau, rue Saint-Gilles, 51, Liège, Belgium, is general secretary. This prize, amounting to 21,000 francs, is awarded for the best original work in French or English, exclusive of popular treatises and mere compilations, upon the scientific advance of electricity and its technical applications in any domain. Though known as the competition of 1920, the next award will be made in 1923 (last year's award was for the 1917 competition, similarly delayed by the war), and works may be submitted up to April 30 next year. The prize may be divided or awarded only in part at the discretion of the jury.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Tri-State Water and Light Association.—Spartanburg, S. C., will be the meeting place of the Tri-State Water and Light Association of the Carolinas and Georgia, when its convention is held on April 19, 20 and 21.

New Section A. I. E. E. Organized in Chile.—On the petition of members resident in Santiago de Chile, the executive committee of the American Institute of Electrical Engineers has granted authority for the establishment of a section in that city which will cover also Valparaiso and the surrounding districts.

Missouri Association of Public Utilities.—The Missouri Association of Public Utilities will hold its sixteenth annual convention at Daniel Boone Tavern, Columbia, Mo., May 4, 5 and 6. One session of the convention will be reserved for answering questions and problems of members. W. J. Canada, of the National Electric Light Association, will speak on "Inductive Interference."

April Meetings of A. I. and S. E. E.—These April programs have been scheduled by the sections of the Association of Iron and Steel Electrical Engineers: Cleveland, April 10, "Use and Abuse of Flexible Steel Ropes in the Steel Mill," by W. Voigtlander, John A. Roebling's Sons Company, Trenton, N. J.; Pittsburgh, April 15, "Selective Switching, Including Overload and Reverse Relays and the Interconnecting of Large Power Plants"; Philadelphia, April 18 (joint meeting), "Wireless Telegraphy, Telephony and Radio Control," by L. R. Krumm, radio engineer Westinghouse Electric & Manufacturing Company; Pittsburgh, April 22, "Heating Furnaces."

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Youngstown, March 25, Birmingham, March 25; Cleveland, April 10; Pittsburgh, April 15; Philadelphia, April 18.

A. I. E. E. Section Meetings—Atlanta, March 30; Utah, March 31; Vancouver, April 7; Toronto, April 7.

A. I. E. E. Spring Convention—Chicago, April 19-21.

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21

American Physical Society — Washington, April 22

American Electrochemical Society—Baltimore, April 27-29.

A. S. M. E. Spring Meeting—Atlanta, May 8-11.

N. E. L. A. Annual Convention—Atlantic City, May 15-19

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Price of Energy to Motion-Picture Theaters.—The Missouri Public Service Commission has ruled in a number of cases brought before it that the owners of a motion-picture theater are entitled to power rates and need not pay lighting rates for energy consumed in operating motors and current rectifiers.

Charges on Extraordinary Extensions Cannot Be Imposed on Domestic Consumers.—Finding against a water company that wished its rates to reflect the charges on extraordinary extensions made in war time for industrial customers, the Public Service Commission of Pennsylvania declared that the contention that a greater burden could be placed on domestic consumers than would have been required had the extension been made to meet their needs alone was not tenable.

Free Municipal Service, Off-Peak Service and Discrimination.—Electric service furnished to a municipality without cost, under the terms of a franchise, was construed by the North Dakota Board of Railroad Commissioners as an exchange for the use of the streets and alleys, rather than as free service. The commission, however, expressed its disapproval of this practice. In the same case, one which resulted in the reduction of the electric rates of the company supplying the city of Dickinson, the commission held the theory of off-peak rates to be reasonable but insisted on the same privileges in this regard being granted to all users of electricity for like service and not confined to the large consumers. Another dictum of the commission in this case was that "successful management, modern facilities and economical and efficient operation should be encouraged and rewarded, not by indirection through the creation of a mythical going value, but by increasing the rate of return."

Municipal Operation in Utah.—In granting permission to the Dixie Power Company to increase its electric rates, the Utah Public Utilities Commission referred to the fact that municipal plants in the state had sometimes undertaken to supply service at rates so low that disaster was invited. "Annual reports," the commission continued, "from municipally owned power plants would seem to be an argument in favor of public ownership, for the reason that energy is apparently furnished much cheaper than by private corporations. That is true, however, when you do not, in figuring costs of service, take into consideration the amount invested in the plant and system. The people are, by taxation, required to pay for the plant, generally purchased by the issuing of bonds, and likewise to pay the interest on such bonds for a series of years, and in fixing the rates to be collected from the public in a municipally owned power and light plant the commission does not take into consideration plant investment, interest and sinking fund on bonds. These amounts are taken care of by special assessments on general property of the city or town. Thus, in fact, a part of the rates only must be paid by the consumer, directly, while in private corporations rates necessarily are fixed to cover the balance of the rates paid in municipal operation, indirectly, and, as we have indicated, through taxes. So, after all, consideration must be given all the necessary elements in the giving of service, and whether it is a publicly owned plant or privately owned, the consumer of the energy cannot expect to escape the paying of the just cost of such service."

Extensions of Lines.— Order No. 1,692, on "Standards of Electrical Supply Service to Consumers," effective Feb. 1 last, has been issued by the Michigan Public Utilities Commission. Sections entitled "General," "Records and Reports," "Meters," "Tests Upon Application to Commission," "Transactions with Consumers," "Operation" and "Information for Commission and Consumers" are followed by the regulations governing extensions of lines, which in ordinary cases apply only where consumers contract to use the service for a minimum of two years. These line-extensions rules are as follows: "*Free Extensions.* — When a formal request for service is made of a utility by a prospective consumer or a number of prospective consumers grouped together in the same vicinity, it is recommended that the utility make free of charge such line extensions as may be necessary for giving service, and furnish free service connections, provided that the estimated gross revenue of a period of two years from such prospective consumers is equal to the direct cost of making the extension, and provided that the prospective demand shall be of such permanency and the probable future growth of the demand shall be such as will justify the capital expenditure required. *Restricted Extensions.*—If the direct cost of making a line extension is greater than the estimated gross revenue for a period of two years, then it is recommended that the following principle be made to apply: The utility may require the prospective consumers to furnish a subsidy equal to the difference between the direct cost of the extension and the estimated gross revenue for a period of two years, such subsidy to be refunded to the original prospective consumers in annual installments equal to 10 per cent of the excess of the annual gross revenue after the first two years above one and one-half times the average estimated annual gross revenue for the first two years."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Unusual Definition of "Properly Insulated."—The Iowa Supreme Court has held, in Young vs. Electric Service Company of Central City, that in an action for damages based on a death caused by coming into contact with an electric light wire, the court did not abuse its discretion, in granting a new trial after verdict for defendant, by reason of its instruction that "properly insulated" meant to place in a reasonably isolated condition or situation without unreasonably interfering with efficiency of power lines. (185 N. W. 54.)*

Minnesota Federal Court on Basis of Valuation.—In fixing a gas rate for the Wisconsin-Minnesota Light & Power Company in a suit brought against it by the city of Winona because of exceptions taken to the report of the master, the United States District Court for Minnesota, First Division, asserted that the cost of reproduction less depreciation is not necessarily the value of a utility, that valuation must be based on reasonable judgment of all circumstances, that experience shows there is no such thing as a normal price to which costs of material and labor tend to return, that depreciation should be determined by inspection and not by theory, that the cost of financing is not an element of value without evidence of expenditure, and that cost of rate litigation cannot be considered in fixing rates. (276 Fed. 996.)

Powers of Michigan Commission.—In Taylor vs. Michigan Public Utilities Commission it has been held by the Supreme Court of Michigan that the commission is not without power to entertain a proceeding to fix rates to be paid a gas company whose franchise has expired, though the application was not made by the municipality, in view of the fact that the former Railroad Commission, whose powers were taken over by the Public Utilities Commission, could act on its own motion. Where, at the time an application was filed with the commission by consumers of gas to fix the rate to be paid a company whose franchise had expired, the city and the gas company were negotiating in good faith with a view of arbitrating the rate preliminary to the granting of a new franchise, the commission might in its discretion withhold action until they had an opportunity to conclude such negotiations, and the Supreme Court should not compel it to act by mandamus (186 N. W. 485.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

James H. Manning has recently been appointed engineering manager of Stone & Webster, Inc., with headquarters at Boston. Mr Manning is a graduate of the Worcester Polytechnic Institute, class of 1906. Following graduation he entered the employ of Hugh L. Cooper and served as designer and field engineer on a number of important hydro-electric projects. In 1910 he became a member of the construction division of Stone & Webster, Inc., and was superintendent of construction for Stone & Webster on hydro-electric projects for the Boston & Maine Railroad at Franklin, N. H., for the Truckee River General Electric Company at Reno, Nev., and for the Northwestern Electric Company at White Salmon, Wash. He was later transferred to the engineering division of Stone & Webster and was successively hydraulic engineer and consulting engineer. As such he was in charge of a large number of engineering and economic reports for Stone & Webster and their clients. In 1917 Mr. Manning was loaned by Stone & Webster to the American International Shipbuilding Corporation as chief engineer and was in charge of the general planning and detail design of the Hog Island shipyard. Early in 1919 he returned to Stone & Webster and became assistant engineering manager, in immediate charge of engineering work. He is a member of a number of engineering societies and also of the hydraulic power committee of the National Electric Light Association.

J. H. MANNING

Dr. Lamar Lyndun, electrical engineer, has returned to New York after a prolonged absence in Paris. He is engaged in some private engineering work in this country and expects to return to France in about two months.

Pierce J. Kent, chief system operator of the Edison Electric Illuminating Company of Boston, has passed his thirty-fifth anniversary as a company employee, and in honor of the event a banquet at the Copley Plaza Hotel was tendered to him on Feb. 28, two hundred associates in the generating department acting as hosts. From the company Mr. Kent received a diamond-studded gold service pin and from the men under his supervision a set of electrical appliances. Mr. Kent is one of the best-known operating electrical engineers in New England. He is a native of Exeter, N. H., and has been in general charge of the handling of the Boston Edison electrical system since 1902. His development of the load-dispatching system used at Boston has given him a wide reputation in central-station circles.

S. L. Naphtaly has been elected vice-president of the Great Western Power Company of California and will be in charge of all of the activities and operations of that company. Mr. Naphtaly was born in San Francisco in 1875 and graduated from the University of California in 1896. Immediately thereafter he entered the electrical business and in 1899 was manager of the Central Light & Power Company of San Francisco. When this company was purchased by the San Francisco Gas & Electric Company Mr. Naphtaly became assistant engineer in charge of the electrical department. In 1902 he was promoted to the position of manager of the electrical department and in 1903 became general superintenednt and chief engineer. This position he held until 1905, when the San Francisco Gas & Electric Company was merged into the present Pacific Gas & Electric Company, at which time he became engineer of operations and maintenance in charge of electric operations. In 1907 he left to become associated with the City Electric Company of San Francisco, of which he was general manager and chief engineer. When this company was purchased by the Great Western Power Company Mr. Naphtaly became general manager of the latter company, remaining until 1913, when he resigned to complete the construction of the San Francisco-Sacramento Railway. He occupied the position of vice-president and chief engineer of the railway company. In 1917 he organized the Los Angeles Shipbuilding & Drydock Company, of which he was vice-president and general manager. That company built thirty-five steel ships for the government, and upon the completion of the work Mr. Naphtaly returned to the Great Western Power Company to take his present position.

Earl R. Ernsberger has been elected president and general manager of the Southwestern Cities Electric Company, Oklahoma City, Okla., and has also been elected president and general manager of the Keys Corporation, owning and operating oil and gas fields at Walters, Okla. Mr. Ernsberger has been actively engaged in public utility operation for the last fifteen years. He has made a special study of public relationship policies and has been a firm believer in the conducting of business on the "golden rule" plan. He is a graduate civil engineer and immediately after graduation followed that profession for several years, engaging in railroad work. He first became connected with electrical operations through the electrification of the Northwestern Elevated Railroad in Chicago but his real entry into the electric light and power industry was as chief engineer and general manager of the Mount Hood Railway & Power Company, Portland, Ore., an electric railway and hydro-electric power development. In 1913 he became connected with the Charles City Western Railway Company, Charles City, Iowa, as vice-president and general manager. Under his management this company was entirely electrified and put on a paying basis. In February of this year he was, as already stated, elected president and general manager of the Southwestern Cities Electric Company, which is a holding company for the Lawton & Duncan Electric Company, the Mangum Electric Company, the Lawton Gas Company, the Quanah Light & Ice Company and the Pecos Valley Gas & Electric Company.

E. R. ERNSBERGER

Paul Liunde of the engineering department of the New York Edison Company sailed recently for Denmark for several months' stay. Mr. Liunde will investigate electrical installations in Denmark while in that country.

Daniel M. Fraser, formerly with the Canadian General Electric Company in Toronto as estimating engineer and acting superintendent of construction, has formed the Dominion Engineering Agency in Toronto and is its president. Mr. Fraser was born in Edinburgh, Scotland, in 1879 and was educated in that city at the Normal Training College and Heriot-Watt College. During the fifteen years following his graduation from college he acquired a wide experience in electrical and mechanical engineering, being employed on practical work as well as in the technical and commercial departments of power and central-station companies. He was employed successively by the Edinburgh Corporation at Dewar Place power station; Mavor & Coulson, Glasgow; British Engine, Boiler & Electrical Insurance Company, Manchester, and Drake & Gorham, Ltd., Manchester. He arrived in Montreal, Canada, in 1910 and spent some time with the Montreal Light, Heat & Power Company, leaving to go with the Mines Power Company, Cobalt, now the Northern Ontario Power Company. He spent several months during 1912 in England and Switzerland, investigating hydro-electric developments in the latter country. In October, 1912, he was appointed estimating engineer with the Canadian General Electric Company. Mr. Fraser is a fellow of the A. I. E. E. and a member of the Engineering Institute of Canada.

D. M. FRASER

Bert H. Shepard has opened an office as consulting engineer in the City Bank Building, Syracuse, N. Y.

F. W. Pennock has resigned as vice-president and general manager of the Gleaton Company (of Canada), Ltd, to become connected with the firm of Gelinas & Pennock, consulting engineers, 207 St. James Street, Montreal.

C. B. Veit, formerly Chicago district manager for the Yale & Towne Manufacturing Company, has been transferred to the New England territory, of which, in addition to the territory in Canada east of Montreal, he will have charge.

C. H. Pearson, formerly New England district manager for the Yale & Towne Manufacturing Company, has been placed in charge of the Western and Northwestern territory for the company.

A. H. May, for the past three years works engineer for the General Motors Company, has opened an office in the Allen Theater Building, Windsor, Ontario, as a consulting electrical and mechanical engineer.

Kenneth Seaver, formerly assistant general manager of sales, Harbison-Walker Refractories Company, Pittsburgh, has been made general manager of sales. Mr. Seaver has been with the Harbison-Walker company for nineteen years.

S. F. Bowser has retired as president of S. F. Bowser & Company, Inc., Fort Wayne, Ind. The company was founded in 1885 by Mr. Bowser and since that time has grown to be one of the largest manufacturers of oil pumps and storage tanks. Mr. Bowser will be succeeded by S. B. Bechtel, until recently vice-president and general manager.

Charles M. Sullivan, formerly with Manning, Maxwell & Moore, Inc., as a sales engineer, has become district sales agent in Cleveland for the Kaestner & Hecht Company, Chicago, elevator manufacturers. Before his connection with Manning, Maxwell & Moore, Inc., Mr. Sullivan was Pittsburgh district sales manager for the Milwaukee Electric Crane & Manufacturing Company. He is a graduate of the electrical engineering course of the University of Illinois.

M. H. Schussler, the new vice-president of the Northern White Cedar Association, has been in the pole business since 1893, when he joined the Michigan Cedar Company at Minneapolis. In 1896 he was promoted to the managership and had charge of the sawmill, the logging railroad and the general store at Hunts Spur, Mich. When the Coolidge-Schussler Company was organized in 1899 he was elected secretary and treasurer and has held this position ever since.

M. H. SCHUSSLER

George L. Washington, who has been a salesman in the Havana (Cuba) office of the Westinghouse Electric International Company, has been appointed assistant to the manager of the Havana office of that company. Mr. Washington attended the Alabama Polytechnic Institute of Auburn, Ala., from 1912 to 1916, being graduated with the degree of bachelor of science in electrical engineering. He entered the employ of the export department of the Westinghouse Electric International Company in May, 1917, after completing the Westinghouse apprenticeship course. He entered the military service at the beginning of the war and was discharged Jan. 28, 1919, as first lieutenant of the Forty-sixth United States Infantry. Upon his return he was placed on order work in the Westinghouse International Company and later was transferred to the negotiation division. About eighten months ago he was sent to Cuba as a salesman in the Havana office.

G. L. WASHINGTON

Obituary

Albert E. Roberts, assistant chief electrical engineer of the Northern New York Utilities, Watertown, N. Y., was instantly killed on March 13 when a bare copper connector cable in his hands came in contact with a choke coil carrying 22,000 volts. The accident took place at the company's substation on Mill Street.

John H. Felthousen, chief engineer of the S. Morgan Smith Company, York, Pa., died at his home in York on March 5, after a brief illness. Mr. Felthousen, who was about sixty-five years of age, had been associated with the company named for many years and was identified with its activities in the development of modern water-power equipment. He had become one of the foremost figures in the hydraulic-turbine industry. His loss will be keenly felt by a host of friends and associates.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Pole Prices React Upward

AFTER a protracted series of downward revisions prices of some sizes of Western red-cedar poles have finally been raised. The change amounts to only about 5 per cent and applies only to a few of the larger sizes, such as the 35-ft. and 40-ft., but it shows the healthy tone of the market and the lowering of pole stocks of those sizes. One of the main reasons for pole producers bringing their prices as low as they were around the first of the year was the possession of small stocks by outside brokers who were willing to undersell the nominal market. These "outside" stocks have been practically cleaned up, it seems, and the producers are again able to bring their prices to what they consider a reasonable level. Stocks cannot be replenished from the woods for several months, and the new prices can be maintained at least until that time. Developments then are not being predicted; the supply of poles from the woods this year is reported not to be so large as last year's, and by the time these stocks arrive demand may have picked up so that prices can maintain the new levels.

Good Inquiries for High Tension Insulators with Sales Lagging

THE near approach of good outdoor construction weather has brought a large number of inquiries from insulator purchasers, and manufacturers are confident of a good spring season. Sales during March have dropped somewhat below those of the first two months of this year but are slightly better in volume than in March, 1921. This drop from January and February totals is accepted by producers as merely one of the ups and downs of present-day business and has not lessened the belief in a good spring season. Contemplated construction of important lines is reported from California and the northern Pacific coast, while numerous small extensions of transmission lines are expected in the Middle West. These undoubtedly will be small individually, but in the aggregate should bring considerable business to manufacturers of pole-line material.

A reduction of about 5 per cent has just been put into effect on suspension-type insulators by several of the larger manufacturers, the cut to apply on all sizes. Prices of other types have not changed recently. Whatever reduction has been accomplished to date—estimated at about 30 per cent below peak—has been accomplished by cutting labor costs, according to one manufacturer.

Labor, this producer said, has borne most of the burden of readjustment, while raw material and sales costs have escaped liquidation almost entirely. Labor costs, he continued, have been forced down to the very bedrock and the only hope for cheaper porcelains is downward revision of raw-material prices, greater economy in distributing and sales organizations and lower freight rates. Power companies, however, he added, were not dissatisfied with prices, and he felt that buyers would not hold off on this account as they did last spring. A factor in this is the growing realization that manufacturers are producing much better insulators at only slightly higher prices than in 1915. The producers assert that insulators of the 1915 quality could be purchased now, if they were being made, at less than 1915 prices.

Competition has become keener lately because of the presence in the field of a number of smaller manufacturers. This is affecting sales of insulators under 50,000 volts and particularly the 2,300-volt to 6,600-volt sizes. Only the well-established producers have the facilities to make the very large sizes and price concessions are not so noticeable on jobs of that size.

Storage Battery Sales Increase Since First of Year

THE storage-battery business is good and the outlook is bright for increased sales in 1922, in the opinion of H. B. Gay of the Electric Storage Battery Company, Philadelphia. There has been a satisfactory increase in sales in the past two months over the corresponding period of 1921, and Mr. Gay stated to a representative of the ELECTRICAL WORLD that at present a good volume of business is being closed.

"New sales are naturally dependent upon general conditions, and the readjustment of business is already having its good effects," he said. "The storage-battery business is like that of other industrials depending upon trade developments. In this connection can be mentioned the railroads and farmers. The railroads have limited their purchases to the minimum during the past few years and have piled up orders for needed material. Orders are now beginning to come from these companies in the shape of new business as well as for the needed supplies. The general adjustment of prices of food to a more stable basis has increased demand that has been felt from the farmers; they are now ordering in larger quantities.

"The storage battery is an essential and indispensable part of many different kinds of electrical systems and apparatus, and the field for renewals and replacements is large. The reduction in price of batteries is also a contributing cause of increased sales. Character of the inquiries for this year is better than for the year previous. More settled conditions in Europe will, I believe, stimulate export business."

No Signs of Slacking in Demand for Radio Apparatus

DESPITE the efforts of manufacturers of radio apparatus to catch up with the demand for their product, deliveries are still far in arrears and orders continue to come in in ever-increasing volume. The larger manufacturers are not yet ready for deliveries in quantity, though the announcement has been made that there will be a normal supply for the country within the next six weeks. In the meantime dealers and jobbers are scouring the country in an attempt to find something with which to placate their customers and are discovering the same situation in all jobbing centers. Moderate supplies were supposed to exist in Cleveland, Detroit and Pittsburgh, but one dealer recently in New York said that he had not been able to buy enough in these cities to supply even the wants of his small community. In New York the large demand of two months ago has grown to such proportions that several dealers have had to close down their radio departments for several days at a time because of inability to obtain supplies. Stocks of head sets have been particularly short.

The Radio corporation, the sales agent for the Westinghouse Electric & Manufacturing Company and the General Electric Company, has announced to the trade that the present shortage should be overcome within the next six weeks owing to the greatly enlarged production of these two companies. At the present time considerable quantities are being shipped to the jobbing outlets of various manufacturers, but because of the desire of these jobbers to supply old customers first the majority of the dealers have not benefited by the increased production as yet. This applies particularly to those dealers who have just recently installed radio departments but have been unable to obtain enough stock to really keep them going.

One of the older manufacturers of radio apparatus has just made plans to quadruple output, though only a short time ago the original production of the plant had been doubled. This company is making partial delivery now on all orders accepted in from three to six weeks and in from five to eight weeks will deliver in larger quantities. After April 1, according to present plans, deliveries will run two to four weeks, while immediate delivery will be given after June 1.

Sales of Irons Running Ahead of Last Year

PURCHASES of electric irons by wholesalers and dealers since Jan. 1 have been considerably ahead of those for the same period of 1921, according to a survey of that market just completed by the ELECTRICAL WORLD. January and February are recognized as lean months on account of seasonal conditions, but even so the volume of sales by manufacturers has been only slightly below that of last August and September, normally the two busiest months of this year. This revival of demand has led manufacturers to predict that 1922 will go ahead of 1921.

Viewed from the angle of stocks on hand there is also room for optimism. Both jobbers and dealers turned into 1921 with large supplies of irons on hand. Bit by bit, aided by several price reductions throughout the year, these stocks were worked off, and by January last many jobbers and retailers were on a hand-to-mouth basis. It is true that orders are still small, but their frequency shows a good turnover, which is more to be desired than large sales to distributers with the attendant delay in the repeat order. Retailers report a satisfactory movement of flatirons to the public, a movement which is shared by most of the appliances selling at low prices.

Deliveries can be had immediately on the small orders going through at present, and a majority of the manufacturers interviewed stated that under the conditions anticipated deliveries will continue normal. However, surplus stocks have been cut down even by the manufacturers, and concerted buying such as that of 1919, would probably result in temporary delays in shipment.

Prices are regarded generally as stable. There were three downward changes in 1921 and another slight revision on Jan. 1, 1922.

Rigid Conduit Manufacturers Expect Heavier Spring Demand

A MORE active demand than at any time in the last two years is anticipated this spring by manufacturers of rigid conduit. Sales of pipe have held up very well all winter, and at the present time production is on a comfortable basis, though practically no plants are working on a capacity basis. The effort to spread out this business during the winter has been successful, and thus the sales curve has not shown the peaks and valleys noticeable in other lines.

Though of satisfactory volume, the demand has been of a more or less hand-to-mouth character, and stocks now are small. Contractors have ordered by the job, and jobbers with a few exceptions have kept their stocks so low as to have to pass on orders direct to the manufacturer. The result will probably be a temporary shortage early in the spring, for manufacturers also have cut down stocks. Building should not be seriously affected by such a shortage, for there is usually a moderate length of time intervening between the placing of the order and the actual use of the material in the job. However, such a condition would have a healthy effect on quotations.

A good amount of business should develop within the next three to four weeks, according to one manufacturer. Big building projects are maturing in New England, New York, the Southeast, Chicago and the Pacific Coast, all of which will consume a considerable amount of pipe. The Pacific Coast in particular is proving a worth-while field, distributers of one concern having taken at least two cars a week, and often more, for several months past. The Southwest, including Texas, has been an active market, but the Middle West and the Southeast have been quiet. Both New York and New England have been absorbing a good volume.

Metal Market Situation

DOMESTIC purchases of copper fell off last week and the market sagged somewhat in consequence. The development was not unexpected, however, after the activity of the preceding two weeks. Foreign buying did not recede to as noticeable an extent as did domestic, but sales to that market were actually smaller and prices went off about an eighth of a cent. As a result of the turn of affairs there were freer offerings by some producers for second quarter as well as for prompt deliveries. Some of the smaller producers also solicited business for the third quarter at prices which would not have been accepted a few days before. The prevailing price at the beginning of the week was 13 cents delivered for domestic shipment in March and April, as well as 13 cents f.a.s. New York for export.

Consumers, nevertheless, continued to be cautious and not much buying was reported at this price. The demand for finished copper products is improving slowly but steadily, but most of the manufacturers seem to have provided for their needs for the next thirty days and are not disposed to anticipate future requirements. Wire and rods went ⅛ cent higher last week as a result of the large buying.

Much of the recent upturn of the market is laid by one commenter to unusually good foreign sales, which were reported to exceed even domestic orders. During the first part of March England was a large buyer while Germany came back into the market on a moderate scale. Scattered orders from France, Italy and the East have combined to raise the volume of foreign business. Imports of copper into the United States in January, according to the Department of Commerce, were 12,880,483 lb., the smallest monthly imports reported since September, 1920. Exports in January amounted to 54,808,928 lb.

There is a stronger tone in the lead market in the West, and this is being confirmed by the placing of good-sized orders for April shipment at the stronger prices. Dealers as well as consumers are in the market for that position, and there is also a good demand for May, which however, producers are not disposed to quote. Business has been done for soft Missouri brands at 4.52½ cents Chicago.

NEW YORK METAL MARKET PRICES

	March 14, 1922	March 21, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	60 12 6	59 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00–13.25	13.00–13.25
Electrolytic	13.00	13.00
Casting	12.62½	12.62½
Wire, base	14.00	14.00–14.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.15	4.25
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	8.00
Zinc, spot	5.00–5.05	5.05
Tin, straits	28.87½	29.00
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.00 –11.25	11.00 –11.25
Brass, heavy	5.00 – 5.50	5.00 – 5.50
Brass, light	4.75 – 5.00	4.75 – 5.00
Lead, heavy	3.75 – 3.87½	3.75 – 3.87½
Zinc, old scrap	2.25 – 2.50	2 25 – 2.50

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

LAST week in the electrical trade was uneventful, but business continued to plug steadily along and March, it is believed will show a better volume of sales than either the preceding month or the same month last year. Building remains active in most of the centers of business and continues to require steady shipments of wiring supplies, and there is more or less spasmodic activity in other electrical lines. New England is improving industrially, better conditions being noted in the construction and metal-working fields; more active buying of industrial lighting equipment and lamps is noted there. Atlanta reports the best week in several months, owing to better weather. Chicago business is quiet, but better motor business than last year is reported there, and St. Louis observes greater activity in industrial electrical supplies. In the West conditions are spotty, but both California and the Northwest report business picking up.

NEW YORK

Some improvement in the sale of wiring materials was noted by the jobbers last week. This is attributed almost wholly to the increase in residential building which has been brought about by the approach of spring. During the last week there has been a most significant increase in the amount of new construction placed under contract, and the volume of newly reported building in prospect is far in excess of the most optimistic predictions of a short time ago. Figures for the territory including all of New York State and New Jersey north of Trenton show that during the tenth week of this year there were first reports on 777 new building and engineering projects in this district that will involve a total outlay of approximately $37,158,900. During the same period there were 342 contract awards announced that will require a total expenditure of $20,397,600. Residential building, both prospective and actually under contract, is by far the most important in volume and cost, and there is every reason to expect that this character of construction will dominate the building situation throughout the coming season.

Prices remained virtually unchanged and jobbers' stocks are fair to good on all items. Price competition is still in evidence, although it is not so keen as formerly.

Rigid Conduit.—A slight adjustment of prices was announced by manufacturers, but it was not sufficient to affect jobbers' quotations. Prices this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50; ¾-in., $58.10, and 1-in., $82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $50, $64.50 and $92.20 per 1,000 ft. Demand is only fair with stocks generally good.

Wire.—No change of price or of conditions in the wire market was noted last week. No. 14 rubber-covered is quoted at $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots. Demand is moderate and stocks are good.

Flexible Armored Conductor.—Prices for this material remain uncertain. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft., and double-strip at $45 per 1,000 ft. in that quantity. Quotations on similar material have been made at $40 per 1,000 ft. for single-strip and $42 per 1,000 ft. for double-strip. Demand is good, and stocks in the hands of both jobbers and manufacturers are reported to be small.

Lamp Cord.—Demand is moderate and stocks are good. No. 18, cotton, twisted, is quoted from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft.

Dry Cells.—Batteries are moving fairly well and jobbers' stocks are good. Igniters in barrel lots sell for $30 per 100.

Metal Molding.—There is a moderate demand for this material and stocks are ample. In lots of 1,000 ft. the three-wire size sells for $5.50 per 100 ft.

Fans.—Jobbers report that their fan business this year promises to be much better than last as the dealers are placing fair-sized orders for early delivery in response to contracts sent out about a month ago. Prices on 12-in. and 16-in. fans are from 10 per cent to 13 per cent lower than last year.

CHICAGO

Only a few changes were noticed last week in the electrical trade either in price or demand. While there was a steady volume of wiring materials moving to contractors, no tendency to increase stocks was found and hand-to-mouth buying still exists. Conduit is still selling at varying prices. Manufacturers of high-tension equipment report more interest in this line and feel that spring business will be good. The price reductions on motors produced very little increase in buying, but most dealers say that this year's business so far is better than that of 1921.

During the week the citizens' committee to enforce the Landis award announced that it had insured for $28,000,000 505 jobs, ranging from bank buildings to cottages and employing 5,594 workman of all trades.

Rigid Conduit.—Jobbers' quotations vary widely, ranging from $40 to $42.50 per 1,000 ft. in 5,000-ft. lots for the ½-in. black pipe. The demand the past week has been moderate but steady. Stocks in jobbers' hands are good.

Flexible Armored Conductor. — Sales have been steady and most jobbers' stocks are being replenished by shipments from manufacturers. Prices have been shaded a bit, and the No. 14 two-wire, single-strip, is available for $43 to $45 per 1,000 ft. in 5,000-ft. lots.

Wire.—A fair volume of sales on No. 14 rubber-covered wire during the past week has been reported, and prices have remained steady. Quotations on No. 14 rubber-covered range from $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots, and dealers' stocks are in fair condition. An increased demand for weatherproof has been noticed due to spring building, but the price still remains at 16¼ cents per pound. The bare wire market has been active and stocks are ample.

High-Tension Equipment.—Reports from manufacturers indicate that spring activity has started. Orders for a 1,500-kva., 22,000-volt outdoor substation for a Northwestern central station, three 600-kva., 33,000-volt outdoor substations for a Middle Western utility and a 13,200-volt, 600-kva. substation for the South were received during the week by one manufacturer.

Poles.—Nearly all dealers say that they have realized a bit of the increased spring business on this equipment. An increase in price on Western red cedar poles has been noted. The 7-in., 30-ft. pole sells for $7.80, and the 7-in., 35-ft. pole for $11.60 f.o.b. Chicago. Stocks are in good condition.

Motors.—The average 10 per cent drop in price on polyphase induction motors has not stimulated trade to any noticeable degree, although dealers report more activity. They feel that this improvement is purely a seasonal one and was in no way affected by the price change. One dealer tells of receiving orders for several 150-hp. motors. Another company reports its 1922 motor business to date better than that of 1921 by 7 or 8 per cent. A 3 to 4 per cent drop in single-phase motors is reported by one company. All dealers say their stocks are in good condition.

Safety Switches.—Sales are steady and not confined solely to the standard 30-amp. household switch. Orders for the larger types, ranging from 100 amp. up, have been reported by dealers. Stocks are ample for current needs.

BOSTON

Underlying conditions continue to improve slowly in the electrical industry. Trade is better in many lines than last month, notwithstanding the effect of textile strikes in various localities in New England. For the latest reported week building and engineering contracts placed in New England totaled over $3,900,000, a gain of nearly $1,000,000 over the same week a year ago. The metal industries are showing more activity. House-wiring campaigns are bringing excellent results in several places and central-station outputs in representative plants show substantial gains over last year. Prices are fairly firm, barring readjustments which do not represent pronounced changes all along the line. The shortage in radio-telephone apparatus continues, and it was reported Monday that some of the smaller sizes of bare copper wire for aërials were difficult to obtain promptly. Competition for trade among distributers is exceedingly sharp, but the public is coming into the market more and more, though nothing like a boom is apparent. Municipalities are showing much interest at present in public building and especially schoolhouse illumination.

Motors.—A much better feeling is evident. Sales are largely confined to sizes not exceeding 10-hp. rating, though occasionally much larger motors are required. One distributer noted an improved demand last week for polyphase equipment.

Lamps.—The demand holds up remarkably well, and a leading distributer reported Monday sales ahead of last year's. Considerable industrial-plant buying of lamps is under way, after a long period of low ordering for replacement. The demand for lamps for window lighting and for projector work is also fairly active. Larger-sized units are in much favor.

Wire.—Competition is extremely acute. A 3,000-lb. order was decided last week by one purchaser on a quotation difference of only $7.50 for the lot as between a manufacturer and a jobber. Little demand for bare wire exists except for radio aërials, and No. 14 seven-strand copper was hard to obtain promptly the first of the week. Rubber-covered No. 14 wire is quoted all the way from $5.80 to $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is 15 cents.

Sockets.—A light demand features the market, with much complaint of narrow margins of profit among jobbers. In some cases business is better than earlier in the year. The ruling price on pulls in case lots is 31½ cents net, keys moving at 18 cents and keyless sockets at 16½ cents.

Rigid Conduit.—Small-lot sales are going through, 500-lb. orders or less from contractors to jobbers being common. Prices on ¾-in. black and galvanized conduit in less than 500-lb. lots are respectively 7 cents and 7.5 cents per foot from Boston jobbers' stocks.

Fixtures.—A fair demand is reported. Fixtures for public buildings and mercantile establishments are moving most actively, and a growing trade in equipments for residential service is anticipated as building operations increase. A large amount of scattered house construction is apparent in the suburban Boston district.

Meters.—A moderate demand is apparent, which bids fair to improve as the season advances. Some mercantile meter installations are helping to round out the present light output of manufacturers in comparison with their total facilities.

ATLANTA

Some improvement in business conditions is reported this week for the first time since the beginning of the year. There have been a few consecutive days of good weather, and this is having an excellent effect both in the cities and in the rural communities, allowing building construction to continue in the cities and giving the farmers an opportunity to get started on spring planting. According to the report of the building inspector in Atlanta, 401 homes have been completed since Jan. 1, establishing a record in the city's history.

There is little cash money in the small towns and rural districts, except where industrial-plant payrolls are being spent, and as a result collections are rather slow with no likelihood of the money market easing off until well in the summer months. Public works construction is tending to help the situation materially, the State Highway Commission announcing that it will construct $4,000,000 worth of roads this year, while municipal improvements, such as installation and expansion of waterworks, sewerage systems, schools, etc., will help still further.

A great deal of interest is being displayed in radio equipment, two of the large newspapers in Atlanta recently announcing the installation of broadcasting stations. This particular line is helping materially to sustain the sales volume of a number of jobbers and dealers in this section.

Portable Drills.—The continued slowness in the automobile and garage business is reflected in the slackening demand for portable drills, though a few sales are being made to industrial plants. Local stocks and factory shipments are both reported good, with prices steady.

"White-Way" Lighting Equipment.—There is considerable activity in this line, municipalities displaying a great deal of interest in improvements and expansions. Factory shipments are reported quite satisfactory.

Panelboards.—Panelboards continue to sell well, the small sectional boards leading in popularity, though some of the larger lighting and power panels are moving.

Electric Ranges.—Certain sections of the territory report considerable activity, particularly South Carolina and Florida. Jacksonville announces a range campaign for this spring which should serve to place a fair quantity. Local stocks are in good shape, with prices unchanged.

Fans.—Fans are becoming quite active with the prospects splendid for a good season this year. Jobbers have placed orders approximately equal to those of 1921 and are beginning to actively push this line of business.

Printing-Press Equipment. — This line continues quite active and a number of very satisfactory orders have been received recently. The orders are about one-third for direct-current and two-third for alternating-current equipment, with the three-phase type of apparatus predominating. Local stocks are in fair to good condition with shipments satisfactory.

Exhaust Fans.—Movement is beginning again, especially in the small and moderate-size types, the 18-in., 24-in. and 30-in. being most popular. Prospects for summer business are good with stocks at present fair to good. There is a rumor of price reductions in the near future, though there is nothing definite obtainable as yet.

Oil-Engine Generating Sets.—Sets in all sizes up to and including the 200-hp. size are reported very active, the larger sets being particularly in demand in south Georgia, south Alabama and Florida. The house-lighting and small commercial sets are also moving quite satisfactorily. Local stocks of the smaller types are fair, with shipments on the larger sets on about a six-week basis.

ST. LOUIS

Another labor group, the cement finishers, has contracted with the builders on a basis of 20 per cent wage reduction, and, with negotiations under way with the other groups, it is felt that the average scale in construction work will soon be such as to give real stimulus to building. Jobbers are now feeling some improvement in demand for house-wiring materials, and there is a large amount of work under way which has not reached the wiring stage. The electrical situation as far as industrial plants are concerned is also much healthier than a few months ago. Industrial operations are not expected to be on a large scale this year, but the volume of work now done is so greatly in excess of what has been the rule that all view the future with undisguised optimism. Appliances, however, are reported to be moving very slowly.

Stocks in the hands of the jobbers are found to be slightly larger than last year, because of increased demand, but they are still closely watched on account of the possibilities of further price reductions. No difficulty is experienced in filling all ordinary requirements immediately from local stores.

Loom.—Demand is spotty, but in general shows improvement. Representative prices are: $\frac{7}{32}$-in., $14.80 per 1,000 ft. in 250-ft. lots and $14.40 per 1,000 ft. in 1,000-ft. lots; ¼-in., $18.90 per 1,000 ft. in 250-ft. lots and $17.75 per 1,000 ft. in 1,000-ft. lots.

Flexible Armored Conductor.—Prices are easier, and the demand, though steady, is not much better than at the first of the year. No. 14, two-wire, is selling for $70 per 1,000 ft. in lots less than 250 ft. and for $50 per 1,000 ft. in lots of 2,500-ft. Connectors sell for $3.60 to $3.75 per 100.

Tape.—Improved demand has reduced the large stocks of a month ago until they are now on a normal basis. The price of rubber tape remains at 36 cents per pound, but that of friction has lowered slightly, now varying from 35 cents to 58 cents, depending upon quality. The most generally used grade of friction tape is selling for around 37 cents.

Entrance Switches and Cut-outs.—Stocks are very conservative because of the comparatively slow demand. Some jobbers report improved sales in St. Louis, but sales throughout the territory are very spotty. In lots of 100 or more a combined entrance switch and cut-out is priced at $36 per 100. Double-pole main cut-outs are priced at $12.70 per 100. Externally operated entrance switches are priced at $1.30 each in lots of twenty-five or more. An all-porcelain switch is on the market for $1 each in any quantity.

Sockets.—Very little change in the demand is noticeable, but there should be improvement when the houses now under construction near completion. Prices for ⅛-in. cap, brushed brass, in lots of 500, are: Key, $18.15 per 100; keyless, $16.50; pull, $33. Porcelain sockets, in lots of 250, are quoted at $25.50 for the key type and at $23 for the keyless. Mica weatherproof sockets, in lots of 250, sell for $10 per 100.

SAN FRANCISCO

A few consecutive days of warm weather following the unusually cold and long winter immediately quickened local buying. A larger proportion of new bungalows now being erected in the outer districts are being wired by ex-wiremen who are usually satisfied if they achieve their former daily wages. Collections are still rather long, running over fifty days, but they are being handled with constantly increasing vigor. Time-payment business has dropped except in one or two conspicuous instances to a mere trickle.

Motors.—A campaign is now being waged to promote the use of fractional hp. motors, and dealers are being urged to search for this business among small industrial consumers such as jewelers, grocers and others. Local stocks are fair, and as many instances of complete shortage have been recently reported there is no doubt that within the next month or so many good stock orders will be placed. The demand for larger motors, especially those of pumping size, is increasing, and with good local stocks and plenty of water for irrigation purposes a good spring motor season is anticipated.

Radio Apparatus.—This new and practically unexploited field is one of the briskest locally. A highly successful campaign to interest the maturer public is being carried on, and at the same time future business is being promoted by public competition for boys' home-made apparatus. New broadcasting stations are being established and already-established service is being perfected. New manufacturers are selling in the local market and new dealers, such as the large department stores are making elaborate preparations to enter the field.

Heating Appliances.—Waffle irons of the new round type will soon be ready for distribution by several manufacturers. One company reports that it is still nearly one thousand irons behind the demand.

Ironers.—There are unmistakable signs that the demand for ironing machines is again approaching its 1920 level after a rather slack year. The character of this demand, however, seems to have changed. There is more shopping and more insistence that the machine shall do a greater proportion, if not all, of the family ironing. Local stocks are good and prices are dropping.

Christmas-Tree Outfits. — Jobbers' salesmen have just received new information and are now closing business for next season. Quite heavy stocks were carried over by jobbers from last year; dealers too are well supplied.

PORTLAND—SEATTLE

Building activity continues unabated throughout the Northwest, residential and apartment-house construction being the most active. The lumber situation remains about the same. Production for the week ending March 11 was 11 per cent below normal, new business was 16 per cent below production, and shipments were 13 per cent above sales. Adverse weather conditions have prevented the opening up of logging operations, but will not act as a hindrance much longer. General business is fair. Electrical jobbers report conditions continuing quiet, although there is apparently no feeling of apprehension about the future. Country business is very spotty. Some activity is reported on high-tension insulators, copper wire and electric ranges. No price changes of any note have occurred during the week, although some instability is evident in porcelain prices. Demands for radio equipment continue unprecedented. Contractor-dealer business is somewhat spotty, some reporting business very good and having figures to prove it. Residence wiring is very active and many large jobs are being placed, but on these the competition is so keen that little profit is left. Dealers cannot get more than 10 per cent of their orders for radio apparatus.

Porcelain.—No. 5½ solid knobs are quoted at $11 per 1,000 in lots of 500. No. 5½ "Nail-it" knobs are $22 to $23.75 per 1,000 in lots of 500. In similar lots and quantities 3-in. x $\frac{5}{16}$-in. porcelain tubes are $5.85 to $6.55 and 4-in. x $\frac{5}{16}$-in. porcelain tubes are $7.50 to $8.20. Two-wire and three-wire cleats are quoted at $17.50 to $19.25 per 1,000 in lots of 250.

Insulators.—No. 9 pony glass insulators are quoted at $66.45 per 1,000 in lots of 400.

Loom.—$\frac{7}{32}$-in. loom is quoted at $19 per 1,000 ft. in coil lots of 250 ft.

Electric Ranges.—Ranges are selling more rapidly than any other line of appliance at present.

SALT LAKE CITY—DENVER

The labor situation shows improvement, the railroads having taken back some of their men who have been idle for months, with an indication that they will enlarge the payrolls still further. The coal strike set for April 1 will not affect the Utah mines, since they are not unionized. There is a report current that freight rates on coal will be reduced at the beginning of April, making it possible to lower prices to consumers. The copper outlook continues to grow brighter, with a steadily growing demand. It is estimated that the domestic and foreign markets will absorb upward of 750,000,000 lb. of new refined copper during the first six months of 1922. This will call for a materially increased production. There is scarcely any building activity, the season not being far enough along to permit outdoor construction. However, the real-estate men are active and will launch cottage-building campaigns as soon as the weather permits.

Selling is sluggish in all departments of merchandising and electrical dealers are just marking time, hoping for better times but financially unable to do much in the way of creating business. Jobbers are filling a few small orders for construction materials, washers and vacuum cleaners. The call for pole-line materials is small. Credit conditions show steady though slow improvement. There is far less trouble with collections than was experienced a year ago. Banks are granting loans, but with rigid security demands.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

New Interests Control Diamond Power Specialty

The business of the Diamond Power Specialty Company, Detroit, manufacturer of "Diamond" soot blowers, has been purchased by new interests and a new company has been formed under the name of the Diamond Power Specialty Corporation. The old company was a copartnership, the members of which in selling out have agreed to retire from the soot-blower business in the Western Hemisphere. N. L. Snow, until recently vice-president of the Terry Steam Turbine Company, is now president and treasurer of the Diamond corporation.

Los Angeles Manufacturer Reports Sales Gain

The Pacific Manufacturing & Electric Company of Los Angeles reports that the present market for electric water heaters has shown a decided improvemen during the past few months. In addition to domestic orders, heaters are being sold for export, principally to Japan, where heaters of this type have become popular. The company is planning extensions of its business, which will include the addition of new lines of apparatus. Among other developments being considered is a line of radio receiving apparatus.

American Eveready and National Carbon Consolidate

The sales and accounting divisions of the National Carbon Company, Inc., which have been carried on at Cleveland under that name will, it is announced, be consolidated with the American Eveready Works of the National Carbon Company, Long Island City, N. Y., and the new organization will be operated as the National Carbon Company, Inc. Another change will be the removal of the general offices of the Columbia products division from Cleveland to Long Island City. Warehouses and district sales offices will be maintained at Chicago, Kansas City, Atlanta, Cleveland and Long Island City. Both the Columbia and Eveready products will be handled by all sales representatives, and the personnel of the sales forces of both divisions will be little changed.

J. R. Crawford, who has been general sales manager of the Columbia division of the National Carbon Company, Inc., at Cleveland, has been appointed to the same position with the consolidated organization and will have his headquarters at Long Island City. E. G. Clemenson, formerly assistant general sales manager of the Columbia division, and Emmet Moore, formerly assistant general sales manager of the American Eveready division, will both become assistant general sales managers of the merged organization. F. A. Wilson-Lawrenson, who has been general sales manager of the Eveready division, will have charge of advertising and sales promotion work for all the National Carbon products.

Allis-Chalmers Business Continues to Improve

New business booked by the Allis-Chalmers Manufacturing Company, Milwaukee, in February exceeds that of any month since December, 1920, coming close to $2,000,000, according to information derived from the company. The greater part of the recent business for the company consisted of orders from consumers of small machinery, particularly for machinery used for cement mixing for roads and building construction. A moderate amount of new business is coming from public utility companies, though this end of the business is expected to assume larger proportions later in the year.

The annual statement for 1921 will be published within a few weeks and will show gross earnings for 1921 of about $24,685,000 compared with $31,516,000 in 1920. The unfinished business at the close of the year was $7,300,724 compared with $17,046,724 on Dec. 31, 1920. Thus to attain a gross of $24,685,000 for 1921 the company had to draw on its unfilled orders to the extent of $10,000,000.

General Electric Gets Big Pacific Coast Order

The Southern California Edison Company, Los Angeles, has just placed an order with the General Electric Company involving a total of 455,000 kva. of 220,000-volt transforming equipment, 60,000 kw. of 72,000-volt transformers, a 17,500-kva. generator, a 30,000-kva. synchronous condenser and a considerable amount of switching equipment, including eight 220,000-volt oil circuit breakers. This order is for additional equipment for the Southern California Edison's Big Creek No. 1 power house and the initial equipment for the new receiving substation known as Laguna Belle, and it includes auto-transformers to be used in raising existing stations to the new transmission voltage of 220,000 volts. It is reported that the order will amount to over $1,000,000.

Faden Succeeds Washington Light Company

The Faden Electrical Supply Company, 186 West Lake Street, Chicago, has been organized to succeed the Washington Light Company, formerly at that address. Alex Faden, for the past six years president of the Metropolitan Electrical Supply Company, is president and treasurer of this new company, and Michael Loehr, formerly manager of the Metropolitan company, is the new firm's secretary. Mr. Faden said that while his company would continue in the lighting-fixture business, it would also engage in the electrical supply jobbing business.

Brown & Pengilly Take Over Foulkes Plant

Brown & Pengilly, 607 East Fourth Street, Los Angeles, manufacturers of dead-front switchboards, relays and other control apparatus, have recently acquired the manufacturing plant of the Foulkes Electric Company of Los Angeles and are expanding their activities to meet the rapidly increasing demand for safety switching devices. The rapid growth of California, the expensive program of building construction and new rulings of the California Industrial Accident Commission have combined to widen the market for these classes of equipment. Several new items have been added to the lines formerly made by this concern.

Westinghouse Inaugurates Campaign for Better Street Lighting

An educational campaign in behalf of better street lighting is being conducted by the Westinghouse Electric & Manufacturing Company, with the object of pushing the installation of more street light and particularly of municipal systems of the ornamental type.

The movement has a strong appeal to the civic instincts and civic pride of the people, and favorable comment has already been received from many points throughout the country. Civic officials have been reached through the "direct-by-mail" feature of the campaign, attractive letter-folders pointing out the many advantages accruing to a municipality and its citizens from the installation of a modern lighting system having been sent out in this way. Circularization of persons and organizations interested in the beauty, safety and progress of their respective cities has been carried on on an elaborate scale. Among those being reached by literature are mayors of cities of more than 1,000 population, city commissioners and managers, city engineers, city purchasing agents, superintendents of streets and parks, chairmen of public works boards, etc.

The movement is expected to assist central-station companies in building up lighting loads and to aid others engaged in the electrical industry.

Because of the decrease in the cost

of materials and labor and because of the lower rates at which municipalities may borrow funds, the Westinghouse company feels the present is especially opportune for carrying through a campaign of this kind which stimulates business and promotes progress in the municipality.

Engineering Company Reorganizes

Ophuls, Hill & McCreery, Inc., engineers, 112 West Forty-second Street, New York, have applied for a change in charter to Ophuls, Hill, Inc., the interests of J. H. McCreery having been purchased by the other partners. The firm will continue with the same personnel and in the same location. According to the announcement of the company, Mr. McCreery was never active in the firm, and as an enlargement of its scope and a broadening of its field of activity is contemplated, a change of name was deemed advisable. Fred Ophuls is president and H. P. Hall is vice-president and treasurer.

Coast Campaign for Better Electrical Service Wiring

With the use of electrical energy increasing at the rate of 10 per cent annually and a yearly consumption of energy in Washington, Oregon and California nearly three times as much per capita as for the rest of the United States, the Pacific States Electric Company, realizing the growing importance of electrical energy to the average home owner, has inaugurated an educational campaign along the Coast to establish a basis of confidence between electrical contractor and home owner. The campaign is under way in Seattle and is being conducted under the immediate direction of David E. Harris, vice-president and general manager of the Pacific States Electric Company, San Francisco, and J. D. Barnhill of Evans & Barnhill, Inc., also of San Francisco.

It is contended by those in charge of the campaign that in spite of the rapid growth of the use of electricity in the home most people fail to get the full value of the electrical service to which they are entitled because they have not realized the importance of quality in the original installation. Recent surveys have indicated clearly that the owner often fails to get the service which he may reasonably expect because wiring contracts are let on the basis of price alone. Letting contracts to the lowest bidder, they say, usually means that the work is poorly done. When the bid is too low there must be poor material and poor workmanship to make up for it. It is claimed that the average number of outlets at the present time is only one-half the number required for the best results.

This campaign is said to be the first of its kind to be put into effect in the United States, and much good is expected to flow from it.

Motor Manufacturer Announces Name Change

The Galvin Electric Manufacturing Company is the new name of the company known formerly as the H-G Manufacturing Company, 1215 Pine Street, St. Louis. The company manufactures a line of electrical specialties, including fractional-horsepower motors. According to the company announcement the change in name does not mean a reorganization, and the ownership control, policies and personnel remain as before.

Improvement Last Fall Shown in Worthington Annual Report

Although 1921 considered as a whole proved a year of poor business, according to the annual report of the Worthington Pump & Machinery Company, 115 Broadway, New York, an improvement in the bookings of the company occurred in the latter part of the year, and it is believed this will continue at a slowly increasing rate. Bookings during the year amounted to $12,093,375, while billings were $17,335,854 and profits, after deducting depreciation, were $1,544,309. Unfilled orders on Dec. 31, 1921, were $4,496,232, less than half of those on the Dec. 31 previous.

During the year in the adjustment of contracts for pumping equipment to meet war requirements certain buildings and equipment of the Blake & Knowles Works were taken over from the government. The facilities acquired, it is announced, will be used in the production of recently developed lines, among them a two-cycle solid-injection Diesel engine. Inquiries received for this product, the statement says, have been increasing from month to month and a large volume of business is expected to develop during 1922.

Wisconsin Electric Appliance Succeeds Twin Cities Supply

The Wisconsin Electric Appliance Company, 125 Main Street, Menasha, Wis., has been organized to succeed the Twin Cities Electric & Supply Company and not to operate as a subsidiary of that company, as stated in the ELECTRICAL WORLD last week.

Weber Sales Agent Makes Organization Changes

Henry D. Sears, Boston, Mass, general sales agent for the products of the Weber Electric Company, Schenectady, N. Y., has appointed Henry E. Nickerson, for the past eleven years Mr. Sears's New England representative, to take charge of sales in the metropolitan district of New York and in Connecticut, west of the Connecticut River. Mr. Nickerson will have an office at 342 Madison Avenue, New York. Carl C. Smith, formerly with the Renim Specialty Company, Boston, will have charge of sales in New York State outside of the metropolitan district and all new England except the part of Connecticut under Mr. Nickerson. Henry G. Anschuetz, formerly representing the Manhattan Electrical Supply Company on its manufactured products, will have charge of sales in southern New Jersey, eastern Pennsylvania, Delaware, Maryland and Virginia and will make his headquarters in Philadelphia.

F. B. Colt & Company, contracting engineers, 15-17 West Forty-second Street, New York, have been formed by F. B. Colt, formerly associated with Colt & Brackett.

The Pettingell - Andrews Company, Boston, has established a department for wholesaling radio apparatus. The company will distribute the products of the American Radio Company of New York City.

Ralph M. Setterley, foreign sales manager, has established offices at 149 Broadway, New York, where he will arrange for the foreign representation of American manufacturers of electrical and other products. He is planning a European trip in April.

The Chase-Shawmut Company, Newburyport, Mass., manufacturer of fuses, cut-outs, etc., has appointed the J. S. Jacobson Company, 627 West Jackson Boulevard, Chicago, as Chicago representative. A complete stock will be carried there.

The C. W. Hunt Company, Inc., manufacturer of conveying and other apparatus, West New Brighton, N. Y., has re-established its New York City office at 143 Liberty Street. The company has taken over the sales and engineering work which has heretofore been carried on by its subsidiary, the C. W. Hunt Engineering Company, Inc.

The Apex Electrical Distributing Company, Cleveland, has established a sales promotion department for the northern California territory in conjunction with the Electric Railway & Manufacturers' Supply Company, its representative in that district. B. A. Butterfield, assistant district manager for the Apex products in the Western territory, will have charge of the sales promotion office under the supervision of J. B. Fullerton, Western district manager, whose headquarters are in Los Angeles. The San Francisco sales promotion department is at 607 Santa Fe Building.

The Champion Incandescent Light Company, 235 Market Street, Philadelphia, has purchased the building at 635 Market Street. The structure will be occupied as a new plant as soon as alterations are completed.

The Elwood Electric Company is the new name of the company formerly known as the Liddell Electric Manufacturing Company, Inc., 990 Housatonic Avenue, Bridgeport, Conn. The company will retain its present plant.

The Black & Decker Manufacturing Company, Baltimore, has removed its Cleveland office from 6225 Carnegie Avenue to 2030 East Twenty-second Street. The office is in charge of Dan Paul, formerly Pittsburgh manager.

Foreign Trade Notes

NEW ELECTRIC COMPANIES REGISTERED IN CHINA.—Among the new companies to which registration in China has been granted, according to *Electrical Industries*, are the Yang Lu Electric Company, Kiukiang, Kiangsi; the Haiming Electric Company, Kiangsu, and the Shachi Electric Light Company, Shachi. Wang Kionsetsing and others of Hyiao Feng district, Chekiang, purpose to establish an electric light company. The Pekin Electric Light Company, Ltd., has awarded a contract for a 5,000-kw. generator for its new power station at Shihchinshan.

ELECTRICAL EXPORTS TO RUSSIA.—Decided expansion of the Russian market for electrical equipment is predicted at the Department of Commerce. The volume of this business moving to Russia already has attained some proportions. In analyzing exports, however, it is necessary not to lose sight of the fact that many shipments intended for that country are credited to Scandinavian ports.

THE RHEINISCH WESTFAELISCHE ELEKTRICITAETSWERK, Essen, Germany, belonging to the Stinnes group, according to the *Journal of Commerce*, is increasing its capital stock from 150,000,000 marks to 550,000,000 marks for the development of the combined Witte-Stinnes coal-mine interests. Two and one-half million marks of the new shares will be offered to local municipalities and 25,000,000 marks to employees and workmen.

AMERICAN FILM LOSES ELECTRIC CONTRACT IN CHINA.—Because of the more favorable selling terms offered by the British General Electric Company, according to *Commerce Reports*, an American firm lost a contract for power-plant equipment for the Swatow Electric Lighting Company in China. The contract offered by the British firm called for payment of 10 per cent on signing of the contract, 10 per cent on arrival of the machinery, 10 per cent when installed and the rest in six months, with 7 per cent interest on unpaid balances. The erection engineer was to be furnished by the manufacturer without additional cost to the purchaser. The price submitted by the American bidder, it was reported, was substantially the same as that quoted by the British company, but the placing of the business was decided by the more favorable terms offered by the English manufacturer.

DEMAND FOR SMALL ELECTRIC LIGHTING SETS ABROAD.—Compact and simply operated electric lighting sets for household, estate or club installation find a good sale, according to *Commerce Reports*, in such countries as India, Ceylon, Mexico and northern Argentina, though just at present the demand is light, owing to unfavorable conditions. The small electric lighting sets, as naturally expected, find their most ready market where central-station service is least developed and where there are large plantations and estates.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agent in Spain (No. 1,106) desires the exclusive representation of manufacturers of miscellaneous electric supplies and specialties, especially supplies needed for lighting installations in dwellings and office buildings.

A merchant in Norway (No. 1,120) desires an agency for the sale of copper wire for electrical use, copper plates, etc.

An American firm having a travelling representative in Brazil and Uruguay (No. 1,126) desires to represent manufacturers of electrical goods.

A firm of electrical dealers in India (No. 1,133) desires to secure from manufacturers the sole representation for the sale of electrical apparatus.

An importing firm in Belgium (No. 1,137) wishes to purchase electrical apparatus for medical purposes and heating and general electrical material for high-tension and low-tension transmission, generators, motors, transformers, rotary and lever interrupters, etc.

A firm of engineers in the United States, having connection with importers in Great Britain and France, desires to secure the representation of firms manufacturing electrical specialties.

CABLE FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until April 29, under specification No. 200, for 22,000-volt, three-core cable and accessories. Copies of tender form and specification may be had upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, First National Bank Building, Chicago, and 734 Custom House, New York City, and also at the office of the Commissioner for Australia in the United States, Room 3012, 61 Broadway, New York City. Tenders are to be addressed to R. Liddlelow, secretary, 673 Bourke Street, Melbourne, Victoria, Australia.

PATENT RIGHTS OFFERED FOR AN ELECTRIC FURNACE.—An Italian engineer who has patented an electric arc furnace in the United States desires to sell American rights. Any American manufacturer interested in studying the specifications of the patent and desiring to get in touch with the inventor may receive the necessary information from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., by referring to miscellaneous exhibit No. 239.

New Apparatus and Publications

MOTORS.—Bulletin No. 284, issued by the B. F. Sturtevant Company, Hyde Park District, Boston, describes its new line of polyphase squirrel-cage induction motors.

FILAMENT WINDING MACHINE.—The General Engineering & Supply Company, 160 Fifth Avenue, New York City, consulting engineers, has developed a new "Gesco" filament winding machine.

CIRCUIT BREAKER.—The Condit Electrical Manufacturing Company, South Boston 27, Mass., has developed a new oil circuit breaker, known as type D-22. It can be furnished in sizes up to and including 1,200 amps. for 15,000-volt service.

BLOWER AND VACUUM PUMP.—Bulletin No. 74, issued by the Central Scientific Company, 460 East Ohio Street, Chicago, covers its "Cenco" (electrically driven) rotary blower and vacuum pump combined.

EXTRACTION APPARATUS.—The Central Scientific Company, 460 East Ohio Street, Chicago, is distributing bulletin No 94; describing its new pickel ("Cenco" built) electric extraction apparatus.

ILLUMINATOR.—The Central Scientific Company, 460 East Ohio street, Chicago, is distributing a leaflet describing the "Silverman" illuminator, "A New Eye for the Miscrope." It is intended for use in miscropic examinations and photographing of opaque and semi-opaque objects.

SPECIFIC GRAVITY SCALES.—The Central Scientific Company, 460 East Ohio Street, Chicago, has issued a four-page leaflet describing its specific gravity "Chainomatic" balance scale, with case, for liquids.

WIRE.—"Hazard Keystone Wire" is the title of a small booklet issued by the Hazard Manufacturing Company, Wilkes-Barre, Pa., covering the "Hazard" insulated copper wire.

WOODWORKING MACHINERY.—The Hutchinson Manufacturing Company, Norristown, Pa., is distributing a six-page folder entitled "What Shall We Name It?" covering a new electrically driven combination woodworking machine recently placed on the market by the company.

EQUIPMENT TEST BENCH.—Paul G. Neihoff & Company, Inc., 232-242 East Ohio Street, Chicago, is distributing a leaflet describing its "A. E. S." equipment test bench.

GALVANIZED-IRON WIRE.—"Double-Galvanized Steel Strand and Iron Wire for Electrical Transmission and Distribution" is the title of a booklet published by the Indiana Steel & Wire Company, Muncie, Ind., in which it gives information concerning the use of double-galvanized iron wire and steel strand for transmission purposes.

CODE.—The Greenfield Tap & Die Corporation, Greenfield, Mass., has published a comprehensive telegraph and cable code designed to cut down the expenses of those of its customers ordering by wire.

SWITCH.—A new type of manually operated, non-automatic, single-throw horn-gap switch for outdoor service has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THERMOMETERS.—"How Far Can You Read It?" is the title of a folder issued by the Foxboro Company, Inc., Foxboro, Mass., describing the "Foxboro" thermometers.

CORD.—A small four-page folder, known as publication 2,056, issued by the Cutler-Hammer Manufacturing Company, Milwaukee, describes the C-H appliance cord recently put out by the company.

WASHERS.—The Kales Stamping Company, 1659 West Lafayette Boulevard, Detroit, is distributing a four-page leaflet giving a list of sizes of special washers, in any gage and any material.

FITTINGS AND DEVICES.—The Erie Electrical Equipment Company, Johnstown, Pa., is distributing a catalog covering the "Erie" fittings and devices.

INSURANCE.—The Travelers Indemnity Company, Hartford, Conn., is distributing a folder entitled "Engine Insurance," calling attention to plant protection by its insurance methods.

FIXTURES.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, is distributing two catalogs, Nos. S-6 and D-7. The first contains 128 pages, covering its complete line of "S," "C" and "Baby Denzar" lighting fixtures. The other describes its commercial lighting equipment for store, office and school lighting.

New Incorporations

THE DUNBAR LIGHT & POWER COMPANY, Charleston, W. Va., has been incorporated by J. H. McClintic, W. G. Matthews, G. F. Skidmore, W. H. Truslow and P. J. Newlon, Charleston. The company is capitalized at $50,000.

THE DAMASOUE POWER COMPANY, Youngstown, Ohio, has been incorporated with a capital stock of $500 by W. J. Smith, J. Howard Bothwell, G. F. Hammond and others.

THE ORANGEBURG N. E. SUBURBAN LIGHT & WATER COMPANY, Northeast Orangeburg, S. C., has been chartered with a capital stock of $1,000. The officers are: F. L. Lyons, president; C. C. Holman, treasurer; S. E. Middleton, secretary, and J R. Fordham, general manager.

Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 28, 1922)

1,408,403. Electric Heating Device; Edwin H. Ruehl and Arthur L. Ruehl, St. Louis, Mo. App. filed April 15, 1921. Element inclosed in metal case.

1,408,406. Mounting for Electrodes with Cooled Metallic Heads; Curt Schraepler, Essen-on-the-Ruhr, Germany. App. filed March 25, 1914. Furnace electrodes.

1,408,418. Electrode with Cooled Metallic Head; Martin Sperling, Essen-on-the-Ruhr, Germany. App. filed Aug. 25, 1913. Furnace electrodes.

(Issued March 7, 1922)

1,408,426. Electrical Propulsion of Ships; Albert Aichele, Baden, Switzerland. App. filed Sept. 30, 1919. Synchronous motor with direct-current winding for starting.

1,408,435. Miner's Blasting Battery; Joseph S. Beeneck, Nanticoke, Pa. App. filed July 10, 1919. Mounted in waterproof casing.

1,408,446. Telegraphy; Thomas B. Dixon, Brooklyn, N. Y. App. filed Jan. 15, 1920. Compensation of distortion by shunts.

1,408,525. Electric Battery; William R. Loveman, Bridgeport, Conn. App. filed July 31, 1920. For flashlights.

1,408,526. Pocket Flashlight; Anker S. Lyhne, Bridgeport, Conn. App. filed July 19, 1920. Pencil size.

1,408,527. Flashlight; Anker S. Lyhne, Bridgeport, Conn. App. filed Oct. 18, 1920. Bulb at right angles to battery.

1,408,528. Focusing Device for Electric Lamps; Anker S. Lyhne, Bridgeport, Conn. App. filed Feb. 12, 1921. Hand adjustment for flashlights.

1,408,534. Trolley-Pole Holder for Street Cars; Regas Regopulos, Milwaukee, Wis. App. filed Dec. 8, 1921. To prevent pole from swinging upward.

1,408,540. SIGNALING SYSTEM; Frank M Slough, Rochester, N. Y. App filed March 3, 1919. Automatic telephone ringing.

1,408,555. ART OF PRODUCING STEP-BY-STEP MOVEMENTS; Frank W. Wood, New York, N. Y App. filed Nov. 13, 1918. For ship telegraph signaling.

1,408,559. PANORAMIC X-RAY APPARATUS; Alvin F. Zulauf, Brooklyn, N. Y. App. filed Jan. 7, 1920. For obtaining dental shadow photographs.

1,408,567. TRANSMISSION EQUALIZATION ARRANGEMENT; Leo H. Darrow, Brooklyn, N. Y. App filed Dec. 23, 1920 Constant-current vacuum tube for telephone circuits.

1,408,579. STORAGE-BATTERY GRID; Arthur O. Garrett, San Diego, Cal App. filed Oct. 27, 1920.

1,408,600. TROLLEY-POLE HEAD; William T. Jones, Panther, W. Va. App. filed Nov. 16, 1921. Feed wire to controller bolted to wheel bracket

1,408,601. SAFETY TRANSFER-CABLE REEL AND TROLLEY-POLE SWITCH; William T. Jones, Panther, W. Va. App. filed Nov. 16, 1921. Mine locomotive gathering reel.

1,408,611. OPERATING MECHANISM; Chester W. Larner, Philadelphia, Pa. App. filed March 9, 1918. Solenoid operates hydraulic valves.

1,408,618. CHROMIC-ACID REGENERATION; Ralph H. McKee, New York, N. Y. App. filed Sept. 4, 1919. By electrolytic process from waste liquids

1,408,625. METHOD OF NITROGEN FIXATION; Casper W. Miles, Anderson Township, Hamilton County, Ohio. App. filed July 22, 1918.

1,408,634. WATER HEATER; Alphonso F. Passmore and Ernest B Fletcher, Toronto, Can. App. filed Oct. 25, 1920. Instantaneous type; water coils incircle element.

1,408,639. ARMATURE WINDING MACHINE; Philip F. Rhoades, New York, N. Y. App. filed Oct. 22, 1920. For small armatures.

1,408,648. TELEPHONE TRANSMITTER; Michael Setter, Chicago, Ill. App. filed March 19, 1917. Bridge and face plate held together by friction.

1,408,664. FLASHLAMP; Frederick W. Wakefield, Vermilion, Ohio. App. filed March 29, 1920. Pocket flashlamp.

1,408,758. OPERATION, REGULATION AND CONTROL OF DYNAMO-ELECTRIC MACHINES; Friedrich W. Meyer, Milwaukee, Wis. App. filed Jan. 21, 1918. Converts direct current to alternating current.

1,408,759. BATTERY TESTER; John H Miller, Oak Park, Ill. App. filed July 1, 1920. For making cadmium voltage tests.

1,408,777 and 1,408,778. X-RAY ANGLE INDICATOR; Howard R. Raper, Albuquerque, N. M. App. filed Jan. 3, 1921. Indicates angles and indicia in dental radiography.

1,408,784. RINGING REGULATOR; John F Toomey, New York, N. Y. App. filed Sept. 17, 1918. Automatic ringing on telephone.

1,408,805. ARC-WELDING SYSTEM; Claude J Holslag, South Orange, N. J. App. filed Sept. 2, 1920. Uses alternating current.

1,408,838. TRANSMISSION OF ELECTRIC ENERGY TO MOVABLE ELEMENTS; Erik G. Sohlberg, Schenectady, N. Y. App. filed April 27, 1920. Endless conductor on pulleys fastened to crane.

1,408,844. SPEED REGULATION OF ALTERNATING-CURRENT MOTORS; Louis W. Thompson, Schenectady, N. Y. App. filed July 10, 1918. Auxiliary winding for changing flux.

1,408,860. TROLLEY STABILIZER; Charles B. Branson, Lincoln, Neb. App. filed Sept. 13, 1921. To prevent trolley leaving wire at curves.

1,408,920. BURGLAR ALARM; Fred L. Anderson, Kansas City, Mo. App. filed May 12, 1919. Foot operated for banks, stores, etc.

1,408,931. DYNAMO-ELECTRIC MACHINE; Thomas L. R. Cooper and James C. Todman, London, England. App. filed Nov. 21, 1918. All field laminations in one piece.

1,408,953. VARIABLE-RESISTANCE UNIT; Stanley L. Law, St. Paul, Minn. App. filed Jan. 17, 1919. Attachment prevents burning out by lightning.

1,408,989. X-RAY APPARATUS; William D. Coolidge, Schenectady, N. Y. App. filed Jan. 24, 1919 Portable generator

1,408,992. VARIOMETER; Joseph W. Doron, Hamilton, Ohio. App. filed Feb. 14, 1921. Variable inductance for radio communication.

1,409,019. ELECTRICAL HEATING DEVICE; Michael S. Parnell-Smith, London, England. App. filed Oct. 11, 1920. Element inclosed in inert gas chamber.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

CANTON, ME.—At a recent town meeting it was voted to accept the proposal of the Rumford Falls Light & Power Company to extend its transmission line from Rumford to Canton to furnish electrical service here.

EAST EDDINGTON, ME.—Steps have been taken by residents of East Eddington, East Holden and Clifton to organize a company to erect and operate an electric transmission line to supply electricity to the three towns. It is proposed to secure electrical energy from the Bangor Railway & Electric Company.

MERRIMAC, N. H.—The Amoskeag Manufacturing Company, Manchester, is planning to build a hydro-electric plant on the Merrimac River at Mooars Falls, to cost about $2,000,000.

AYER, MASS.—The Ayer Electric Light Company will construct a substation on Park Street.

BOSTON, MASS.—The Boston Elevated Railway Company is planning to erect an addition to its power plant on First Street, to cost about $900,000, including equipment. Dwight P. Robinson & Company, 61 Broadway, New York, are engineers.

PROVIDENCE, R. I.—A two-story power house, 45 ft. x 60 ft., will be erected by the Colwell Worsted Company at its new mill buildings on Hartford Avenue, which will be equipped for electrical operation. The C. I. Bigney Construction Company, 357 Westminster Street, is contractor.

NEW BRITAIN, CONN.—The American Hosiery Company, Park Street, is preparing plans for the construction of a one-story power house, 40 ft. x 52 ft. Reeds & Thorpe, 60 Prospect Street, Hartford, Conn., are engineers.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Charles L. Cadle, superintendent of public works, Capitol, Albany, until April 11, under terminal contract No. 122, for furnishing and installing two 5-ton electric gantry cranes on barge canal terminals, one each at Rochester and Syracuse.

ALBANY, N. Y. — The Municipal Gas Company contemplates extensions to its electric power plant and system, to cost $955,000. Application has been made to the Public Service Commission for permission to issue $955,000 in bonds for the work.

BATAVIA, N. Y. — The Council has awarded contract to the Genesee Light & Power Company to install a street-lighting system from the city line to the Pembroke town line, on the Buffalo-Batavia highway.

BUFFALO, N. Y.—An electric pumping plant and other electric equipment will be installed at the new filtration plant for the municipal waterworks, for which an appropriation of $4,500,000 has been voted. George G. Andrews is water commissioner.

FREEPORT, N. Y.—The Board of Trustees has approved the report of engineers for extensions and improvements to the municipal electric light plant, involving an expenditure of about $150,000. The proposal to issue bonds for the work will be submitted to the voters.

ITHACA, N. Y.—The Board of Directors, City Hospital, will build an addition to the power house at the institution. Gibb & Waltz are architects.

MALONE, N. Y.—The Malone Light & Power Company has filed application with the Public Service Commission for permission to build two power stations at Waverly and Dickinson, N. Y., respectively.

NEWSTEAD, N. Y.—The Council has contracted with the Genesee Light & Power Company, Batavia, to install a street-lighting system on the main state road from Clarence to Pembroke and on the Grant Road.

DOVER, N. J.—The New Jersey Power & Light Company will build a transmission line from Hamburg to Sussex, to connect with the system of the Woodbourne (N. J.) Electric Company, recently acquired.

MONTCLAIR, N. J.—A power and refrigerating plant will be installed by the Montclair Rink & Ice Company at its new skating rink, estimated to cost $200,000. George W. Backoff, 9 Clinton Street, Newark, N. J. is architect.

TRENTON, N. J.—The annual appropriation bill, now before Governor Edwards for approval, provides a fund of $275,000 for a power plant and other work at the State School for the Deaf, Trenton Junction. The power plant will cost about $175,000 and will be built early in 1923. The State Board of Education is in charge.

KANE, PA.—The Keystone Power Company contemplates the installation of two generating units, one this year and the other during 1923.

LITTLESTOWN, PA.—A central power house, to cost about $35,000, will be erected by the Hoffman Orphanage. Kast & Kelker, 222 Market Street, Harrisburg, Pa., are architects.

PLYMOUTH, PA.—The Luzerne County Gas & Electric Company has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA. — The John T. Lewis & Brothers Company, Lafayette Building, will erect a two-story power house at its paint factory, to cost $60,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company will commence work at once on an addition to its plant at Beach and Palmer Streets, for the installation of a 30,000-kw. generating unit, increasing total output to 90,000 kw. The company has contracted with the Municipal Transit Department to furnish and install cables and equipment for service for the Frankford elevated line from the central station to cost $150,000.

PITTSBURGH, PA. — The West Penn Railway Company has increased its capital stock from $20,000,000 to $30,000,000, part of the proceeds to be used for extensions and improvements to its electric system.

PITTSBURGH, PA.—The Duquesne Light Company has been granted permission by the Public Service Commission to acquire the property and franchises of the Pittsburgh-Beaver Light Company, which it will consolidate with its system.

SCRANTON, PA.—A power plant to cost $150,000 will be erected by the Scranton Lace Company, Albright Street. Lockwood, Greene & Company, 101 Park Ave., New York City, are engineers.

SHARON, PA.—The Pennsylvania-Ohio Power & Light Company is planning the installation of equipment at its Lowellville plant. A number of lines will be built to serve industrial plants in this district, to approximately, with rural line extensions, more than 150 miles.

SHREWSBURY, PA.—The plant of the Deer Creek Light & Power Company has been purchased by the Glen Rock (Pa.) Electric Light & Power Company. The new owner will make extensions and will connect the lines with its system.

WILKES-BARRE, PA. — The Wilkes-Barre Light Company is being reorganized and plans to install and operate a light and power system in this district.

WILMINGTON, DEL.—A one-story power house, 95 ft. x 150 ft., will be erected by the Wilmington Sugar Refining Company at its sugar mill at Christiana Avenue and B Street. W. J. Wayte, Inc., 125 East Forty-sixth Street, New York City, is engineer.

HAGERSTOWN, MD.—The offer of the Hagerstown & Frederick Railway Company to furnish electric service for the city has been rejected by the Board of Street Commissioners, and plans for the extension of the municipal plant will soon be started.

PATUXENT, MD.—A power house will be constructed by the Patuxent Clay Products Company, 210 Equitable Building, Baltimore, Md., in connection with its new local plant, to cost about $100,000.

CHARLESTON, W. VA.—The Ray-Burdette Coal Company is planning the installation of a new engine-generator set, etc., at its properties.

LUNDALE, W. VA.—The Lundale Coal Company, operating at Three Forks, near Lundale, is planning to equip its entire plant for electrical operation. The entire cost is estimated at about $1,000,000. George M. Jones is general manager.

CHARLOTTESVILLE, VA.—Officials of the Union Bank, Richmond, Va., have acquired the electric light and power and cold storage plant of the Carter Corporation, at Crozet, near Charlottesville. The new owners contemplate improvement of the plant and will resume operations at an early date.

CLIFTON FORGE, VA.—A bond issue for $240,000 for the construction of a municipal electric plant has been approved by the citizens.

CROZET, VA.—The Crozet Cider Company is planning rebuilding the portion of its plant, including power and engine house, recently destroyed by fire.

North Central States

DETROIT, MICH.—The Detroit Edison Company contemplates extensions and improvements to its system during the spring, to cost about $2,000,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 219, City Hall, Cleveland, until March 28 for ornamental glass globes for park and boulevard lamps for the street-lighting division.

DAYTON, OHIO.—A power house will be established by the Terminal Cold Storage & Ice Company in connection with its proposed ice and cold-storage plant at Baker and Ludlow Streets, to cost $500,000. The George B. Bright Company, 103 Marquette Building, Detroit, Mich., engineer.

ONTARIO, OHIO.—The Rural Electric Service Company, Shelby, Ohio. will build a new transmission line to Ontario. R. M. Mead Company. Shelby, is engineer.

SHELBY, OHIO—The Huron Valley Light & Power Company contemplates the construction of a new transmission line. The R. M. Mead Company, Shelby, is engineer.

JACKSON, KY.—The Carbon Coal Company, recently organized, is planning the construction of an electric power plant. Emory Cain is general manager.

LOUISVILLE, KY.—A power house, electric pumping equipment, air compressors, etc., will be installed at the new local plant to be constructed by the Producers' Wood Preserving Company, affiliated with the Ayer & Lord Tie Company, Railway Exchange Building, Chicago, Ill., estimated to cost $100,000. Russell Lord is president.

INDIANAPOLIS, IND.—Arrangements have been made by the Interstate Public Service Company for the construction of a large hydro-electric plant on the St. Joseph River at Mottville, Mich.

LAFAYETTE, IND.—The Northern Indiana Gas & Electric Company, South Bend, Ind., has been granted permission by the Public Service Commission to purchase the property of the Lafayette Public Service Company.

ASTORIA, ILL.—Plans are being prepared by the Canton Architectural Company, Canton, for the construction of a coal-mine tipple, power house, railroad tracks, scales and cable for a company now being formed. The cost is estimated at $300,000.

LISLE, ILL.—The Benedictine Convent, care of Shattuck & Layer, architects, 19 South La Salle Street, Chicago, is having plans drawn for the construction of a power house at the institution, 45 ft. x 106 ft.

MARENGO, ILL.—The Elgin & Marengo Railroad Company will erect a one-story power plant, 42 ft. x 105 ft., in Marengo.

MATTOON, ILL.—The Central Illinois Public Service Company has issued $1,500,000 in bonds, the proceeds to be used for the construction of a steam-driven electric plant in the coal fields of southern Illinois.

MANAWA, WIS.—The Little Wolfe River Lumber Company has plans under way for the construction of a hydro-electric power plant. Thomas W. Orbison, Appleton, Wis., is engineer.

AUSTIN, MINN.—The Water & Light Board is preparing plans for rebuilding the municipal power plant, to cost about $100,000. A. L. Pillsbury, 1,200 Second Avenue, South, Minneapolis, Minn., is engineer.

GRAND FORKS, N. D.—The Red River Power Company contemplates improvements to its system, including the installation of a 2,000-kw. turbine and laying a 20-in. pipe line from the plant to Red River. The cost is estimated at $125,000. W. H. Brown is manager.

ALVO, NEB.—The Council has engaged the Hollister Engineering Company, 517 Bankers' Life Building, Lincoln, Neb., to prepare plans for the construction of an electric lighting system in Alvo.

Southern States

ASHEVILLE, N. C.—The North Carolina Electric Power Company contemplates the installation of a new turbine unit at its hydro-electric plant at Weaverville and extensions to its steam-operated plant at Elk Mountain, to cost about $250,000.

CHARLOTTE, N. C.—The Southern Power Company is securing estimates of cost for a new steel-tower transmission line in connection with its hydro-electric development at Mountain Island.

SANATORIUM, N. C.—The North Carolina Tubercular Sanatorium is having plans prepared for the erection of an addition to its power house, to cost $80,000. H. A. Underwood, Raleigh, N. C., is engineer.

DOBSON, N. C.—C. C. Hutchens and associates are organizing a new company to construct and operate a hydro-electric power plant near Dobson.

ATLANTA, GA.—The Georgia Railway & Power Company has issued $150,000 in bonds, part of the proceeds to be used for extensions and betterments.

MANCHESTER, TENN.—The Public Light & Power Company contemplates the erection of a new transmission line. G. B. Adams is treasurer.

SAVANNAH, TENN.—The town officials are considering establishing electric light and ice plants, to be operated by water power. The plans include the construction of a concrete dam and installation of a turbine waterwheel. A. M. Patterson is chairman of committee.

AMORY, MISS.—The Council will receive bids until March 31 for the construction of a municipal electric power plant. F. G. Proutt, Randolph Building, Memphis, Tenn., is consulting engineer. E. E. Cowley is city clerk.

ELTON, LA.—An election will be held in April to vote on the proposal to issue $40,000 in bonds for the installation of lighting and water systems.

NEW ORLEANS, LA.—The Citizens' Light & Power Company, recently organized with a capital stock of $2,000,000, is planning to build a power plant at Carrollton, near New Orleans.

WELEETKA, OKLA.—The Council is preparing plans for a municipal electric light and power plant, and an electrically operated pumping plant for the waterworks, for which a bond issue of $215,000 has been approved. W. V. Long & Company, Colcord Building, Oklahoma City, Okla., are engineers.

DALLAS, TEX.—The Pacific Avenue Improvement Association will soon submit plans for the installation of an ornamental lighting system on Pacific Avenue to the Council. Harry A. Olmstead is chairman.

RALLS, TEX.—The Council is negotiating with the Texas Utilities Company, Lubbock, Tex., to extend its transmission line to Ralls, for local service.

ROBSTOWN, TEX.—The Robstown Gin & Ice Company will install new generating equipment at its power plant and will equip its cotton-ginning plant for electrical operation.

VERNON, TEX.—The Council will submit a proposition to voters at the municipal election, April 4, whether to construct a new electric plant or purchase the local station of the Texas Public Service Company. Bonds for the new plant recently were voted.

Pacific and Mountain States

KELSO, WASH.—The Spirit Lake Railway & Power Company, Vancouver, Wash., has applied to the Federal Water Power Commission for permission to develop water power on the Toutle and Green Rivers in the State of Washington. A permit to develop 17,000 hp. is asked.

SPOKANE, WASH.—The Mount Spokane Power Company is planning for the erection of an addition to its power plant on the Little Spokane River, near Milan. M. F. Mendenhall is president.

TACOMA, WASH.—The Council has approved an ordinance for the installation of ornamental lamps standards on Tacoma Avenue from Centre Street to Division Avenue.

TACOMA, WASH.—A federal permit has been granted to Henry J. Pierce, president of the Washington Irrigation & Development Company, for the development of the Priest Rapids dam. The total cost of the project is placed at $40,000,000.

VANCOUVER, WASH.—The Northwestern Electric Company has been granted permission by the Federal Water Power Commission for a hydro-electric development near Amboy.

COTTAGE GROVE, ORE.—The Mountain States Power Company, Albany, is reported to have purchased the property of the Cottage Grove Electric Company. The former company plans to erect a 11,000-volt transmission line to connect with its plant at Springfield, which will be the terminus of the 110,000-volt line of the California-Oregon Power Company.

PORTLAND, ORE.—The Pacific Power & Light Company is considering the construction of a hydro-electric generating plant on the Deschutes River, near Bend.

SALEM, ORE.—The Willamette Valley Flax & Hemp Company contemplates the construction of a hydro-electric plant on the North Santiam River.

WALLOWA, ORE.—The Nibley Minnaugh Lumber Company is planning construction of a hydro-electric plant.

CLARKSBURG, CAL.—The Great Northern Power Company plans the construction of a transmission line 15 miles long, to cost about $50,000.

EL CERRITO, CAL.—The Great Western Power Company, San Francisco, will soon break ground for the erection of a substation, to cost about $125,000.

PATTERSON, CAL.—The Board of Trustees is considering the installation of an ornamental lighting system in the business district.

SACRAMENTO, CAL.—At an election to be held March 28 the proposal to issue $45,000 in bonds for the installation of an electric distributing system in the Carmichael district will be submitted to the voters. A. D. McDonnell 2,601 S Street, is member of board of directors.

SACRAMENTO, CAL.—Plans are under consideration for the construction of a hydro-electric plant on the South Fork of the American River to supply electricity for lamps and motors at Camp Sacramento. A. Givan is city engineer.

SAN LUIS OBISPO, CAL.—The Midland Counties Public Service Corporation will erect a 60,000-volt transmission line from San Miguel to San Lucas, a distance of 25 miles, along the Salinas River to furnish electricity for irrigation purposes in the lower Salinas Valley. The total cost of the line is estimated at $100,000.

TULARE, CAL.—The Southern California Edison Company contemplates extensions and improvements in the Tulare district during 1922, to cost about $498,000. The work will include water-power development in the mountains, new transmission lines, distribution lines, substations, etc. J. R. Haskins is district manager.

WEAVERVILLE, CAL.—The Board of Supervisors has granted W. H. Samson, Corning, a franchise to erect electric transmission lines on the highways and streets of Trinity County. Mr. Samson recently located several water-power rights in Stuart's Fork River and its tributaries.

BILLINGS, MONT.—Plans have been prepared for the construction of a dam across the Yellowstone River and a hydro-electric plant at Buffalo Rapids, to be equipped with eight horizontal turbines, capable of developing 27,000 hp. at high-water periods. Alvin C. Leighton is at the head of the project.

YODER, WYO.—Application has been made to the State Public Service Commission by E. P. Bacon, general manager of the Natrona Power Company, Casper, and others for a certificate of convenience and necessity to erect an electric transmission line to the new town of Yoder. This project would connect with the transmission line of the United States Reclamation service from the Guernsey dam and would supply electricity for farmers and ranchers along the right-of-way.

ELKO, NEV.—The Elko-Lamoille Power Company contemplates improvements to its plant, including the erection of a new power station, installation of a 250-hp. engine, etc. The cost is estimated at $50,000.

Canada

MONTREAL, QUE.—The Montreal Public Service Corporation, it is understood, contemplates the development of water power on the Kipawa River in Pontiac County, where it is estimated that 90,000 hp. can be developed. This corporation, it is said, has applied for permission to erect transmission lines in twenty-three counties in Quebec Province.

LONDON, ONT.—Improvements are contemplated to the street-lighting system, for which, it is understood, that from $60,000 to $75,000 will be available.

BRIDGEBURG, ONT.—A committee has been appointed by the Town Council to negotiate with the Hydro-Electric Power Commission of Ontario regarding extending its transmission line into Bridgeburg. The commission will soon begin work on a line from Chippawa to Stevensville, which will almost touch the town.

OTTAWA, ONT.—The installation of a police signal system and fire-alarm box, to cost about $30,000, is under consideration. A. F. Macallum is city engineer.

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Our Waiting Ships

WE, THE people, are possessed of many ships. Idly they lie waiting on the placid harbor waters. Fifteen hundred bottoms gather barnacles—waiting for what and why?

These ships were built to win a war. They cost $250 a ton. The war was won. They are now worth say $25 a ton, and the difference charges not against the ships but to the price of war. But we, the people, own the ships. It has become a business problem for America. What shall be done?

THERE are two reasons why nobody buys these ships. We make it cost too much to operate our higher-priced vessels under American registry by setting a standard of both food and wages that impoverishes the ships. We make it possible for a Swedish sailor to come to America, take out his papers, earn $90 a month on a Yankee ship, where he earned $40 formerly, live better and send his money home. So the Yankee skipper cannot compete. And who buys ships to make a loss?

That is one reason, and the other is a matter of trade conditions. Americans have stayed at home engrossed in the immediate problems of developing the U. S. A. They have not put a trader in every port, as have the British and the Germans, to insure a carrying cargo to each ship that calls. And so we have another disadvantage that only time and trade will overcome.

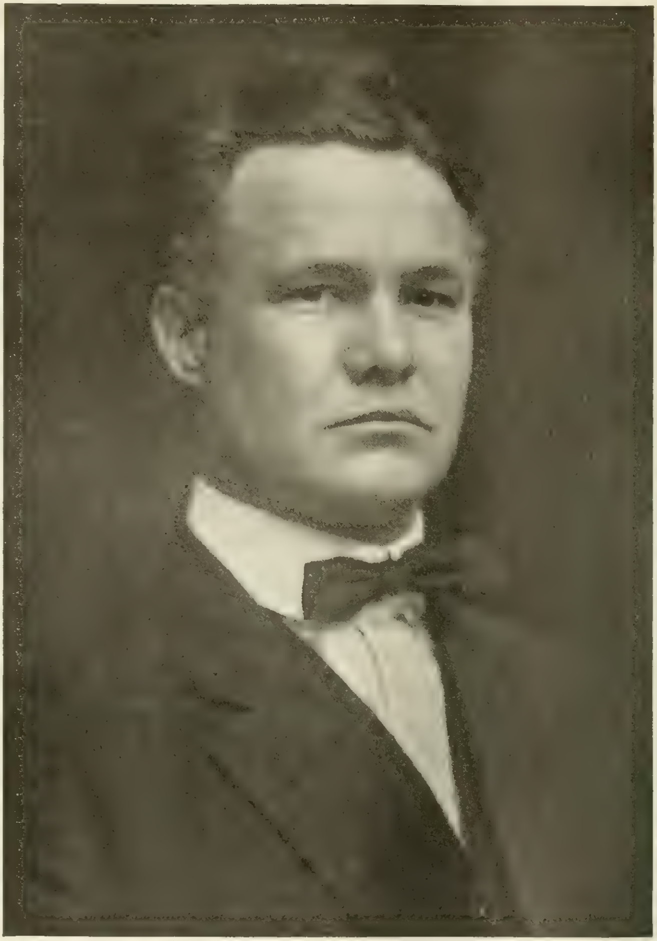
But we possess the ships. And we have things to sell. And all the world offers its goods. Taken together it presents a problem and an opportunity. American industry must act.

SUBSIDIES are not popular in this country. The word smacks of politics in business, and government operation has proved bad. But we face a matter of costs. The United States Shipping Board, after long study, recommends a subsidy—to balance the penalty of our Quixotic seamen's law until it shall be changed, and to encourage American traders to enter the foreign fields, until our ships can ply from friend to friend, and the great profitable future of our foreign trade can gradually unfold. And the subsidy will cost perhaps 40 per cent of what we will lose by scrapping all these ships or giving them away.

Our transcontinental railways were made possible by subsidies of land. Our export trade—in which the electrical industry will open up some day a mine of wealth—may wait upon a similar impulse. Surely it is better that the products of our ingenuity—already famed around the globe — should be sold abroad, aided for a time by subsidy, than that the present opportunity should be wasted at even greater cost in ships.

William Suddards Franklin

Teacher and physicist whose original and high-minded service to engineering education spans a generation.



TO MEASURE the indebtedness of a rapidly developing industry to those who teach its underlying science is an almost impossible task. The ever-invisible limits of a capable teacher's influence expand with the years. His personality and work bear fruit in the success of the men who are out attacking the complex problems of the day through effort made more effective by rigorous training. The rewards of a true teacher of science may never be gathered together for enumeration, but the reality of his influence is no more to be doubted than the power of current thought in controlling the affairs of men. Happy, therefore, should be a man like William S. Franklin, who considers teaching "the greatest of fun" and who finds himself after thirty-five years of service keeping the scientific faith with keen enthusiasm for its advancement and a wise comprehension of the limitations and possibilities of the student.

Professor Franklin was born in Geary City, Kansas, Oct. 27, 1863, and was educated at the University of Kansas, at the University of Berlin and at Harvard University, where he held the Morgan Fellowship in 1891-2. Later he studied at Cornell University, from which he received the degree of doctor of science in 1901. From 1887, when he took the post of assistant professor of physics at the University of Kansas, Professor Franklin has concentrated his attention upon this branch of science, also teaching electrical engineering at Iowa State College from 1892 to 1897 and at Lehigh University from 1897 to 1903. From 1903 to 1915 he occupied the chair of physics at Lehigh. In 1917 he was called to the Massachusetts Institute of Technology as lecturer in physics, and in 1919 he was made full professor of that subject.

Dr. Franklin is known widely outside academic circles as an author of numerous papers on scientific subjects, and within the allied fields of electricity and physics his output in the form of singularly lucid and usable textbooks has won him a national reputation as an educator. Among his works, written individually or as co-author, are volumes on electrical engineering, alternating currents, generators and motors. "Electric Waves," "Elements of Mechanics," "Elements of Calculus," a "Calendar of Leading Experiments," "Practical Physics," and "Bill's School and Mine," a collection of pungent essays on education. Professor Franklin's originality of viewpoint on educational matters and his championship of clarity in instruction without committing "the fatal error of being exacting and unintelligible" are equaled by his loyalty to the scientific spirit—a devotion which loses nothing from his interest in the "humanities."

Dr. Franklin is a member of many scientific societies, is a fellow of the American Association for the Advancement of Science and past-chairman of the physics section, past-president Iowa Academy of Sciences, former councilor Society for the Promotion of Engineering Education and a member of the American Physical Society. During the summer of 1918 he investigated aëronautics at the Bureau of Standards, Washington, and he is continuing researches in this field for the government at the Massachusetts Institute of Technology.

Editorial Comment

Electrical World, April 1, 1922
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Incompetency of Government in Business Affairs

NO ONE giving serious thought to the matter ever expects the government to do anything cheaply or efficiently. Yet there is a constant cry on the part of the uninformed for government ownership and operation. Undemocratic it is, to be sure, but what heed do politicians, ill versed in democratic institutions, give to that? Spoils are their goal and nothing else matters.

Last week a premier international figure in retail commerce, H. Gordon Selfridge of London, arrived in the United States. It so happened that when Mr. Selfridge landed in New York the British Ambassador, Sir Auckland Geddes, was speaking on the Pacific Coast.

Both of these men discoursed upon the evils of modern government, and their views, when brought together, make an excellent presentment. Selfridge says: "Just now there is too much government everywhere, too much of taxes, too many enterprises being carried on by government bureaus. Many of these should be carried on by private individuals. Remember that the money used for these enterprises is the people's money and has to be furnished by taxation. Put these things back where they belong, and the result would be that taxation would be reduced and everybody except the office holders would be satisfied. That government operation rarely is made to pay is shown by the Glasgow tramways. These are being operated in arrears and the deficit supplied from the Glasgow treasury." Geddes says: "The vast majority of men in public life are in mental capacity and knowledge far behind the best minds and the best thought as represented by the highly specialized university professor. That knowledge which is power is not present in our government today." Selfridge is right. We suffer from too much government. Geddes is right. Those who govern are not fit to govern. Ideal democracy cannot thrive while inefficiency and incompetency prevail, and the less we have of such government in business affairs the better.

These "Outsiders" Who Sell Appliances

WHEN the first industrial machinery came into use it was violently opposed by labor because it was believed that it would throw men out of work. As a matter of fact, it merely increased the output of industry and the service and wealth of mankind, and yet this idea has persisted. The policy of the labor unions, particularly in the building trades, has been to hold back rather than to speed up the job, and to restrict rather than to increase the work that a man can do, and there has been less work because it has been made so costly.

The point of view so commonly expressed, that non-electrical merchants should be prevented some way, somehow, from selling electrical appliances, is another example of the same kind of wrong economic thinking. It is an attempt or a desire to keep the trade small for the benefit of the men already engaged in the business, to limit the development of the industry for fear some outsider might share in the opportunity, forgetting that the first consideration is to get the appliances sold and build up the industry by increasing the use and popularity of everything electrical. For, in order to grow, the electrical trade must continually attract to this business of selling electrical merchandise more and better men with bigger and busier stores.

No man who knows the electrical industry and sees the trend of its unfolding can doubt the opportunity for every man now in the business. The success of the individual will only be measured by his own capacity for progressive achievement. The activity and prosperity of the central-station appliance shop will increase year after year, for it has an established contact with all the people that makes installment selling simple, profitable and secure. The central station will continue to be the greatest outlet for appliance selling, and the electrical contractor-dealer too will continue to market an ever-growing volume of this household equipment. But also the department store and the hardware store and the furniture store, as the market grows, will give more and more attention to the sale of these devices, and we should all be glad. The great purpose, the alluring common opportunity, is to expand and quicken the electrical business, no matter who does the selling. We shall all share in the benefits according to our worth, and we must think straight about these so-called "outsiders" who sell appliances.

Let Us Have the Whole Truth on the Coal Situation

HOW long will an outraged public endure patiently its annual struggle with the powers that control the coal fields? It is high time to arise and smite the despoiler whoever he may prove to be, whether organized labor, organized capital, or an unholy combination of the two impelled by a common desire for loot. We are glad to see that a government investigation of the whole question is likely to start. Investigations, however, instead of laying the cornerstone of reform, sometimes produce merely noise to drown the growing clamor of those who suffer. With whatever honesty of purpose this particular investigation starts, we trust that it will be charged with plenary power sufficient to find out and make public the truth.

Nobody at present seems to be able to discover how much a miner earns, how much profit an operator makes, or what is a proper charge for transportation. As between operator and union, neither side seems to be willing to play with cards upon the table, or to disclose frankly what the real conditions with which it is contending are. On one side you will hear that the industrious miner can make $5,000 a year, on the other that he is drawing his belt tighter in impending starvation. The public pays the bills and has the right to know the whole truth. To this end the official investigators must have authority to summon witnesses and put them under oath, to place auditors on the books, and to ask the secret service to be on the alert for evidence of perjury by whomsoever committed.

The operators proclaim to the press that the miners will not work steadily and insist on a five-day week and six hours a day. The miners assert that they do not get a fair chance to work because the operators have been skillfully organizing a perpetual shortage of coal. It is time to find out which contention, if either, is correct and also to discover what mysterious intermediaries, if any, get away with a considerable part of the price the consumer has to pay, and, incidentally, what price is charged consumers within sight of the breakers, with the transportation eliminated. This investigation should be thorough and conclusive, leading to action that will at once and forever bring the remedy demanded. The thing at stake is nothing less than the continuance of our present industrial civilization. If fuel costs rise in the next ten years as they have in the last ten, the inevitable result will be the decadence of industry in regions where humanity has to depend on artificial heat during a large part of the year. We know the resources of the country in "white coal," and we know also that they are not enough to save or greatly to ameliorate this threatening situation.

The electrical industry in particular is the victim of the warring forces in the coal fields. It has to pay such prices as they formulate in their struggles, but it has to sell its product at such prices as commissions deem fair and right in protecting the public. If the public should be guarded against unwarrantable profit on the part of central-station companies, why should it not also be saved from the possible extortions of those who supply fuel to both station and private consumer? We see no reason why commissions should not be authorized to take as full charge of the supply of fuel to the people of the country as they do of the supply of electricity to the same individuals. The products of both mine and central station are necessary to the maintenance of our existing civilization, and if one should be subject to regulation in the public interest, so also should be the other.

Character in the Humbler Employee

EMPLOYEES of central-station companies are selected and paid according to the work they are hired to do. It is the job, the task that is set them, that governs the type of man chosen and the compensation paid. This is the traditional and natural viewpoint and method, but it overlooks entirely the fact that every employee contributes to the situation another thing besides his work, and that is *influence*. And this influence is not dependent upon his salary but on his character. In selecting a man to do a definite work, therefore, something more than his ability to do the work should be considered, for the influence of his character in that job may be a factor of far greater importance as it affects public relations.

Following out this line of thinking, E. L. Milliken presents in this issue a chart which shows a comparison of the number of times that different classes of central-station employees come in contact with the public. It is a most important point. It demonstrates that some of the humbler jobs, in point of skill required, are clearly the most vital when the need for character is considered. A meter reader or collector can be hired for little pay, but each of these men will meet in a single day more customers than an executive will talk to in a month. The character of the man who fills this secondary job is of primary importance, and he should be selected not just for the work to be done, but for the opportunity that this work will bring to spread a good influence for the company.

Mr. Milliken has put his finger on something that every utility executive should think about. It has been the custom to pick for these small jobs men of small capacity for work. But because they have been small in character also they have been great in capacity for wasting opportunities to win friends for the company. Yet the reading of the meter or the collecting of the money may, after all, be of less importance than the contact with customers. Perhaps the man might far better have been selected and paid for the influence of his character. Good character would not have made his work less accurate.

British Imperial Wireless Chain

A CHAIN of wireless stations practically encircling the world is the subject of a recent report by the Wireless Telegraphy Commission appointed by the British government. It proposes intercommunication among stations extending from Vancouver on the west to Australia and New Zealand on the east, with a number of lateral reaches. The commission was not only empowered to determine the choice of operating system but was also asked to submit recommendations as to design and location of transmitting and receiving stations and estimates of costs both of construction and maintenance. It constitutes, therefore, one of the most elaborate studies yet made for a unified world-embracing system of long-distance radio communication. It is of great importance technically, since it deals in detail with practically all questions of design of transmitting and receiving stations.

The chief recommendations, covering nine principal stations, are that the thermionic-valve method of generation be used in the major stations, and that in the initial stages the arc method of generation be used in several subordinate stations, to be, however, ultimately replaced. Each transmitting station is to be capable of working with either of two wave lengths, as may be appropriate to the time of day and the atmospheric conditions. Each receiving station is to be provided with antennas and equipment for working simultaneously with all stations normally communicating with it.

The discussion of the thermionic generators is of special interest. A set capable of delivering at least 120 kw. of high-frequency power to the antenna is specified, with provision for extension ultimately to 240 kw. These figures are given notwithstanding the fact that neither the Admiralty nor the Marconi company, the only British manufacturer of thermionic valves, has yet succeeded in continuous operation at higher than 30 kw., although a special test of the Marconi company has delivered 100 kw. to the antenna. The equipment in this case consisted of forty-eight glass tubes rated at 2.5 kw. each. Apparently the most serious questions in the minds of the commission are the cost of replacements of tubes and the development of manufacturing facilities to furnish them. That the recommendations described should have been made under the circumstances is an indication of the confidence of the commission in the ultimate superiority and reliability of the thermionic method of generation. The commission is headed by Lord Milner, with Dr. W. H. Eccles, the well-known radio specialist, as vice-chairman.

No reference is made in the abstracts of the report so far available to a comparative study of the several available means for generation for long-distance radio. In this country, as is well known, the high-frequency generator for radio purposes has been brought to an advanced stage of development and is in use in important stations. There are also a number of arc stations of large capacity in operation. In these columns a few weeks ago we called attention to the adoption by the Dutch East Indian Company of the arc generator for the exceptionally long distances involved in its system. It appears therefore that there is no present probability of international agreement as to a common system of transmission. In many respects this is unfortunate, as an agreement on a single system would undoubtedly greatly accelerate its development and the consequent improvement in service. The commission has, however, had in mind the discussion which has already taken place concerning an international agreement as to wave lengths, and so the feature most essential to satisfactory operation in relation to the work of other countries is taken care of. The report will undoubtedly stimulate a general discussion of international communication, and if the system recommended is constructed and operated, it will exert a powerful influence on future practice.

Economics of Electric Residence Heating

THE idea of heating residences as well as mercantile establishments by electricity has long been a dream not only of men in the industry but of the consuming public at large. There have even been efforts on the part of consumers to force the supplying of electrical energy for this purpose at rates far below those possible of attainment. A notable instance of this occurred in Idaho two or three years ago, where it was proved beyond dispute that the plan was not feasible; and from the data contributed to this issue by E. A. Loew describing an extensive experiment in electrical house heating in Tacoma, Wash., it appears that there is little present hope for the general adoption of electric heating for some time to come.

The city of Tacoma, by offering electrical energy at a figure very much lower than is usually found practicable for this class of service, has built up an extensive load for the supply of electric heating to residences. It is claimed that the city has been able to show a profit during the years in which this experiment has been under way. The great convenience which the electric method affords, as well as the freedom from dust and dirt and the elimination of the disagreeable task of tending a coal furnace, has, of course, brought demand. It is said that electric furnace plants are installed at a moderate cost—about the same as that of a hot-air coal-burning plant. In residences not equipped for furnace heating the use of either the portable or the permanently installed types of radiant heaters provides the same convenience and economies as the hot-air furnace type.

It is a principle recognized by regulatory commissions that surplus power may properly be sold for what it will bring so long as the power company's business as a whole is on a paying basis. This experience from Tacoma is interesting, not because there is any prospect of electric heating of houses becoming practicable in other cities within the near future, but because the peculiar local conditions at Tacoma have there made it possible for the first time on an extensive scale. The low cost of a small system, plus an unusual seasonal excess of water under a high head, has made power available for this experiment.

Temperature Basis the Logical One for Loading Apparatus

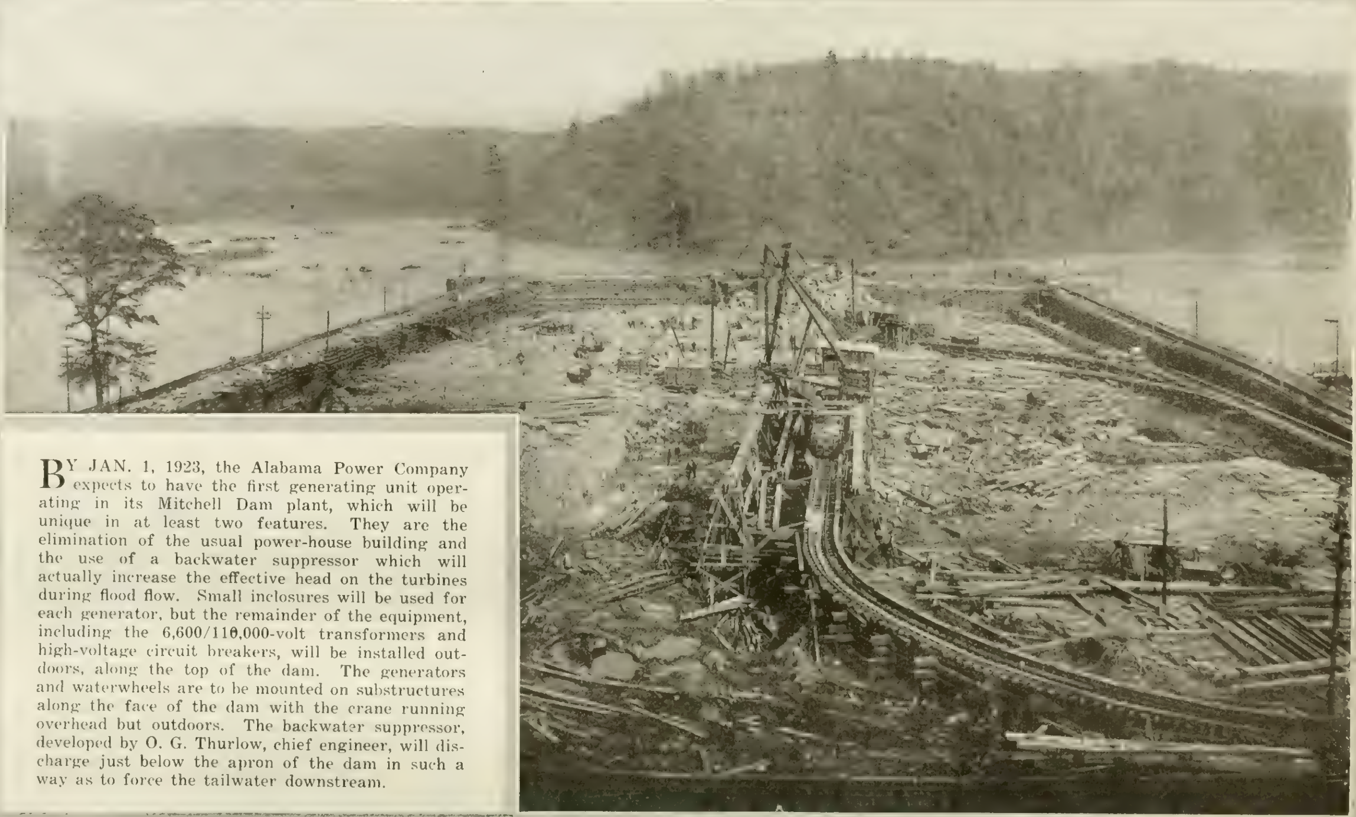
UNUSED transformer capacity costs money in idle investment and energy losses. Present economic conditions demand that such equipment shall pay its way to the limit of safe and reliable service. The real problem is the determination of allowable heating and regulation limits as regards distribution transformers. On another page L. L. Elden throws new light upon this question in a noteworthy contribution to the literature of transformer research. He who runs may read, but in a word the author has thrown down the gauntlet to the A. I. E. E. Standardization Rules and, on the basis of several years' investigation on the Boston Edison system, asks why distribution transformers should not be operated on greater temperature rises from low ambient temperatures than the Institute rules specify.

Mr. Elden's investigations point to no higher limit of "hot-test spot" temperature for class A insulation (105 deg. C.) than the Institute allows, but they do indicate the desirability of revising the allowable maximum observable rise (55 deg. C.) below 40 deg. C. ambient. Roughly, each degree below 40 C. permits a 1 per cent increase in transformer loading and vice versa. The effect of operation at high loadings on regulation appears to be entirely satisfactory, and by thus "taking up the slack" in rating below 40 deg. striking gains in transformer output are indicated.

Operation on a temperature basis with the use of suitable indicators showing when a transformer reaches the cautionary and danger points in heating logically follows these investigations. On the Boston Edison system operation on the temperature basis indicates a reduction of at least 10 per cent in transformer capacity readily attainable, with a similar decrease in annual losses. Including the elimination of the expense of changing transformers and testing, a decided burden under the old method of estimating the suitability of transformers for anticipated loadings, the total yearly savings will easily reach $30,000 in the near future.

What this means to the practical operating man, burdened as, owing to the vagaries of the appliance load and other causes, he generally is with overloaded or underloaded transformers, need not be enlarged upon. The development of indicators competent to meet the requirements of transformer service represents a new application of physical science to the tasks of the central-station engineer, and if the excellent results thus far realized are maintained—and no present evidence is forthcoming to the contrary—the utility industry will have taken a long step forward in the economic conquest of materials designed to perform varied and exacting services.

Unique Power House to Occupy This Location on the Coosa River



BY JAN. 1, 1923, the Alabama Power Company expects to have the first generating unit operating in its Mitchell Dam plant, which will be unique in at least two features. They are the elimination of the usual power-house building and the use of a backwater suppressor which will actually increase the effective head on the turbines during flood flow. Small inclosures will be used for each generator, but the remainder of the equipment, including the 6,600/110,000-volt transformers and high-voltage circuit breakers, will be installed outdoors, along the top of the dam. The generators and waterwheels are to be mounted on substructures along the face of the dam with the crane running overhead but outdoors. The backwater suppressor, developed by O. G. Thurlow, chief engineer, will discharge just below the apron of the dam in such a way as to force the tailwater downstream.

Reducing Customer Contacts to Figures*

Careful Analysis of Points of Contact with Public Shows Importance of Training Different Classes of Employees—Personal Value of Utility Employees in Promoting Good Will

Assistant Manager Blackstone Valley Gas & Electric Company, Woonsocket, R. I.

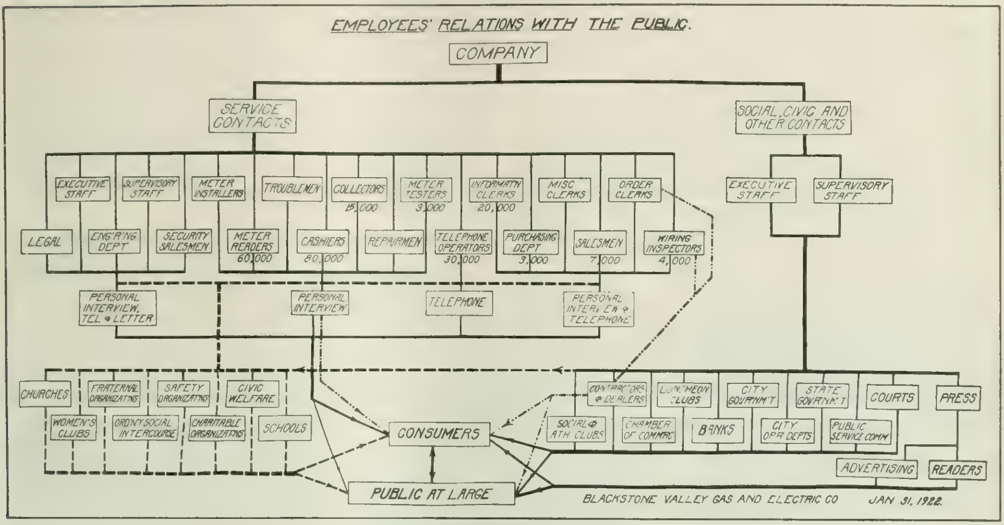


CHART SHOWS NUMBER OF POSSIBLE SERVICE CONTACTS PER YEAR BY ANY ONE EMPLOYEE

SOME months ago a representative of a large financial house was investigating a public utility certain bonds of which his principals were possibly to underwrite. Every one with whom he came in contact in the territory was loud in praise of the utility and its management. So strongly favorable were these opinions that the investigator, in talking with the general manager, just before leaving for home, asked him: "How is it that you keep your public relations in such good shape?" The executive replied: "Public relations? Great Scott! I don't have time to bother with them. I have enough to do looking after my wife's relatives." This executive had really solved the problem of satisfactory public relations, but did not recognize it under that name. The illustration serves to show that the term is a comparatively new one and is not as yet thoroughly understood.

Though the term is new, that phase of the public utility business which it covers is as old as the industry. Almost all of the methods which may be suggested at this time have actually been used for a long time by various utilities throughout the country. The connotation "public relations" merely brings all of these activities under one head, correlates them and makes possible wider consideration and discussion of how they may be used generally to the advantage of the industry.

The state of a company's public relations, in the last analysis, is really the state of its contact with the public it serves. That intangible thing known as the company can have no relations or contact with its customers or the public except through its employees.

Graph of Public Relations Contacts

It seems advisable at the outset of any such work to analyze the entire subject—that is, to set down all of the possible contacts between the employees of any company and the public which it serves. In the accompanying chart an attempt has been made to do this. All of our employees, in some way or other, at some time, come in contact with the public, either as individuals or in groups. Upon the manner in which they make these contacts will depend whether they engender the good will or the ill will of the public toward the company.

If we are to improve our public relations, we must make a study of these contacts. As a matter of fact, such a study is entirely one of psychology. We must study the state of mind of the employee, and likewise the state of mind of the public and more particularly of our consumers—all with the end in view of bringing these two states of mind into accord. It behooves us first to bend our energies toward shaping the minds of certain employees who for want of a better name we will call "contact employees" and who are almost continually in intimate touch with the public. These have been divided into two classes:

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*Read before the New England Division, N. E. L. A., at New Bedford, Mass.

First, those whose contact primarily is directly with the consumer on questions of service, yet who, through their activities when not on duty, in various ways come in contact with the public at large.

Secondly, those officials of the company whose duties bring them intimately in contact with the various powers and activities in the community or with various organizations, made up in part of the company's consumers, but including as well people who are not consumers.

While the first class most influences, perhaps, the attitude of the consumer, yet the second class is charged with so directing the energies of the first class as to make this attitude favorable. In addition, the impression which the second class makes upon the public at large has much to do with surrounding the company's business dealings with the proper atmosphere. Although naturally our efforts are first to be directed toward inducing a proper attitude toward the company on the part of its customers, we should not overlook the fact that any insidious propaganda or political agitation directed against the company is almost always influenced to a considerable degree by sections of the public who may not be consumers. The attitude of the public at large is second only in importance to the attitude of the consumer class.

Coming back to the chart, it will be seen that under certain classifications are figures which represent the number of possible service contacts per year by any one employee under each classification. These have been estimated from consideration of actual cases and in general may be held to err on the side of conservatism.

Study Problems of the Contact Line

It is obvious from these figures that we should first give attention to training cashiers, meter readers, telephone operators and information clerks, directing our efforts next to collectors and salesmen, and thence down the line in the order of these possible contacts. We must therefore look forward to hiring, training and paying these contact employees, having always in mind a thorough understanding of their relative importance to the organization from the public-relations standpoint. Those whose contact necessarily is by personal interview must be taught the proper method of approach, and they must also be thoroughly impressed with the importance of their personal appearance.

Local purchasing in our own communities is always desirable, all other factors being equal. Members of the purchasing department should bear in mind that those from whom they buy locally are generally good commercial or power customers, and hence nothing should be done to nullify any of the work which other departments are doing to obtain the good will of these consumers.

In purchasing property, securing rights-of-way and pole easements and in other phases of the engineering department's work its members should likewise bear in mind that if those with whom they are dealing are not already customers, even those in the remotest country districts are likely soon to become customers.

Turning now from service contact to the other division on the chart, while the importance of many of these contacts has been recognized for years, perhaps we have not fully availed ourselves of the opportunities offered by some of them. Amicable relations with the press, city government, civic operating departments and public service commissions have always been essential. In due course the participation by company officials in the work of chambers of commerce, "Rotary," "Kiwanis" and similar clubs has been impressed upon the industry.

Perhaps we have not given so much consideration to the opportunity of promoting good will through contact by employees by means of membership in churches, fraternal, charitable and welfare organizations. Employees are not members of these organizations primarily for promoting the company's interests, yet is it possible for them to aid materially in molding public opinion favorable to the company by actively and proficiently performing their duties as members of such bodies. It is much easier for any employee to transact business with people who have gained a favorable impression of him through such association. As a company is known by the men it employs, so some of the employees of every company are known to certain sections of the public only through membership in such organizations. Any contact by employees with other elements of the public which smoothes the path of the company's business is a phase of public relations which should not be overlooked.

Get Closer to the Contractor-Dealer

Not all companies are giving sufficient attention to their relations with the electrical contractor-dealers in their territory. At present a spirit of co-operation seems to pervade the entire electrical industry, and we should take advantage of this to cultivate the good will of the contractor-dealer. It should not be forgotten that collectively the contractor-dealers in any community come into intimate contact with our consumers before we place their names on our books. We cannot afford to have any consumer's attitude toward us tainted by any wrong impressions of the company given him by a contractor-dealer.

There is much yet to be done to bring about this happier relationship. Because of past experiences and indifference, there is a lingering antipathy on the part of the utility's employees which must be overcome. They must be made to realize that the contractor-dealer is an essential part of the industry. We cannot do it all. Most of the contractors are willing to meet us, but we can well afford to go more than half way in promoting greater harmony between these two branches of the industry. The effect on our public relations will be decidedly favorable.

One great national movement offers at this time an unexcelled opportunity for company officials to foster better public relations, namely, safety work. Local safety councils, following the lead of the national organization, are rapidly making safety teaching part of the school curriculum. By active participation in this and other safety work in the community company officials get their safety ideas into the schools, and at the same time the utilities can be shown in a more favorable light to nearly every element in the community.

If the chart only initiates a more careful consideration and study of employees' relations with the public, it will have served a purpose. If it leads to a study of the consumer's state of mind, its value will be increased. Our employees' attitude toward the public may not look the same to us as to that public, and we should study the subject from both viewpoints. We should put ourselves in the place of the public and view our organization as from the outside. We may find that what from the inside we thought was the proper handling of the public is not exactly what we would wish it to be.

Limits of Electric House Heating*

Large-Scale Heating of Residences, Stores and Other Establishments in Tacoma Shows Limits Within Which Electric Heating May Compete with Other Heat in Mild Climates

By **E. A. LOEW**
Associate Professor of Electrical Engineering, University of Washington

THE city of Tacoma, Wash., has for a number of years had in effect a power rate which is intended to encourage consumers in the use of electrical energy for house heating and as a result has built up a considerable domestic heating load. This represents what is perhaps the largest-scale application of electrical energy to house heating in America.

Tacoma derives its power from a 20,000-kw. hydro-electric station which is owned and operated by the municipality. There is virtually no water storage. The plant was completed in 1912 at a total cost, including transmission lines and substation, of approximately $2,355,000, or about $112 per kilowatt of rated capacity. This low unit cost has been one of the principal factors in making possible the attractive schedule of rates which the city has maintained since the plant was completed. Because the size of the development was considerably in excess of the existing power requirements of the community, and on account of the abnormally large water supply available during the rainy season, which in that locality includes six or seven months from October to April, the city had a large percentage of surplus power. It became a question of either creating additional demand for a large block of power outside of the ordinary applications or else wasting the surplus. The domestic heating load offered possibilities of large additional loads if rates were established which would make it economically possible. Such a rate must be low enough to encourage the use of considerable electrical energy for heating, and still high enough to maintain coal and wood in a strongly competitive position.

TYPICAL ELECTRICALLY HEATED RESIDENCES WITH CONNECTED LOADS OF 9.4 KW., 26 KW. AND 11 KW. RESPECTIVELY

The domestic rates for power fall in two classes:

1. *Combination Light and Cooking Rates.*—Applicable to residences, flats and apartments. Under this rate a charge of 5 cents per kilowatt-hour is made for a monthly kilowatt-hour consumption up to a certain minimum known as the "lighting base" kilowatt-hour. This minimum depends upon the size of the residence or apartment, but a fair average figure is 33 kw.-hr. All energy in excess of the lighting base kilowatt-hour is billed at 1 cent per kilowatt-hour. Under this rate the average monthly bill of customers having range, lights and the usual appliances is about $2.50.

2. *Heating Rate.*—For customers having electric house-heating equipment. A minimum charge of $9 per kilowatt of maximum demand per year is made and a regular energy charge of ½ cent per kilowatt-hour. The customer is required to have a separate meter on his heating load in order to take advantage of this rate and is permitted to use this service only on air-heating and water-heating equipment. The purpose of the minimum charge is to reduce demand as much as possible.

The ½-cent rate covering the use of energy for house heating has been in effect since 1914. A small number of consumers took advantage of this rate from the time of its first introduction. For the most part the electric heat was used as an auxiliary to heating plants of one kind or another which were already installed in the residences. At the prices of coal and wood which then

TABLE I—AVERAGE SPECIFIC ENERGY CONSUMPTION

For nineteen consumers having furnace plants, based on their December consumption and the percentages given in the table

Month	Outdoor Temp., in Deg. Fahr. Average Monthly Temperature	Outdoor Temp., in Deg. Fahr. 68 Deg. Fahr. Minus Average Monthly Temperature	Average Estimated Kw.-hr. Consumption per Furnace Plant	Per Cent Yearly Total	Average Kw.-hr. Per Month Deg. Fahr Below 68 Deg.
January	39.5	28.5	4,850	14.1	170
February	39.8	28.2	4,650	13.5	165
March	44.4	23.6	4,550	13.2	193
April	45.6	22.4	3,995	11.6	178
May	51.8	16.2	2,410	7.0	149
June	58.6	9.4	1,760	5.1	187
July	64.6	3.4	860	2.5	252
August	64.6	3.4	344	1.0	101
September	58.0	10.0	963	2.8	96.3
October	49.8	16.2	2,125	6.3	117
November	46.1	21.9	3,580	10.4	163
December	42.6	25.4	4,300	12.5	169
Average	50.4	17.55	2,860		162

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*Complete results of investigation contained in Bulletin No. 15, University of Washington, Engineering Experiment Station, entitled "Electric Heating of Residences."

prevailed, electric heating, even at this low rate, was considerably more expensive than coal or wood if used to supply the full heating requirements.

At the close of the year 1918 only 378 consumers had taken advantage of the ½-cent heating rate. Up to Dec. 31, 1919, 547 consumers had begun to use electric heat and were supplying either part or all of their heating requirements in this way. Of these 139, or 25.5 per cent of the total, used this service throughout the entire twelve-month period. Thirty-six of the 139 had a connected load of less than 4 kw., and the remaining 103, or 19 per cent of all the heating consumers, had an average connected load of 8.17 kw. It is probably safe to assume that no consumer having a connected load of 4 kw. or less could get along comfortably throughout the winter in even a small house without additional heating facilities, while an average connected load of 8.17 kw. would serve to heat the average house, assisted perhaps, by a little additional heat from stove, furnace or fireplace during the most severe winter weather. The 103 consumers having an average demand of 8.17 kw. roughly represent those whose entire heating requirements during 1919 were taken care of electrically, whereas the remaining forty-four used auxiliary heating apparatus to a greater or less extent.

EXAMPLES OF HOT-AIR ELECTRIC FURNACES

Increasing Load

The heating business of 1920 showed considerable increase over that of 1919. The total number of consumers increased from 547 to 925, or approximately 69 per cent; the number of consumers using energy the full year from 139 to 423, or a little over 300 per cent; the number using 4 kw. or over the full year from 103 to 305, or about 300 per cent, and the total connected load from 3,625 kw. to 6,104 kw., an increase of 168 per cent. The tendency of the old consumers to continue to use electric heating throughout the year after once having experienced its advantages, as well as to reduce the amount of auxiliary heating, is indicated by the fact that while the total number of consumers increased by 69 per cent, those using electric heat throughout the year increased by 300 per cent, or four times as fast. Those using over 4 kw. throughout the year and heating more or less wholly by the electric method increased in a similar ratio.

TABLE III—ELECTRIC HEATING IN TACOMA IN 1920

	Class of Customer			
	Residence	Apartment	Business and Miscellaneous	Total
Number of customers	795, or 86%	54, or 5.8%	76, or 8.2%	925
Number of full-year customers	377, or 89%	15, or 3.6%	31, or 7.4%	423
Total kw.-hr. consumption	7,207,600, or 81.3%	396,360, or 4.5%	1,256,000, or 14.2%	8,860,000
Average kw.-hr. consumption per customer	9,075	7,340	16,500	8,580
Total kw. connected load	5,141	307	656	6,104
Average kw. connected load per customer	6.47	5.68	8.63	6.60
Total income	$39,812, or 80.6%	$2,298, or 4.6%	$7,290, or 14.8%	$49,400
Average annual income per customer	$50.10	$42.50	$96.00	$53.00
Average annual income per kw. connected load	$7.90	$7.50	$11.10	$8.09
Average rate per kw.-hr. sold	$0.0552	$0.0579	$0.0581	$0.0557
Number customers using 4 kw. or more a full year	271	10	24	305
Total connected load of full-year customers of 4 kw. or over	2,274 kw.	75.5 kw.	236 kw.	2,585.5 kw.
Average connected load of customers using 4 kw. or over	8.38 kw.	7.55 kw.	984 kw.	8.48 kw.
Average income for year per customer using 4 kw. or over	$81.00	$92.00	$132.00	....
Total income from customers using 4 kw. over a full year	$21,973.00	$919.87	$3,168.87	$26,061.75

A point of interest is the fact that the average rate per kilowatt-hour sold increased from 0.52 cent to 0.557 cent, or 1.1 per cent, the schedule of rates remaining unchanged. The increase of the average selling price above the ½-cent rate results from the operation of the nine-dollar minimum. The tendency is to install sufficient heater capacity to take care of the coldest weather conditions. This often leads to the installation of heater capacity considerably in excess of that required for average winter weather and results in the minimum charge for the year exceeding the charge based on the straight kilowatt-hour consumption.

Among the business consumers are included numerous small stores and shops in which often only part of the space is heated, or perhaps only sufficient heat is supplied to take the chill off the room, as in grocery stores, etc. In other places of business, such as ware-

TABLE II—MONTH-BY-MONTH ENERGY CONSUMPTION FOR HOUSE HEATING BY RESIDENCE CONSUMERS IN 1920

Month	375 Full-Year Residence Consumers; Average Connected Load 6.28 Kw.				278 Full-Year Residence and Apartment Consumers Using 4 Kw. or Over; Average Connected Load 7.80 Kw.				Consumption of Ten Typical Full-Year Consumers Who Use Some Auxiliary Heat; Average Connected Load 7.85 Kw.				Consumption of Seven Consumers Using Hot-Air Electric Furnace Throughout the Year; Average Connected Load 10.85 Kw.			
	Kw.-hr Consumption Total	Kw.-hr Consumption Average	Per Cent Yearly Total	Actual Average Cost	Kw.-hr. Consumption Total	Kw.-hr. Consumption Average	Per Cent Yearly Total	Actual Average Cost	Kw.-hr. Consumption Total	Kw.-hr. Consumption Average	Per Cent Yearly Total	Actual Average Cost	Kw.-hr. Consumption Total	Kw.-hr. Consumption Average	Per Cent Yearly Total	Actual Average Cost
January	669,000	1,785	14.1	$9.81	570,800	2,070	13.9	$11.35	36,392	2,020	14.8	$11.65	29,200	4,170	14.6	$21.45
February	643,000	1,715	13.5	9.30	565,600	2,050	13.8	11.30	31,167	1,730	12.7	10.00	27,700	3,960	13.9	20.35
March	625,000	1,665	13.2	9.19	530,200	1,920	12.9	10.50	33,085	1,836	13.4	10.55	28,980	4,140	14.5	21.30
April	550,000	1,467	11.6	8.07	479,600	1,740	11.7	9.50	28,560	1,580	11.6	9.13	24,232	3,460	12.2	17.80
May	332,000	885	7.0	4.87	282,900	1,025	6.9	5.60	17,408	966	7.1	5.60	12,952	1,850	6.5	9.50
June	241,000	642	5.1	3.55	212,900	772	5.2	4.60	17,158	953	7.0	5.51	8,965	1,280	4.5	6.60
July	119,000	317	2.5	1.74	105,200	380	2.6	2.10	4,750	264	1.9	1.50	2,885	410	1.4	2.10
August	49,500	132	1.0	0.70	43,800	150	1.0	0.90	1,143	63	0.5	0.40	3,982	570	2.0	2.95
September	132,000	352	2.8	1.95	109,500	396	2.7	2.20	5,263	292	2.1	1.65	4,145	590	2.1	3.05
October	303,000	808	6.4	4.45	257,600	932	6.3	5.10	15,199	845	6.2	4.90	11,653	1,660	5.7	8.55
November	492,500	1,310	10.3	7.17	422,000	1,530	10.3	8.40	23,806	1,433	10.5	8.25	20,235	2,890	10.1	14.85
December	593,600	1,582	12.5	8.70	522,100	1,890	12.7	10.30	29,910	1,660	12.2	9.60	24,710	3,530	12.4	18.15
Totals	4,749,700	12,660	100	$69.50	4,102,200	14,864	100	$81.85	245,841	13,642	100	$78.75	199,639	28,510	100	$146.65*

* Including cost of water for hot water supply.

houses in particular, heat is supplied for the office rooms only. A few of the business and miscellaneous customers are large consumers. These include theaters, banks and churches. The largest single consumer during 1920 was a theater having a connected load of 152 kw., consuming a total of 291,840 kw.-hr. for the year and costing $1,459.20.

In many cases some additional heat is supplied by means of a kitchen range or a fireplace during the coldest weather. The costs of electrical energy given, therefore, probably do not represent accurately the full amounts of the average heating bill for the customers involved. However, this error is partly compensated for by the fact that a considerable number of the consumers have electrical water heaters connected to the heating circuit.

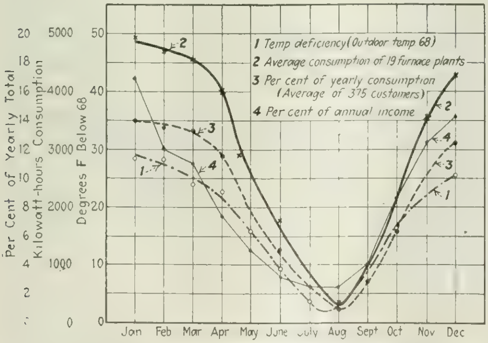
TABLE IV—ANALYSIS OF HEATING LOAD IN 1919

Number of customers Dec. 31, 1919	547
Income from all customers (378 for only part of year)	$19,488 25
Total connected load of all customers, Dec. 31, 1919, kw	3,625
Number of customers served for full year	139
Income from customers served for full year	$9,268.40
Total connected load of full-year customers, kw	923
Average annual income per kilowatt of load	$10.00
Consumption by full-year customers, kw.-hr	1,778,238
Average rate per kw.-hr	$0.0052
Number of customers using over 4 kw. a full year	103
Total connected load (kw.) of full-year customers over 4 kw	842
Average load (kw.) of customers using over 4 kw	8.17
Average load of all 547 customers, kw	6.65

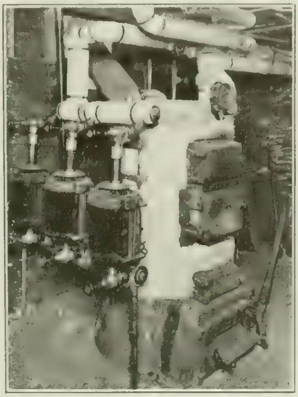
It is a noteworthy fact that these customers paid an average of $78.75 per year each for 13,642 kw.-hr., or at the rate of 0.576 cent per kilowatt-hour. Had they reduced their connected load sufficiently to take advantage of the ½-cent rate without penalty, the average bill would have been only $68.71.

CONSUMPTION BY ELECTRIC FURNACE PLANTS

A limited number of consumers, representing the highest development in the complete electrification of the home, are using hot-air electric furnaces. Nearly all consumers of this class not only have their homes completely electrified, but have eliminated portable electric heaters as well and have substituted in their place a central heating plant, or electric furnace, located in the basement, which supplies either hot water or hot air to the various rooms in much the same way as does the ordinary hot-water or hot-air coal-burning plant. At the present time there are installed in Tacoma residences about fifty such plants. Of these the great majority are hot-air plants, a few use hot water, and a few use electrically generated low-pressure steam. When comparing the consumption of these customers with that of the average consumer, the fact must not be overlooked that these installations are usually found in the homes of those whose houses are above the average in size and who can afford to pay something for extra comforts and convenience. It is perhaps fair to assume that their consumption is considerably above that demanded by the average home where strict economy is necessary, for in addition to the loss of heat by radiation from the furnace and piping in the basement, it is probably true also that lack of close supervision often results in the use of more energy than is required for comfort. Furthermore, these usually include an electric water heater connected to the same meter with the furnace circuit, of an average capacity of perhaps 3 kw., the consumption of which is included in the values given in the table.



RELATION OF DEMAND AND ENERGY CONSUMPTION REQUIRED FOR HOUSE HEATING TO OUTSIDE TEMPERATURES



ELECTRIC INDUCTION-TYPE HEATERS USED INTERCHANGEABLY WITH HOT-WATER FURNACE

The largest single residence consumer occupied a fourteen-room house, and with a connected load of 39.3 kw. consumed 82,400 kw.-hr. during 1920, costing $412. Radiant-type heaters distributed throughout the house were used for the most part, although one or two hot-water induction-type heaters attached directly to hot-water radiators were also employed. The hot-water supply for the house was furnished by electric heaters, while cooking was done by gas.

INFLUENCE OF OUTDOOR TEMPERATURE ON POWER CONSUMPTION

An indoor temperature of 68 deg. Fahr. is assumed as representing the average indoor temperature of a heated house throughout the year. The month-by-month average outdoor temperatures for Tacoma, as recorded by the United States Weather Bureau, are shown in the table of average specific energy consumption, the temperature differences between the average monthly outdoor temperature and 68 deg. Fahr. and the month-by-month consumption of 375 full-year consumers being expressed in per cent of their total yearly consumption. The month-by-month estimated consumption is based upon the actual December consumption and the percentages given in column 5.

One of the illustrations clearly shows how closely the energy consumption follows the outdoor temperature. By dividing the monthly energy consumption by the average difference in temperature between out of doors and 68 deg. Fahr. for the same month, a figure is obtained which represents the kilowatt-hours per month per Fahrenheit degree temperature below 68 deg. for a given class of consumers. This figure is fairly constant for all months except the summer months, during which the energy consumption is small, and is of value when making comparisons of energy consumption.

Twenty-one Observations and Conclusions Regarding Transformer Operation on Temperature Basis

[1]

Transformers in general are designed to operate well within the limits of permissible temperature rise specified by the Standardization Rules of the American Institute of Electrical Engineers (55 deg. C.). There thus exists a measurable amount of capacity available for use if it can be intelligently employed.

[2]

Certain makes of transformers are much more liberally designed than others, there being a large amount of capacity available in such product in excess of normal rating before reaching permissible maximum operating temperatures.

[3]

The conditions described in [1] and [2] are particularly noticeable in certain sizes of transformers where changes in design due to changes in capacity have resulted in more liberal ratings for specific sizes, owing to lower temperature rise. Increased capacities available under conditions noted in [1], [2] and [3] are tremendously increased with reduction in ambient temperature as shown in Figs. 2, 4, 5, 6 and 7.

[4]

Transformer capacity required for a given system load and losses involved in operation may be reduced, if transformers are operated on a temperature basis and protected by indicators.

[5]

Transformers may be safely operated at substantial overloads for extended periods to meet varying conditions of demand, if protected by indicators.

[6]

Increased transformer capacity is available (owing to use of indicators) of one value for units operating at high load factor and of much greater value when units are operating under a low load factor or at variable loads.

[7]

Transformer loading as shown by ammeters, voltmeters or wattmeters is of little value in determining permissible loading. Temperature observations constitute only accurate and efficient method of limiting loading.

[8]

Determination of temperature rise of transformers in service by "resistance method" is impracticable, since service must be interrupted to conduct tests. "Thermometer method" is the only practicable method.

[9]

The rule of the A. I. E. E. which prohibits adoption of increase in temperature use over that specified as permissible (55 deg. C.), even though ambient temperature is lower than 40 deg. C., is inconsistent with good operating practice. To comply literally with this rule would mean a heavy loss in capacity otherwise available.

[10]

The rated capacity of transformers may be increased when ambient temperature is lower than 40 deg. C. if the oil temperature is checked by suitable temperature indicators.

[11]

Increase in capacity with decrease in ambient temperature from 40 deg. C. varies almost directly with change in temperature, viz., for every degree Centigrade which the ambient temperature increases or decreases the capacity of a transformer is decreased or increased approximately 1 per cent, with coil temperature not exceeding 105 deg. C.

[12]

Regulation of transformers not appreciably affected by loading is equivalent to from 150 per cent to 175 per cent of rating if the load is of high power factor. (See Fig. 3.)

[13]

Successful operation of transformers on a temperature basis is entirely dependent upon accurate observation of oil temperature. To be effective, oil temperature must be measured at a point directly over the transformer coils and as close to them as possible.

[14]

Oil temperatures of 176 deg. to 194 deg. Fahr. (80 deg. to 90 deg. C.) are entirely safe and satisfactory for transformers of 7.5 kva. and over when operated in ambient temperatures from 0 deg. to 104 deg. Fahr. (— 18 deg. to 40 deg. C.) is measured as indicated in the preceding paragraph. For units of less capacity, oil temperatures of 159 deg. to 176 deg. Fahr. (70 deg. to 80 deg. C.) may be safely adopted. For those who are conservatively inclined the adoption of 85 deg. C. and 75 deg. C. respectively as the maximum oil temperatures for the two groups of transformers may offer a satisfactory basis for operation. In general for ambient temperatures lower than 0 deg. Fahr. (— 18 deg. C.) oil temperatures lower than the above should be adopted if loading can exceed 175 per cent of rating.

[15]

Most efficient results are obtained by use of a two-stop indicator. With warning signal set as a conservative value, 167 deg. to 176 deg. Fahr. (75 deg. to 80 deg. C.) and danger signal set at 185 deg. to 194 deg. Fahr. (85 deg. to 90 deg. C.) there exists a safety zone which is especially valuable in determining the procedure to be followed in controlling transformer loading. Occasional operation of the warning signal gives information of some unusual use of service which may be disregarded at least until the danger signal is displayed. This feature should prove exceedingly valuable in hot climates where the margin of overload is limited as shown by Fig. 4. In cold climates the warning signal may be interpreted as the danger signal during exceedingly cold periods, thus meeting all operating conditions where recognition of very low ambient temperatures is desirable.

[16]

Allowance of 27 deg. Fahr. (15 deg. C.) for "hot-spot" correction, applicable to the "thermometer method" of temperature measurement, as provided in the Standardization Rules, has been found to be too liberal in some transformers. Temperature gradient from exterior to interior of windings in large transformers is frequently as low as 9 deg. Fahr. (5 deg. C.) and rarely reaches 27 deg. Fahr. (15 deg. C.) in transformers of any capacity now in general use. Adherence to the A. I. E. E. rule leaves a substantial margin of safety over that assumed from test data recorded in Figs. 4 to 7.

[17]

Owing to generally insufficient ventilation, transformers of large capacity installed in manholes are operated under unfavorable conditions as compared with pole-type units. Temperature indicators provide a constant check on such conditions.

[18]

The condition of transformers operating under variable load is reflected in oil temperature. Experience indicates that the heating effect of overloads of short duration is overestimated or the cooling effect of intermediate periods is underestimated, and that transformers of less capacity would be satisfactory in many locations.

[19]

High temperatures developed in transformers due to operation at less than rated voltage will be immediately recorded by an indicator, if expressive. Transformers rated at 2,400 volts, if operated at 2,200 volts, will develop approximately 10 per cent higher temperatures at the lower voltage, when operating at rated capacity.

[20]

High temperatures occurring in transformers regardless of loading conditions, owing to insufficient oil, slow circulation due to heavy or thickened oil or clogged oil ducts, are immediately detected by indicators.

[21]

Abnormal temperature developed in individual transformers operating in multiple to supply a network and due to poor distribution of load or failure of one transformer to carry its proper share of load because of internal defects, loose connections or blown fuses is immediately recorded by an indicator.

Operating Distribution Transformers on a Temperature Basis

Diversity Factor an Unreliable Index of Service Requirements Use of Indicating Equipment Enables Operation at Higher Temperature to Be Safely Continued with Marked Economic Advantages

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STUDIES of distribution-transformer loading on the Boston Edison system have demonstrated that the temperature basis is more effective than the diversity factor in determining service rating. These investigations began several years ago and include both field and laboratory observations. The rapid increase in the use of appliances, introduction of high-efficiency lamps, underloaded motors and marked variations in average maximum coincident demands have in large measure upset former indices of determining transformer capacity. Under present conditions it not infrequently happens that transformers both too large and too small are selected for a given service. Such installations are both unsatisfactory and uneconomical. In one case a change must be made to reduce capacity and daily losses to an economical basis, and in the other the capacity must be increased to prevent failure or destruction of the unit. Both operations are costly in labor if generally required.

BENEFITS OF TEMPERATURE BASIS

Analyses of the loading conditions of individual transformers have repeatedly demonstrated the fact that if the performance of every transformer could be controlled on the same basis as generating and substation apparatus—that is, on a temperature basis—a substantial reduction in plant costs and operating expenses could be effected. Reduction in plant costs would result from a decrease in the capacity of transformers required for a given load. While this would have to be gradual on an established system, it would be effective in influencing new construction and would finally reduce the entire system to a more economical basis by gradually increasing the loading of all transformers.

Reduction of operating costs would result from lower core losses, with elimination of many changes in transformers to meet increased demands for service, and a marked reduction in the testing costs usually considered necessary to check loadings.

TABLE I—NUMBER, RATING AND DUTY OF DISTRIBUTION TRANSFORMERS ON BOSTON EDISON SYSTEM IN 1921

	No Used	Rating (Kva.)	Total Rating (Kva.)	Service
Single-phase .	6,215	0 6—100	56,245	Single-phase lighting, small power and appliances
Three-phase .	1,294	5.0—300	52,208	Three phase power service
Total	7,509	.....	108,453	

	Kw.-hr.
Total sales of energy through above transformers	78,000,000
Core losses, approximately, total................	9,500,000
Total investment in transformers, approximately	$1,000,000

The results obtained from experiments in temperature operation initially conducted on isolated transformers of relatively large capacity (30 kva. to 50 kva.) were so uniformly satisfactory that this method of operation was extended to selected groups of transformers with similar results. From these studies has come finally the adoption of the temperature method of operation for the entire system for units of 5 kva. and over which serve more than one customer.

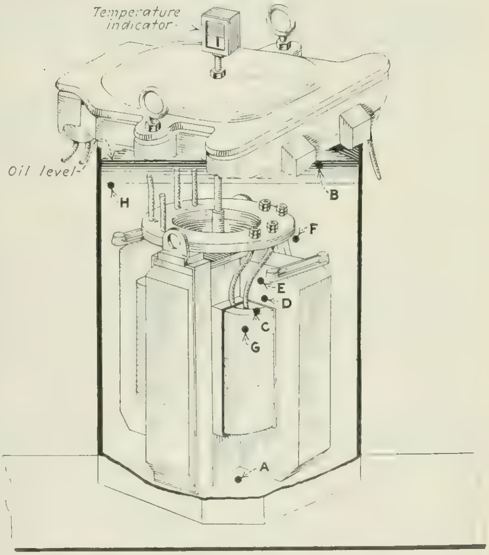


FIG. 1—POSITIONS AT WHICH TEMPERATURE OBSERVATIONS WERE MADE

Conservative estimates of the economies which can be effected by operating the system on a temperature basis indicate a reduction of at least 10 per cent in transformer capacity and a similar reduction in annual losses. Including elimination of costs for changing transformers and for testing, the total yearly savings may easily reach $30,000 in the near future.

In developing a standard to be employed generally in operating transformers on a temperature basis, it was found desirable to measure the actual temperatures developed within units as usually installed and operated. An exhaustive study of oil and coil temperatures in all types and sizes of transformers was undertaken in the field, from which much valuable data were obtained on the effects of ambient temperatures and loading upon oil and coil temperatures. These studies included the effect of seasonal variations in temperature upon the internal temperatures of transformers as developed under various loading conditions. Some of these variations in loading are indicated in Table II.

It developed that if the temperature rise of the windings was to be gaged by the rise in oil temperature, there was only a limited area of the oil body within which the oil temperature consistently followed the changes in coil temperature due to load changes or other causes. Tests made at *A* (Fig. 1) clearly showed that the oil temperature at that point did not vary consistently with coil temperatures, and these also varied widely with different sizes and types of transformers. At this location the temperatures were also measurably affected by the use of oils of different densities, as well as by the different quantities used by the several manufacturers in their respective designs.

Temperatures at *B*, if taken in the center of the transformer, were reasonably consistent except at low ambient temperatures. Temperatures at *H* or any point close to the case were particularly unreliable owing to the varying effects of sun, shade and wind on different parts of the case. Differences of 10 deg. to 15 deg. Fahr. were repeatedly observed on opposite sides of the case when the transformer was exposed to cold winds or partially exposed to an unusually hot sun. Temperatures at *G* and *C* gave coil temperatures which consistently followed loading conditions, and when corrected by adding 27 deg. Fahr. (15 deg. C.) to observed temperatures, in accordance with the Standardization Rules of the American Institute of Electrical Engineers, were assumed to indicate approximately any "hot-spot" temperature within the windings.

TABLE II—COMPARISON OF AVERAGE DEMANDS OF VARIOUS CLASSES OF CONSUMERS

Group 1—First-class and second-class single houses, apartments and stores in community centers in suburban districts; group 2—first-class single and two-apartment houses in residential districts; group 3—second-class two-apartment and three-apartment houses in residential districts; group 4—same as group 1.

Group No.	Rating of Transformers (Kva.)	Consumers Connected	Connected Load (Kw.) Light	Connected Load (Kw.) Power	Connected Load (Kw.) Heat	Connected Load (Kw.) Miscellaneous	Connected Load (Kw.) Total	Maximum Load by Test (Kw.)	Average Demand per Consumer (Watts)
1	10	72	66.6	4.7	...	.	71.3	6.32	87
	10	51	63.8	3.1	0	0	63 9	15.06	295
	10	116	89.2	0.6	0	0	89 8	13.8	110
2	15	18	57.6	2.6	27.8	0	88.0	11.5	638
	15	73	95.6	2.3	0	0	97.9	18.05	247
	15	78	89.9	0 3	0 5	0	90.7	13.9	178
3	20	18	18	0	19	0	37	14.95	830
	20	32	38	0	61	0	99	12.19	380
	20	25	27.9	0	0	0	27.9	4.37	174
4	60	192	235	4.7	1.8	0	241.5	63.25	329
	60	452	415.4	14.2	15.8	6.0	451.4	70.15	158
	90	431	447	49	4.9	5.4	506.3	122.13	283

*Company records of connected load do not include appliances rated at less than 660 watts.

Temperatures at *D*, ½ in. (12.7 mm.) above the coils, at *E*, 2 in. (50.8 mm.) above, and at *F*, approximately 4 in (101 mm.) above the coils, were found to vary not over 3.6 deg. Fahr. (2 deg. C.) from each other and consistently to follow those observed at *G* and *C* at all times regardless of changes in ambient temperature or loading conditions within reasonable limits.

As a result of these tests it was determined that the only reliable location in which to measure oil temperatures as a basis for determining transformer loading conditions was in a position directly over the coils and in close proximity thereto.

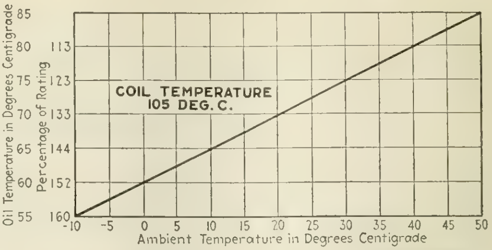


FIG. 2—TRANSFORMER RATING AND OIL TEMPERATURES DEVELOPED AT VARIOUS AMBIENT TEMPERATURES

During the tests transformers were operated singly and in banks, serving every possible form of business. The tests were extended over a long period to permit the full effect of seasonal changes in climate and loading to be carefully checked. Variations in daily temperatures between night and day were found to have a material effect upon transformer temperatures and capacity. Observations in the field were finally checked by laboratory tests on selected transformers, the results of which are shown in Figs. 4, 5, 6 and 7.

Summarizing some of the important operating conditions observed during a survey of the system, the following were noted as typical causes of transformer failures attributable to high temperatures:

Insufficient ventilation of manholes.

Deficiency in oil due to leakage or evaporation.

Reduced circulation due to sludging of oil and clogging of oil ducts.

Loads of low power-factor.

Unbalanced loads on three-wire mains.

Unequal distribution of load between transformers in networks due to poor regulation of certain transformers, loose connections in secondary mains, the blowing of primary fuses and other conditions incidental to multiple operation of transformers.

A considerable number of transformers were found to be regularly operating at substantial overloads, as illustrated by Fig. 3, which clearly indicates the possibilities under the temperature method of operation.

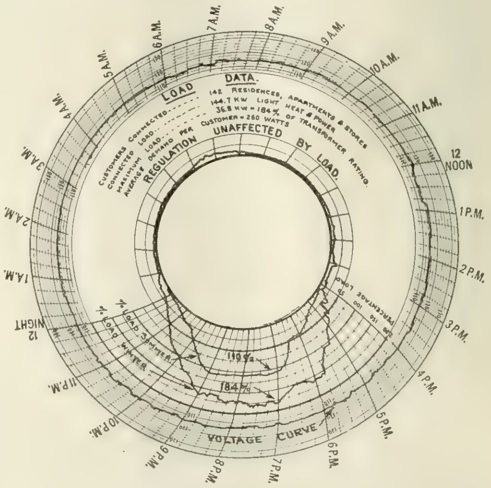


FIG. 3—VOLTAGE REGULATION WAS UNAFFECTED BY OPERATING TRANSFORMERS AT 84 PER CENT OVERLOAD

The figure further indicates the danger of relying on the secondary voltage as an indication of overload.

In considering the temperature to which transformer windings may safely be subjected, we may refer to the A. I. E. E. Standardization Rules, which provide as follows:

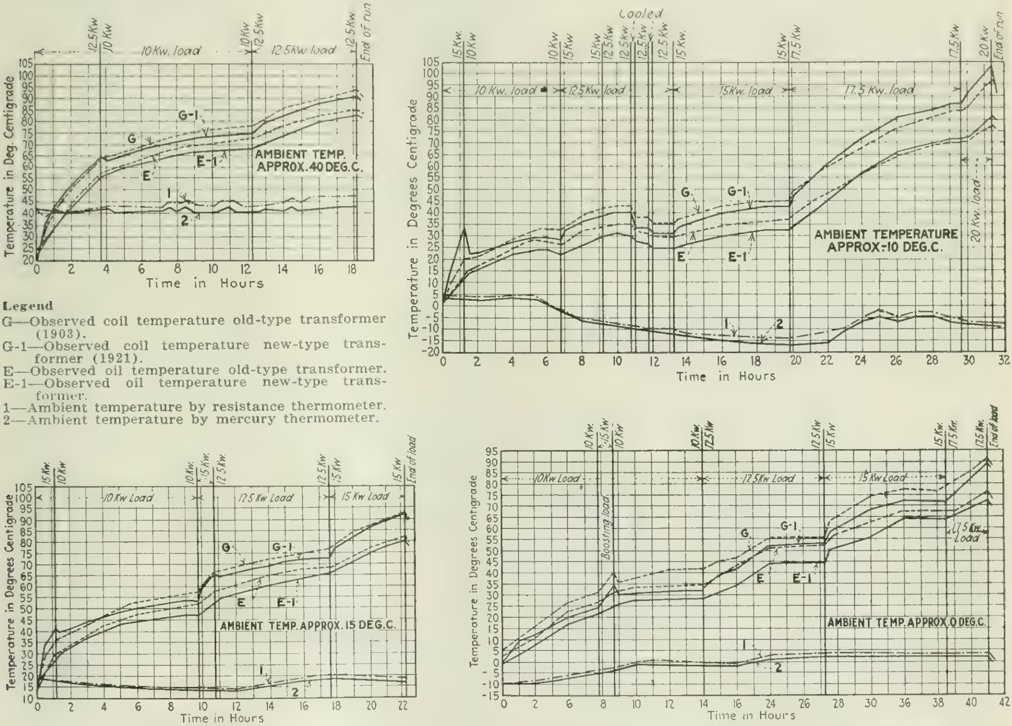
> The limiting "hottest spot" temperature for class A insulation shall be 221 deg. Fahr. (105 deg. C.).
>
> The limiting observable temperature rise for transformers using class A insulation shall be 131 deg. Fahr. (55 deg. C.) from a standard ambient temperature of 104 deg. Fahr. (40 deg. C.) in air.
>
> Temperature of transformer windings shall always be obtained by method 2 (resistance method) but with the results thus obtained checked wherever possible by method 1 (thermometer method). A correction factor of 18 deg. Fahr. (10 deg. C.) shall be added to temperatures determined by method 2 and 27 degs. Fahr. (15 deg. C.) to those determined by method 1 to correct for "hot spot" temperatures in windings. No increase in limiting observable temperature rise specified, 131 deg. Fahr. (55 deg. C.), shall be permitted when ambient temperature is less than 104 deg. Fahr. (40 deg. C.). Limiting observable temperature of oil in which windings are immersed shall in no part exceed 194 deg. Fahr. (90 deg. C.).

Inquiry of manufacturers as to the maximum oil temperature which would be approved for their product was unproductive of definite results. Temperatures varying from 176 deg. to 185 deg. Fahr. (80 deg. to 85 deg. C.) were suggested for medium and large-capacity units and lower temperatures for small units. Great stress has been laid upon the necessity for limiting oil temperatures to materially lower values when ambient temperatures are very low, although happily this proves to be entirely uncalled for even for very high loading values in temperatures as low as 0 deg. Fahr. (—18 deg. C.). So far as is known, the relation between the oil and coil temperatures at various ambient temperatures as developed by one manufacturer and shown in Fig. 2 is the only authoritative information on this general subject which is available even at this late day. This curve clearly shows the increase in capacity which becomes available in ambient temperatures lower than 40 deg. C. and in some measure confirms the results of independent observations.

From the experience gained in the field in the study of transformer operation it appeared that a suitable device for practical use in measuring and indicating the temperature of oil in transformers in service should comply as far as possible with the following specifications:

A. It should display a cautionary signal when a predetermined oil temperature is reached, to be followed by a danger signal when a higher or critical oil temperature value is attained.

B. The heat-actuating element should be extremely ac-



FIGS. 4, 5, 6 AND 7—OBSERVED TEMPERATURE RISE IN OIL AND WINDINGS OF 10-KW. DISTRIBUTION TRANSFORMERS OPERATING AT DIFFERENT LOADS AND AMBIENT TEMPERATURES

The lower the ambient temperature the larger the load which a given transformer can carry without overheating. The accompanying curves, obtained by subjecting units to successively higher loads after constant temperature had been reached at any one, show the excess rating which can be obtained from a transformer when the ambient temperature is dropped from 40 deg. C. to —10 deg. C. Note the rapid decrease in coil temperature with reduction in load. In all cases the capacity available is in excess of that indicated by Fig. 2, even where the coil temperature is corrected for "hot spots" by adding 15 deg. C. The coil and oil temperatures were obtained from measurements conducted with resistance thermometers.

curate in measuring temperatures and capable of adjustment over a moderate range of temperature. Calibration to be unaffected by extreme changes in temperature.

C. The device should be mechanically simple and require the minimum amount of maintenance.

D. Weatherproof, oil-proof, bug-proof and fool-proof.

E. Readily visible from a distance.

F. Suitable for use on pole or subway transformers and so made that it can be installed without causing new opportunities for oil leaks or breaking gaskets or seals under transformer covers. The indicator should be capable of removal after installation without disturbing the operation of the transformer.

G. Equipped with resetting device easily operated by linemen or inspectors.

Indicators based upon these specifications are now in regular field service upon the distribution system of this company.

The use of indicators has materially modified operating methods formerly used in transformer installation. Consideration is now given to the average rather than the maximum demands for service, with the certainty that the overload capacity available will care for most requirements in excess of the average. Load is now added to existing transformers without further consideration if the indicators have not displayed warning signals. If the warning signal has been displayed on occasions, tests may be made to determine the desirability of adding more load; but in general the load is added and the operation of the indicator awaited before increasing transformer capacity.

Inspection of indicators is automatically rendered at little or no expense through daily reports of inspectors and troublemen whose duties require their presence in all parts of the system. Where transformers are installed in vaults or remote locations not under regular company observation, the co-operation of the consumer is obtained, and he reports by mail any operation of an indicator. Under such conditions, with all transformers equipped with indicators, the operation of the company's system will be under observation and control the year through as never before.

Transformers passing through the stock room and repair shop are all prepared for the reception of indicators when required. Existing transformers are readily equipped through the use of spare covers prepared in advance for the reception of indicators and later exchanged for those in field service. The present cost of equipping transformers is about $6 each. The results already attained have more than warranted this outlay and indicate that returns even more favorable will develop through an extension of their use.

A Record Revenue During January

Central Station Output Decreases Below December, but Gross Revenue Increases—Industrial Load Is Largest Since October

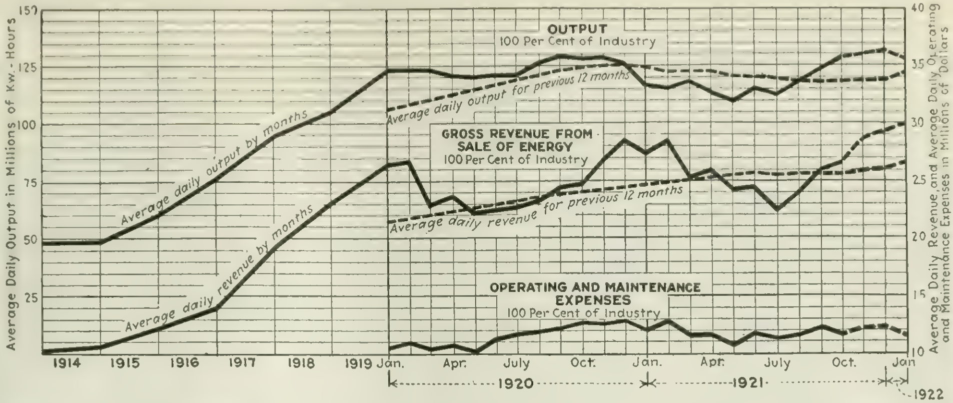
ANOTHER record was hung up by the electric light and power industry during January. In spite of a decrease in the amount of energy consumed during the month, the gross income from sale of energy was $92,700,000, or a daily average of $2,993,000, both of which were record figures. Reports received by the ELECTRICAL WORLD for the month of January from central generating and distributing companies representing 78 per cent of the installed rating of the country indicate that while the output of 3,988,000,000 kw.-hr. was 53,000,000 kw.-hr., or 1.3 per cent, below the record output reported last December, yet it was 265,000,000 kw.-hr., or 7.1 per cent, in excess of that reported for January, 1921. In addition, the operating and maintenance expenses during January were 2.7 per cent below those of January, 1921. From an economic viewpoint, therefore, the January returns are most encouraging to the electric light and power industry, especially when the industry is compared with other primary industries which are still unable to report favorable operations or are just emerging from a period of markedly curtailed production activity.

As indicated above, the electrical energy sold during January was only slightly below that sold during December. Government figures indicate that in general industrial activity during January showed an increase over December. Out of forty-three primary industries, twenty-five reported increased activity over December, fifteen reported decreased activity and three reported operations on a par with December. Three of the most pronounced relative decreases were largely seasonal. Hence, while the lighting load probably decreased slightly during January, the industrial load in the aggregate undoubtedly exceeded that of December. The result of these two opposing tendencies in the aggregate

TABLE I—CENTRAL STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
Feb.	76	2,453,671	2,711,800	-9.4	69	$55,540	$48,633	14.3
Mar.	76	2,806,609	2,989,581	-6.1	70	55,513	49,071	13.3
April	77	2,675,949	2,895,067	-7.0	72	55,326	49,064	12.8
May	77	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6
June	77	2,686,479	2,872,900	-6.4	70	52,385	47,977	9.3
July	77	2,706,016	2,949,132	8.2	70	50,747	49,195	3.4
Aug	77	2,839,498	3,041,927	6.7	70	51,931	50,848	2.1
Sept	77	2,848,212	2,937,339	-3.0	70	54,501	52,955	2.9
Oct.	76	2,997,133	3,045,696	-1.5	71	57,340	55,599	3.1
Nov.	77	3,006,349	2,969,175	1.3	71	61,059	58,381	4.6
Dec.	77	3,129,729	3,024,203	3.5	71	64,054	61,333	4.5
		1922	1921			1922	1921	
Jan.	78	3,113,619	2,905,723	7.1	71	65,780	61,646	6.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Feb.	42	15,085	13,640	10.5	55.6	54.5	22.9	26.0	44.1	47.3
Mar.	52	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	52	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	52	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	53	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	52	18,633	20,964	-11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	53	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept	53	19,765	21,359	-7.5	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	54	19,828	22,231	-10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov	55	19,692	21,773	-9.0	49.9	58.9	23.1	23.3	43.4	50.5
Dec.	55	21,036	22,325	-9.4	47.8	55.9	26.9	29.3	46.1	49.2
		1922	1921		1922	1921	1922	1921	1922	1921
Jan.	55	19,982	20,557	-2.7	45.7	52.7	23.0	23.9	41.2	42.3



CENTRAL-STATION OUTPUT DECREASES WHILE GROSS REVENUE INCREASES DURING JANUARY

was a slight decrease in the output under that reported for the month of December.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives further evidence of the tendency toward financial prosperity in the electric light and power industry. During January, 1922, the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 45.7 per cent, as against 52.7 per cent in January, 1921. As the high-revenue lighting load decreases with the advancing season and the low-revenue industrial load increases with returning industrial activity, the operating ratio in the aggregate will undoubtedly rise. The average operating ratio for companies having steam electric generating plants only was 54.2 per cent during the year 1921, as against 59.3 per cent during 1920.

INDUSTRIAL ACTIVITY GREATEST SINCE OCTOBER

In most primary industries industrial activity during January was the greatest since last October, and in a number of cases production was much higher than in

TABLE II—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
February	54.3	59.5	54.2	60.3	52.3	53.0	52.7	52.1	63.0	57.9	62.1	59.8	59.1	51.2	56.2	52.3	60.2	60.3	64.3	60.3
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.8	57.7	58.3	67.5	46.2	52.4	52.2	57.2	45.3	55.5	55.3	62.7	41.8	45.6	51.6	55.4	47.5	47.8	51.8	56.4
Hydro Plants:																				
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	24.1	20.6	24.6	20.6	28.6	21.4	27.4	20.5	23.9	27.9	26.0	27.6
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	25.0	19.3	30.0	49.7	16.7	21.4	18.0	21.8	28.9	25.6	22.0	21.1	33.8	28.3	29.2	22.2	26.6	25.9	26.1	24.3
Combined Systems of Steam and Hydro Plants:																				
February	44.3	60.0	44.7	58.8	41.8	41.9	42.6	43.8	42.4	49.8	41.9	48.2	41.7	39.6	40.5	42.0	39.6	43.8	37.4	44.7
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.7	43.1	53.4	54.6	39.9	44.7	43.0	47.8	38.8	43.9	46.2	56.1	40.1	38.6	43.8	45.2	33.5	32.2	38.0	43.1

TABLE III—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
KW.-HR. OUTPUT																				
Feb.	81	178,694	216,890	-17.6	80	902,030	970,539	-7.0	72	789,539	882,873	-10.6	59	131,654	132,537	-0.7	83	451,754	508,961	-11.2
Mar.	80	205,348	230,309	-10.8	81	1,029,120	1,119,428	-8.1	72	894,500	941,893	-5.0	59	139,381	136,017	2.4	83	538,260	561,934	-4.2
April	80	196,680	227,008	-13.3	79	963,659	1,052,716	-8.4	71	828,457	894,028	-7.3	59	132,075	135,421	-2.5	89	555,048	586,894	-5.4
May	81	191,141	219,298	-12.8	78	934,973	989,408	-5.5	71	819,506	899,657	-8.9	59	136,573	138,416	-1.3	91	586,264	642,495	-8.7
June	80	192,007	219,476	-12.5	78	940,443	1,003,727	-6.3	71	806,270	880,934	-8.5	60	136,011	129,120	5.3	92	611,128	639,637	-4.5
July	80	187,622	218,995	-14.3	77	934,822	1,026,390	-8.9	71	804,009	884,572	-9.1	60	140,795	141,450	-0.6	92	639,768	678,725	-5.7
Aug.	79	205,351	224,324	-8.5	78	992,681	1,054,124	5.8	71	848,803	923,210	-8.1	60	147,967	154,353	-4.1	93	644,696	685,916	-6.1
Sept.	79	221,364	223,269	-0.8	78	1,004,252	1,051,268	-4.5	71	851,671	886,370	-3.9	60	149,758	151,680	-1.2	93	621,167	624,752	-0.5
Oct.	79	249,202	221,929	12.1	78	1,103,525	1,121,676	-1.6	71	919,514	930,236	-1.1	60	154,266	156,713	-1.5	94	570,626	615,142	-7.2
Nov.	79	247,119	215,565	14.6	77	1,128,453	1,112,914	1.4	71	913,142	908,121	0.5	60	154,125	150,976	2.0	94	563,510	580,124	-3.1
Dec.	79	253,206	216,717	16.8	78	1,196,724	1,150,695	4.0	71	948,670	925,449	2.5	61	153,340	150,646	1.8	93	577,789	580,696	-0.5
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan.	81	252,836	203,887	24.0	81	1,188,754	1,072,841	1.5	71	941,148	864,963	8.8	60	158,001	146,134	8.1	93	572,880	617,898	-7.3
REVENUE		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Feb.	81	$5,925	$5,728	3.4	73	$21,492	$18,327	17.4	58	$15,971	$14,070	13.6	58	$3,915	$3,329	17.6	83	$8,237	$7,179	14.7
Mar.	80	5,784	5,566	3.8	72	21,822	18,934	15.3	58	15,853	14,103	12.4	59	3,747	3,246	15.5	83	8,307	7,222	15.0
April	80	5,665	5,554	2.0	72	21,504	18,609	15.8	58	15,506	13,822	12.2	58	3,744	3,312	13.2	89	8,817	7,767	13.6
May	81	5,362	5,342	0.4	72	20,795	17,613	18.0	58	14,866	13,558	9.8	59	3,516	3,179	10.7	91	9,362	8,240	13.7
June	80	5,285	5,397	-2.4	72	20,058	17,438	15.0	58	14,485	13,519	7.1	59	3,536	3,152	12.2	92	9,021	8,439	6.9
July	80	5,180	5,121	1.1	72	18,798	17,155	9.2	58	14,158	14,689	-3.6	60	3,509	3,145	11.3	92	9,101	8,733	4.3
Aug.	79	5,297	5,483	-3.3	72	19,050	17,926	6.2	58	14,465	14,594	-0.8	60	3,612	3,536	2.2	93	9,507	9,309	2.1
Sept.	79	5,694	5,857	-2.7	72	19,992	18,750	6.6	58	15,324	15,192	0.8	59	3,811	3,673	3.7	93	9,680	9,482	2.0
Oct.	79	6,332	6,072	4.2	71	21,520	20,115	6.9	58	16,098	16,175	-0.4	60	3,920	3,903	0.4	94	9,470	9,334	1.4
Nov.	79	6,806	6,238	9.1	71	23,282	21,541	8.1	58	17,123	16,954	0.9	60	4,139	4,158	-0.4	94	9,745	9,489	2.7
Dec.	79	6,987	6,573	6.3	72	25,168	23,519	7.0	58	17,691	17,508	1.0	61	4,234	4,150	2.0	93	9,965	9,583	4.0
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan.	81	7,205	6,582	9.5	75	26,078	24,019	8.5	58	17,678	16,715	5.7	60	4,385	4,200	4.4	93	10,368	10,085	2.9
OPERATING EXPENSES:		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Feb.	35	$1,069	$1,242	-13.9	52	$6,799	$5,937	14.5	28	$3,958	$3,445	14.8	41	$1,217	$1,053	15.5	55	$2,042	$1,963	3.9
Mar.	45	1,576	1,651	4.5	58	7,969	7,241	10.0	34	4,570	4,228	8.2	47	1,776	1,514	17.2	80	2,866	2,614	9.7
April	44	1,418	1,479	-4.1	56	7,590	7,168	5.9	34	4,347	4,112	5.7	48	1,567	1,403	11.6	80	2,893	2,479	16.8
May	48	1,548	1,577	-1.8	53	6,921	6,660	4.0	36	4,274	4,292	-0.4	49	1,563	1,486	5.2	83	2,969	2,713	9.5
June	45	1,737	1,862	-6.7	53	6,916	6,878	-0.5	38	4,843	5,152	-5.9	56	1,835	1,678	9.4	86	3,565	3,519	1.3
July	46	1,712	2,077	-17.6	50	6,772	7,111	-4.8	37	4,940	5,800	-14.8	58	1,870	2,039	-8.2	86	3,339	3,937	-15.1
Aug.	47	1,861	2,088	-10.8	50	6,871	7,131	-3.6	37	5,028	5,793	-13.2	58	1,892	2,003	-5.5	92	3,648	3,884	-6.0
Sept.	47	2,049	2,262	-9.4	51	6,851	7,294	-6.0	38	5,353	5,687	-5.8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
Oct.	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18.2	59	1,990	2,192	-9.2	93	3,511	3,891	-9.7
Nov.	49	2,040	1,964	3.8	54	7,103	7,790	-8.8	38	4,992	5,972	-16.4	59	1,931	2,262	-14.6	92	3,626	3,785	-4.2
Dec.	50	2,075	1,901	9.1	54	7,993	8,378	-4.6	37	5,162	6,169	-16.2	59	1,966	2,161	-9.0	92	3,841	3,719	3.3
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan.	51	2,060	1,781	15.6	55	7,210	7,563	-4.7	37	5,024	5,659	-11.2	59	1,926	2,144	-10.2	92	3,762	3,410	10.3

any recent month. Industries calling for increased electrical energy were the automobile industry, textiles and building materials, all of which were operating considerably above the 1913 average rate of production.

Increased activity was reported by both the textile and leather industries of New England during January, and several other industrial users of electrical energy in this section reported slightly increased operations. The decreasing lighting requirements, however, were sufficient to overcome these increased industrial requirements, resulting in an average daily output of 270,000 kw.-hr. below that which was reported for the month of December.

The gradual industrial revival from the point of extreme depression which has been reported by the Middle Atlantic States for the past few months was not so marked during January. Most of the industries in this section were operating at about or on a par with December.

In the South Atlantic States capacity operations continued in the textile industry, over 100,000 more spindles being active than in December. Other industries, such as the lumber trade and mining, curtailed operations under those of December. In the aggregate the industrial load of this section during January was probably under that of December.

The returns indicate, therefore, that during January the industrial energy requirements of the Atlantic section in the aggregate were under those of December. The seasonal decrease in lighting requirements was also probably under that of December notwithstanding the addition of new lighting customers during the month. The net result in this section was that the amount of energy sold by central generating and distributing companies per day was about 2,160,000 kw.-hr. under that of December.

Automobile Manufacturing Activity Substantially Increased

The automobile industry of the North Central States reported an increased production of about 15 per cent over December, and the iron and steel industry was operating slightly above December. Energy requirements by other industries of this section were about the same as during December. The decreasing lighting requirements, however, were more than sufficient to overcome the slight increases in industrial requirements, resulting in a decrease in the average daily output in this section of about 350,000 kw.-hr.

The South Central Section was the only one to report an increased energy output over that of December. In this section about 65 per cent of the industrial plants were operating on full time, 25 per cent on part time or with reduced forces, and 10 per cent were shut down.

While substantial gains in activity took place during January in the northern copper-mining regions of the Mountain States and slight increases were reported by the metal-mining regions of the southern part of the section, these increases in industrial energy requirements were offset by curtailed operations in other industries. Industrial activity in the Pacific States was slightly below December, being most pronounced in the iron and steel industry. The net result of these industrial demands in the Mountain-Pacific section, plus a probably decreased lighting load, was an output slightly under that for December.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Mental Inertia Must Be Overcome to Establish Metric System

To the Editors of the ELECTRICAL WORLD:

It is a commonly known physical truth that a moving body can be more easily maintained in its original path than diverted from that path into a new one. Psychology offers a perfect analogy in the working of people's minds. When thought on the subject of measures has happened to start along even one of the more difficult paths another force must be applied to turn it into any other road. Before any change can be brought about in this world the force of reason, or some unreasonable force, must be applied.

Human inertia can be more or less accurately estimated. Our ancestors reckoned with it when they adopted decimal currency, and the present generation has to reckon with a few special interests and this same inertia in securing the advantages of the general use of metric weights and measures.

The Britten-Ladd bill is conservative, does not necessitate any change whatever in the manufacture of goods, but calls for the use of the metric system in buying and selling merchandise ten years after the passage of the bill. According to those responsible for the Britten-Ladd bill, this does not affect buying and selling of articles by the measures in which they are now known. For instance, any one may buy or sell a two-inch pipe, although it is well known that this is a nominal size only and such a pipe is better denoted in millimeters.

When the manufactured articles of America are so expressed in millimeters, they will be sold with far greater readiness in all other countries, with the possible exception of Great Britain. As an example, rating pumps in liters is preferable to United States gallons even in Great Britain, because the use of the United States gallon is illegal in Great Britain and the corresponding British liquid measures, which differ by more than 20 per cent, are illegal in the United States.

The readers of the ELECTRICAL WORLD hardly need to be reminded of the modern and simple method of teaching the metric or meter-liter-gram system. The booklet "Metric Weights and Measures" can be obtained from the American Metric Association or from the bookstores. But the problem is to obtain the co-operation of national associations, firms and individuals in placing the movement in a right light before the American people.

If the readers of the ELECTRICAL WORLD will consider the Britten-Ladd bill and do even a little work for it, the human inertia will be overcome and this much-needed change to metric weights and measures will be greatly facilitated.

M. L. STALEY.

New York City.

Rear-Line Circuits as a Solution of Suburban Distribution

To the Editors of the ELECTRICAL WORLD:

The storms of sleet and snow in the East of the United States, and particularly in New England, bring to the front in a distressingly forceful manner the difficulties of distribution in suburban towns and in small cities as well. The fact is that in places too small to permit of general underground distribution and where the streets are well lined with trees there exist in the path of general distribution troubles and dangers of a very formidable character. One must frankly admit that there is no feasible method of entirely reliable supply where high-tension wires have to be carried through many miles of streets so lined with trees that the circuits must run among them if on the streets at all. Of course, in foreign practice, and particularly in England, the smaller towns are lucky if they have any electric lights at all, on account of the very general sentiment demanding underground service; but the American small city or suburban town, while in the aggregate the service is large and profitable, is so scattered that underground construction must be regarded as fairly out of the question—certainly until entirely different methods of working, at very much lower cost, become common. Circuits carried through long lines of trees are difficult to operate, unsightly, and if at all secure, necessitate an amount of cutting and slashing that augurs ill for the trees.

It appears to me that in a good many cases great relief could be obtained and very much better service if it were made practicable to run the circuits on the rear dividing lines of lots in the town layout, thus providing a very close equivalent to the alley distribution which has been successfully worked in many places. A dividing-line distribution as a rule does not fall foul of great numbers of trees. It does not thrust poles in front of the parlor windows, and it permits transformers to be placed well out of sight and in locations enabling them to feed a considerable group of adjacent houses. Of course, the objection which at once arises is that such a procedure means right-of-way over private property. This is the case, and it involves the outstanding difficulty of some perverse individual absolutely declining to grant rights, but the matter is serious enough for public action. It is certainly enormously for the interest of any town or small city to have a thoroughgoing and reliable distribution, and as the situation outlined exists in a very large number of communities it is sufficiently general to warrant remedy in the interest of the public. If supply companies had a right of eminent domain with respect to the rear lines of lots, under proper restrictions and without demanding punitive payments, the way would be clear for a great deal of simple and safe construction. With such an arrangement of circuits and a very modest amount of underground work of the simplest kind the ordinary suburban town or small city can be well handled with much greater security against interruptions to service than is now the case.

Continuous supply is a matter of general interest for which the public should be willing to sacrifice a little of its territorial exclusiveness, and here the interest of each is the interest of all, since failure of a circuit anywhere generally puts to inconvenience a large group of consumers.

LOUIS BELL,
Consulting Engineer.

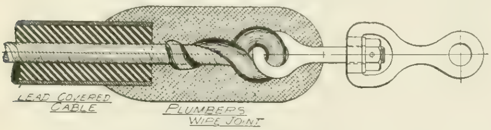
Boston, Mass.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Bolt Eye and Wiped Joint Facilitate the Pulling of Cables

To pull lead-covered cables without damaging the lead sheath or the insulation the method illustrated here has been successfully used. This also prevents moisture from entering the cable while it is being pulled. The method is specially adapted to cables of 1.5 in. diameter over all and larger. The cable end is prepared by removing enough of the sheath and insulation to leave a reasonable run of copper conductor to be pulled through the bolt eye shown and then wrapped back upon itself. After the copper has been well fastened through the eye bolt, a wipe joint is made by a regular cable splicer's outfit. The time required to wipe a joint of this kind is about one hour for one man, which includes the time to strip the cable and make the splice before wiping the joint. The amount of soldering material ranges from 2 lb. to 5 lb., according to the size of the cable. This, however, is melted off when the cable pulling is finished. After pulling the cable the end is sawed off as near as possible to the bolt, and the end of the cable is sealed with solder to prevent entrance of moisture.



DAMAGE TO LEAD SHEATH PREVENTED BY USING WIPED JOINT WHILE PULLING CABLES

The frictional contact of the wiped joint alone would not stand the strain of the pull, making it advisable to fasten the conductor very securely. But, on the other hand, the wiped joint must cover the lead sheath properly to prevent a tendency of the sheath to crack away from the joint, thus permitting moisture to enter the insulation. A very satisfactory distribution of the pull results when the joint is done properly.

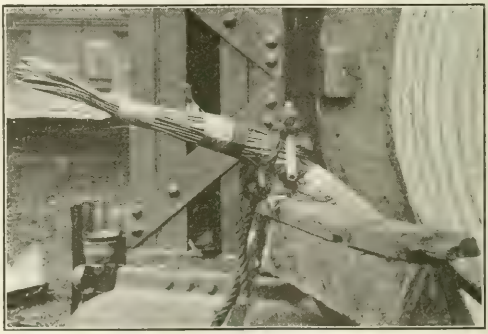
Santa Paula, Cal. A. A. Barbera.

Submarine Cable Laid Across River by Steam Winch

Pulling cables across short stretches of water with a steam winch on one shore and the reels mounted on the opposite bank was recently accomplished with very satisfactory results by the New York Central Railroad Company. This installation consisted in running seven cables 700 ft. across the Harlem River at the Park Avenue drawbridge. Generally when submarine cable is laid it is paid out over the stern of a vessel. In this case, however, such a plan was not practicable. The breaker pier of the drawbridge lay directly between the splicing chambers on each side of the river. A cable laid from a boat would have to pass around the end of the pier and would thus be considerably longer than the width of the river. Therefore it was decided to pull the cables directly across, passing them between the piles which make up the pier. This plan also saved the work of loading the heavy reels on the boat and of unloading them. This was one of the principal reasons why it was better to pull the cable than lay it from a boat. Aside from the fact that the amount of handling of the heavy reels was reduced to a minimum, it would obviously require very much longer lengths of expensive cable if they were carried around the end of the breaker pier.

The cables were delivered on reels at the south end of the drawbridge. Each reel contained 700 ft., which was sufficient for the crossing. The first operation was to prepare the ends as shown in the accompanying illustration. This work consisted simply of unwinding three or four feet of armor wire, cutting off the piece of cable thus exposed, turning back the armor and binding it so as to form a loop for pulling it across the river. Important details in this procedure before forming back the armor were carefully to seal the end of the cable with a wiped lead cap and to place a short piece of cable or other material butting up against the sealing cap, which was held in place by the armor wire. The reason for this was to provide something which would take the squeezing of the looped armor wire while the cable was being pulled across the river and so protect the cap from any injury which might permit the entrance of moisture into the cable.

The reels were then jacked up so that iron bars through their centers rested on heavy timbers. These were placed near the concrete splicing chambers where the land cables are spliced to the submarine cables. As the cables had to pass over the top of this concrete



LOOP FORMED FROM ARMOR WIRE PROVIDES MEANS FOR PULLING SUBMARINE CABLE ACROSS RIVER structure in being unreeled, other heavy timbers with carefully greased beveled edges were provided to reduce abrasion to a minimum.

A steam-driven winch was set up on the north side of the river. A wire-rope cable was brought over from this side by a rowboat and passed between the piles of the breaker pier by a diver. The rope was then attached to the prepared end of the cable by a knot and clamped fast with two single bolt clamps. The actual drawing of the cable took only ten minutes, each of the seven cables being pulled over separately in this way. The cables could not be pulled together as each one had to pass between a different pair of the piles belonging to the breaker pier in midstream. Careful observation of the cable as it passed over the timbers and the gravel on the shore failed to show the slightest damage to the jute covering from abrasion in spite of the fact that it was so heavy that it wore a groove four or more inches deep in the gravel.

After all the cables were in the water a suction dredge was used to make a trench for each one. The mud is simply sucked from under each cable with the help of a diver to guide the suction pipe and see that each cable is in its trench. The action of the tidal currents covers them up. The shore ends were placed in a trench and covered at a time when the tide was at ebb.

F. A. Westbrook,
Field Engineer.

Habirshaw Electric Cable Company, Inc.,
New York, N. Y.

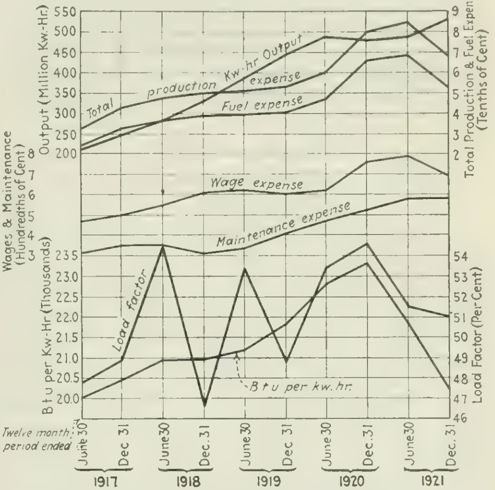
Steel Plates Protect Poles

To protect the butts of a number of poles placed very close to the edge of the pavement along a Texas highway from damage by hubs of automobile and wagon wheels, steel plates ¼ in. thick and 18 in. long by 12 in. wide have been fixed to them. The plates are held to the poles by six lag screws and placed so that the lower edge is about a foot above the ground. The protection which the plates give is well demonstrated by the many deep abrasions showing on them. Without the plates the poles would have been severely cut.

Field Editor Electrical World.
San Francisco, Cal.

Comparison of Production Expenses at Connors Creek

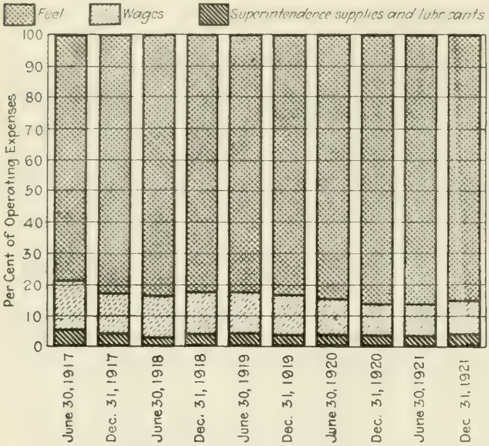
Production expenses of the Connors Creek power station per kilowatt-hour of output are fortunately available again through the courtesy of Alex Dow, president of the Detroit Edison Company. The most striking change since we last reported any data (see Electrical World for Nov. 5, 1921, page 928) is the increase in plant economy, the B.t.u.'s per kilowatt-hour being the lowest since the year ended June, 1917. This is a credit to the company's operating force, because the annual load factor is 3½ per cent lower than the maximum that has existed since June, 1917. Both the average load and maximum load have increased approximately 9 to 10 per cent in the last twelve months, the actual kilowatt-hour output having increased nearly 9 per cent in that period. Although the latest published



TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR AT CONNORS CREEK STATION

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

	Twelve-Month Periods Ending									
	1917		1918		1919		1920		1921	
	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents	June 30 Cents	Dec. 31 Cents
OPERATION:										
Superintendence	0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.012	0.015	0.014
Wages	0.047	0.050	0.055	0.061	0.062	0.060	0.062	0.076	0.079	0.069
Fuel	0.240	0.325	0.368	0.382	0.394	0.407	0.471	0.652	0.682	0.532
Water										
Lubricants	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002
Station supplies and expense	0.005	0.005	0.006	0.009	0.010	0.007	0.011	0.012	0.010	0.010
Total	0.303	0.391	0.439	0.462	0.478	0.486	0.555	0.754	0.788	0.627
MAINTENANCE:										
Station buildings	0.011	0.010	0.008	0.007	0.008	0.011	0.010	0.011	0.012	0.011
Steam equipment	0.019	0.024	0.025	0.023	0.024	0.029	0.036	0.038	0.043	0.045
Electrical equipment	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003	0.003	0.002
Total	0.031	0.035	0.035	0.031	0.033	0.041	0.047	0.052	0.058	0.058
Total production expense	0.334	0.426	0.474	0.493	0.511	0.527	0.602	0.806	0.846	0.685
Output in kw.-hr.	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500	527,121,200
Maximum demand in kw (30-minute)	50,000	58,000	59,000	80,000	82,000	104,000	104,000	100,000	107,500	118,000
Average load (kw.)	23,900	28,400	32,100	37,300	43,700	50,800	55,600	54,600	55,300	60,200
Load factor	0.478	0.489	0.544	0.466	0.533	0.488	0.534	0.546	0.515	0.510
Coal per kw.-hr. (lb.)	1.52	1.61	1.63	1.63	1.67	1.73	1.83	1.92	1.78	1.62
B.t.u. per kw.-hr.	20,040	20,470	20,930	20,900	21,200	21,800	22,800	23,300	21,800	20,250



FUEL CONSTITUTES 85 PER CENT OF OPERATING EXPENSE (NOT INCLUDING MAINTENANCE)

operating and maintenance expenses per kilowatt-hour are still more than double what they were during the year ended June, 1917, they have dropped nearly 19 per cent below the peak of the period ended June, 1921. During the latter period fuel, wages, superintendence and lubricants were at their peak. Maintenance of steam equipment reached a new high level in the last period reported, but this is due largely to undertaking maintenance, which was deferred previously because of high prices or the impossibility of carrying on the work owing to the lack of reserve equipment. While the unit cost of fuel has dropped below the values for the twelve-month period ended June, 1921, it still represents 77.7 per cent of the total production cost, wages ranking second in magnitude, being 10.08 per cent, and maintenance third, or 8.47 per cent.

The exact data comparing production expenses are given in the accompanying table. Better mental pictures of the past fluctuations and present trends are given in the two graphs, the one on page 635 showing production expenses, economy and load factor; the one above gives relations between fuel, wages and superintendence.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Control Battery in Series with Station Main Lighting System

THE fifty-six-cell lead battery for the control of switches and for emergency lighting in a recently completed San Francisco substation has been connected in series with the station main lighting system so that the battery may be charged from the 550-volt bus. The lighting for the station is provided by four rows of four lamps per row. In each row there are two 200-watt lamps and two 300-watt lamps. The lamps in each row are in multiple and the combination is in series with the battery. A no-voltage release is provided so that in case there is no voltage on the 550-volt bus an emergency installation of several 125-volt lamps is automatically connected across the battery. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis.

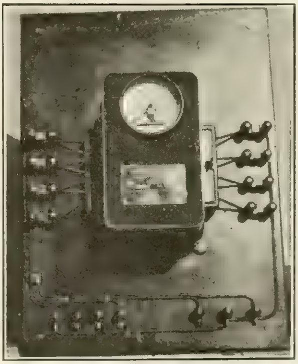
FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Arrangement of Meter Terminals and Links That Facilitates Testing

BY ARRANGING terminals and test links on its meter panels as shown, the Kentucky Utilities Company has been able to shorten considerably the time required for testing meters in outdoor installations and at substations. Besides making the testing easier and simpler, this arrangement also prevents the breakage of meter leads caused by their repeated removal from the meter terminals, as is necessary with the ordinary meter connections. This scheme has been employed at all places where meters must be tested frequently. It may be applied to watt-hour meters, graphic or indicating watt-meter or watt-hour demand meters.

Each meter is mounted on a slate or fiber panel large enough to accommodate the binding posts and links. These links are made out of $\frac{1}{32}$-in. spring brass and measure $1\frac{1}{2}$ in. from hole to hole. Hard-rubber insulation around the center portion protects the tester from shocks. The terminal posts or studs are made out of $\frac{1}{4}$-in. brass rod threaded the full length and are long enough to fit any board that may be used. There are eight sets of these studs for the current and potential leads. The four studs at the bottom left-hand side of the panel are used to short-circuit the current transformers in testing or in case the meter is removed to the shop for repairs. The three studs at the right are attached to the potential transformers and also serve as a convenient place to test for blown-out fuses or to attach the leads of the phantom-load primary.

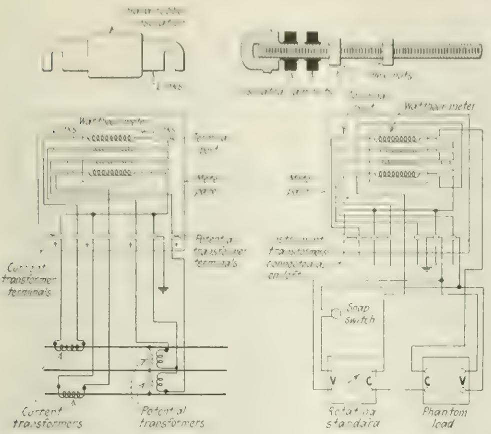
The wiring on the board is all exposed so that it can be easily traced. Colored cable is used from the instrument transformers to the test studs at the bottom of the panel to facilitate the checking of the various circuits.



LINKS PREVENT BREAKING OF METER LEADS ON FREQUENT TESTS

Only a few changes have to be made on one of these panels to connect a rotating standard and phantom load for meter testing. The first step is to short-circuit the current transformers as shown. Then all the links except those on one of the potential coils of the meter are disconnected. The two potential coils are paralleled and fed from one potential transformer. Then the two current coils of the meter and the current coil of the rotating standard are connected in series with the secondary of the phantom-load transformer. Both the standard and phantom load are connected to the same potential transformer that supplies the meter in testing.

With this method of testing none of the meter or instrument transformer wires are disturbed. Where terminals such as those described are not provided frequent testing very often breaks the leads, or in putting them back the tester may fail to tighten the terminal screws properly, thus producing a poor connection.



FACILITIES FOR QUICK, SAFE AND RELIABLE TESTING OF METERS

Left—Normal position of links when meter is in service. Right—Changed position of links when meter is being tested.

There is also the danger of reconnecting the meter improperly by attaching current leads where the potential wires should be or by changing the phase relations.

Kentucky Utilities Company, H. S. EDWARDS,
Harlan, Ky. Meterman.

Diesel Engines Operate for Year at Cost of $0.0139 a Kilowatt-Hour

THE economy of Diesel engines taken alone is usually far superior to that of other kinds of prime movers, but when compared with competitive prime movers operating under adverse conditions the advantages of the Diesel engines become even more apparent. Such a case is that of the Tucson (Ariz.) Gas, Electric Light & Power Company, which has been operating four 500-hp. Diesel engines for several years. During 1921 these engines generated 6,438,326 kw.-hr. at a total average cost of $0.013995 per killowatt-hour distributed.

OPERATING COSTS OF 500-HP. DIESEL ENGINES.

These figures are averages taken from last year's operation of four 500-hp. engines based on the energy distributed. The engines were operating 76.6 per cent of the time at a station factor of 59 per cent. The average cost per gallon for fuel oil was $0.09405, for cylinder oil $0.877, and for engine oil $0.728.

Operating Factors	Gal. per 100 Kw.-hr.	Cost Per Kw.-hr., Cts.
Fuel oil	9 35	0 90149
Cylinder oil	0.0352	0.03085
Engine oil	0.076	0.0554
Miscellaneous operating expenses	......	0.00426
Labor-operating		0 1458
Maintenance	......	0.0759
Replacements	......	0.1858
Total		1 3995

These figures are of the greatest interest when it is remembered that Tucson is in a semi-desert region remote from fuel supply and that the station generated but 59 per cent of the possible output, although the engines were operated 76.6 per cent of the possible time.

Of the 33,792 total engine-hours possible (the fourth unit was placed in service Feb. 22, 1921) the actual engine-hours run were 25,872, and 6,331,937 kw.-hr. was distributed. Fuel oil to the amount of 606,522 gal. was consumed, costing $57,080.37, or an average of $0.09405 per gallon. This equals 10.70 kw.-hr. per gallon of fuel oil, or a cost of $0.00888 per kilowatt-hour generated and $0.00903 per kilowatt-hour distributed. In the usual practice of comparing output on a kilowatt-hour-per-barrel basis the year's run was made at an average of 449.4 kw.-hr. per barrel, which compares rather favorably with the record of 333-335 kw.-hr. per barrel achieved by two high-economy 10,000-kva. steam-turbine stations installed elsewhere in Arizona.

The cost of replacements during year was $11,770.89. Although comparatively large, this was due to the engines being of the earlier type, they having been built during the rapidly changing development stage. This was contributed by Frank E. Russell, manager of the Tucson Gas, Electric Light & Power Company.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Static Condenser Table for Correcting Power Factors of Motors

TO SHOW quickly what size of static condenser is required to raise the power factor of motor circuits the accompanying table has been prepared. When the motor input and power factor are known the table will give the necessary condenser capacity to increase the power factor to any desired value. The table applies to a unit input of 1 kw. at any power factor from 40 to 100 per cent. Exact condenser sizes are given to raise these values to 80, 90, 95 and 100 per cent. For an input over 1 kw. it is necessary to multiply the values for condenser sizes by the kilowatts input.

POWER-FACTOR CORRECTION FOR INDUCTIVE MOTORS BY USING STATIC CONDENSERS

The figures multiplied by the kilowatt input give the necessary condenser kva. for correction from one power factor to another. These figures are the difference of the tangents of the angles whose cosines are the power factors used.

Initial Power Factor Per Cent	Final Power Factor, Per Cent 100	95	90	80	Initial Power Factor Per Cent	Final Power Factor, Per Cent 100	95	90	80
40	2 291	1.962	1.806	1.541	70	1.020	0.692	0.536	0.270
41	2 225	1.897	1.741	1.475	71	0 991	0.763	0.507	0.241
42	2.160	1 832	1.676	1.410	72	0.964	0.636	0.480	0.214
43	2.099	1.771	1 615	1.349	73	0.936	0.608	0.452	0.186
44	2.041	1.713	1.537	1.291	74	0 908	0.580	0.424	0.158
45	1.984	1.656	1.500	1.234	75	0.882	0.554	0.398	0.132
46	1.930	1.602	1.440	1.180	76	0.855	0.527	0.371	0.105
47	1.878	1.550	1.394	1.128	77	0.828	0.500	0.344	0.078
48	1.827	1.499	1.343	1.077	78	0.802	0.474	0.318	0.052
49	1.779	1.451	1.295	1.029	79	0.776	0.448	0.292	0.026
50	1.732	1.404	1.248	0 982	80	0.750	0.422	0.266	.....
51	1.686	1.358	1.202	0 936	81	0.723	0.395	0.239	.....
52	1.642	1.314	1 158	0.892	82	0 698	0.370	0.214	.....
53	1.600	1 272	1.116	0.850	83	0.671	0.343	0.187	.....
54	1.558	1.230	1.074	0.808	84	0.646	0.318	0.162	.....
55	1.518	1 190	1.034	0.768	85	0.619	0.291	0.135	...
56	1.479	1.151	0.995	0.729	86	0.593	0.265	0.109	.....
57	1.441	1 115	0.957	0.691	87	0.566	0.238	0.082	.....
58	1.404	1.076	0.920	0.654	88	0.539	0.211	0.055	.....
59	1.368	1.040	0.884	0.618	89	0.512	0.184	0.028	. .
60	1.333	1 005	0.849	0.583	90	0.484	0.156	.....	.....
61	1.298	0.970	0.814	0.548	91	0.455	0.127	.....	.....
62	1.265	0.937	0.781	0.515	92	0 426	0.098	.....	.....
63	1.232	0.904	0.748	0.482	93	0.395	0.067	.....	.....
64	1.200	0 872	0.716	0.450	94	0.362	0.034	. ...	.
65	1.169	0.841	0 685	0 419	95	0.328	..	.....	. .
66	1.138	0.810	0.654	0.388	96	0.291	.	. ...	
67	1.108	0.780	0.624	0.358	97	0.250	.	...	
68	1.078	0.750	0.594	0.328	98	0.203			.
69	1.048	0 720	0.564	0.298	99	0 142		. .	.

Take, for example, a 5-hp. motor operating at half load. The input, which can be taken either from a meter or figured from the efficiency table of the manufacturer, would be 2.194 kw. with a power factor of 55 per cent. It is desired to correct this motor to have a 90 per cent power factor by using static condensers connected directly to the machine circuit. Multiply 2.194 by 1.034, the figure in the table at 55 per cent initial power factor for a correction to 90 per cent. This gives 2.269 kva., the size of condenser necessary.

National Electric Condenser Co., J. L. MERRILL.
Philadelphia, Pa.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

A Program for Obtaining More Power Business

Some Timely Suggestions Presented by George H. Jones of the Commonwealth Edison Company Before the Recent Joint Convention of Illinois Utilities in Chicago

A CASUAL observer might wonder how a campaign for "more business and better business" can be put on in the industrial field at a time when business in general is "marking time," to say the least. A close analysis of the situation, however, will convince one that there are great possibilities in spite of unfavorable conditions. The whole situation has changed radically during the last two years. During the war and the period shortly thereafter business was being forced upon us. In fact, the time arrived in many cases when we were forced to refuse all business that was not of the most urgent necessity to supply. Today we are facing an entirely different situation. There are, as a rule, no urgent demands for power. In the meantime the central-station companies have, as a whole, installed additional equipment both in generating capacity and distribution system, so they can take on new business and are anxious to do so. We, therefore, have not only new generating units, but the falling off of business in general has released other equipment, so that it is incumbent upon us to use our best brains and effort to get new business. As a suggested program to accomplish that result I offer the following:

G. H. JONES

1. The first thing to be done in this connection is for the power salesmen to "sell" themselves on the idea that a business-getting program can be put on at this time. This is of prime importance because if we go out in a half-hearted way we can accomplish nothing.
2. The next step is to make a survey of all power "prospects," analyzing each one, the idea being to lay stress on those classes of business that will give the most desirable load. In this connection I should like to point out that in view of the present cost of generating equipment it is more desirable than ever to obtain business that is off-peak in its nature. Attention should, of course, be paid to other classes of business, even though they are not so desirable, our slogan being "Electric service for every requirement."
3. Map out a publicity campaign using the newspapers and personal letters followed up by personal solicitation.
4. It is especially desirable at this time to keep in touch with the architects, as they are developing plans for numerous projects which will in all probability be launched within the reasonably near future.

Probably the most fertile field in which to start our work is that of the isolated plant. Although the cost of operating these plants has doubtless been reduced somewhat during the last few months, owing to the lowering cost of coal and supplies, yet in every case that has come to my notice these operating costs are still very high; so that there is no doubt that a central-station company can be of real service to owners of isolated plants.

At this time all managers of isolated plants are looking for economies and will gladly listen to what we have to say along these lines. Possibly they are reluctant to call upon us owing to the fact that for years they may have turned a cold shoulder to our proposition. As an example, I might cite a case that came to my attention some little time ago involving a large industrial plant that was operating a modern, highly efficient turbine station.

On being approached recently regarding the matter of power, the manager of this plant was found to be in a very receptive frame of mind and, in fact, stated that he had been wondering for some little time why the central-station people had not been around to see him in regard to the power situation. Doubtless there are many owners of plants who feel this same way. The experience we have had with our present customers has demonstrated beyond a doubt that we rendered them a real service when we induced them to enter into a contract with us. We can, therefore, go with confidence to these isolated-plant people and without doubt secure a very good load during the next few months.

Growth of Southern California Edison's Customer Ownership

STOCK-SELLING activities of the Southern California Edison Company, as indicated by the number of dividend checks sent out to its consumer-stockholders on Feb. 15, points to the rapid growth of home ownership of this utility. Statistics compiled by Vice-president A. N. Kemp, in charge of the company's financing, show that the company has 25,000 stockholders residing in the ten counties of southern and central California in which it supplies electric service as against 2,000 stockholders residing outside of the radius of its operations. This condition is the result of the company's aggressive campaign for new stockholders carried on in 1921, whereby the number of stockholders was increased from 7,169 to 26,889, or by 370 per cent.

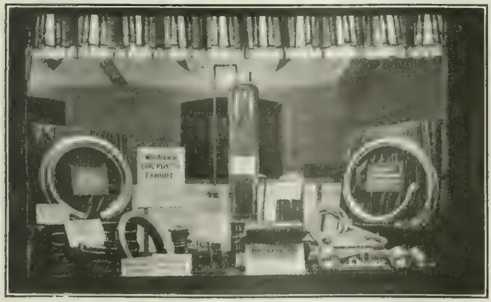
The total amount paid out by the Edison company in dividends for the first quarter of this year amounts to $621,000. The company has 20,789 consumer-stockholders in its twenty-eight districts, in addition to approximately 4,100 employee-stockholders, bringing the total stockholders residing in the territory served by the company to 24,889. Only about 2,000 stockholders in the company reside outside of the territory which it serves. The total number of dividend checks mailed on Feb. 15 to resident and outside stockholders was 26,889. On March 15 the total number of stockholders had increased to 27,831. During the past year the company financed development and extensions for more than $17,000,000 from the sale of its common stock at a price only slightly below par, at a time when the general market reached its lowest level for industrial and utility securities. The sales during 1921 were made at retail by the company through its own securities department and its employees' organization and by conservative and judicious advertising.

On Feb. 1 the company limited the amount of stock to be purchased by any subscriber to twenty shares. It fixed the amount of stock to be sold during 1922 at 75,000 shares, and, judging by the present demand, it would all be disposed of in a short time if the limitation as to the amount sold to one person had not been made. The idea of limiting the sales was to make the stock available to the greatest number of people. The effect has been to add twenty California stockholders to every one in the East.

This year the Edison company expects to spend $22,534,000 for new water-power plants and distributing lines to provide for the expected addition of 50,000 new consumers. Of the total construction expenditures, more than $10,000,000 will go for labor, in addition to the regular operating payroll of $5,500,000.

More Co-operative Window Displays at Hartford

REFERENCE has already been made in these columns to the displays of local manufactured products in the windows of the Hartford (Conn.) Electric Light Company, those products being selected from establishments using central-station energy. This co-operative publicity has been continued and has attracted a great amount of interest in Hartford because of the striking displays of "home-made" products, often of a national reputation. One of the recent displays showing heating equipment and related products of a Hartford concern is pictured here.



DISPLAY OF PRODUCTS MANUFACTURED BY ONE OF THE HARTFORD COMPANY'S CUSTOMERS

Six-Day Electrical Show at Providence Draws 12,128 Visitors

ANOTHER example of the sales and educational value of an electrical show is seen in the recent experience at Providence, R. I. Under the auspices of the Rhode Island Electrical League, this, the first, electrical show at Providence was visited in six days by 12,128 persons, and when the show closed after a week's run Manager N. I. Allen stated that the sales consummated by the exhibitors indicate that it was a complete success financially. The illustration shows a corner of the show, which was held in the ballroom of the Providence Plantations Club.

PARTIAL VIEW OF PROVIDENCE'S FIRST ELECTRICAL SHOW

What Other Companies Are Doing

San Diego, Cal.—To improve its present system of employee identification the San Diego Consolidated Gas & Electric Company has distributed numbered and registered identification badges to meter readers, troublemen, inspectors and others calling upon the public. As customers generally hesitate to demand an employee's credentials, the employees have been requested to display their badges at all times.

New Orleans, La.—The people of New Orleans are to have an opportunity of seeing for themselves the advantages and comforts of the latest electrical appliances for the home. The Electrical League of New Orleans plans to open an electrical home, and at a recent meeting the executive committee of the organization it was ordered to make complete arrangements for the equipment of this method of electrical demonstration, which is new to New Orleans. The home will be opened to the public Sept. 1.

Minneapolis, Minn.—The commercial department of the Northern States Power Company reports another record-breaking year for 1921. In spite of the fact that most businesses and industries suffered somewhat because of the depression, the company shows a gain of 14,459 electric customers, with 27,803 kw. in lighting and 21,110 hp. in motors.

Worcester, Mass.—A twenty-seven-day campaign for house-wiring started on the Worcester Electric Light Company's system March 27, the feature of note being a credit allowance on the wiring bill equal to the total amount paid the company for the first five months' use of electricity. A first payment of $5 is required, with the balance of the payments spread over a maximum period of one year.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Influence of the Underwriters' Inspection on Quality

By W. E. Robertson
General Manager Robertson-Cataract Electric Company, Buffalo, N. Y.

At the time the Underwriters' Inspection Bureau was organized several years ago—and the matter of going into the bureau was a debatable one on the part of certain manufacturers — it was pointed out that those manufacturers who had sold goods on quality and had received more for the goods by reason of the recognition by the trade of the high quality of their product would throw away the benefits which they had gained by years of advertising quality and actually showing it in their product. Some of the manufacturers felt that this position was well taken, but that it was more than offset by the consideration that if all manufacturers had to maintain a certain standard of quality in order to have their product used it would tend to reduce competition. This seemed to be especially true in the manufacture of rubber compounds used for insulating purposes, whether on wire or other materials.

W. E. ROBERTSON

Soon after the Inspection Bureau was established the difference in price which the quality manufacturers formerly enjoyed disappeared, and it was also found that the standard of the Underwriters' Bureau was no deterrent in keeping other manufacturers out of the field, as no manufacturer who wanted to enter into competition with existing manufacturers seemed to have difficulty in finding the necessary technical help to produce an article which would meet the Underwriters' requirements. Instead, therefore, of helping the quality manufacturers the bureau proved to be a source of distinct loss to them.

Insurance companies, which maintain the bureau for their protection, are interested primarily, and should be solely, in establishing standards that reduce the fire hazard to a reasonable minimum. No one should attempt to use this bureau for any other purpose, because to do so will result in inevitable disappointment.

With the present method of protecting each circuit against overload by proper fuses the insulation on most wires used for interior purposes is of little or no consequence, because bare wires could be used with equal safety from a standpoint of fire hazard. When it comes to safety switches, these are for the reduction to a minimum of losses from accidents and not from fire. Of course, where wire is used in damp places the rubber insulation is valuable, but even here it is of little practical value from a fire-protection standpoint, because fuses protect the circuits; the insulation simply reduces to a minimum the blowing of fuses due to short circuits. There is very little needed today for improvement in passive things, such as cables, conduits, fuse blocks, etc., but there is a distinct need of improvement in things that are movable, such as the springs in key and pull-chain sockets, snap and push-button switches, the contact points in switches, flatirons, toasters, etc.

The standard of the Underwriters' Bureau must always be the minimum requirements from an insurance standpoint. To make these standards unnecessarily high would be to increase inexcusably the cost of installation, thereby reducing the use of electricity, and anything that unnecessarily tends to reduce the use of electricity is a disadvantage to the industry as a whole, although it may be an advantage to a particular manufacturer or group of manufacturers.

How to protect the honest manufacturer of quality goods from the claims of equal quality on the part of the outlaw manufacturer is a big problem, and one which cannot easily be solved by the Underwriters because, primarily, that is not their function. A certificate as to quality from an absolutely honest, impartial and fearless testing laboratory might be the solution.

Guarantees of service from the manufacturer or his distributers extending over a period of years are unwise as well as impracticable, because of the difficulty of arriving at the exact facts in order to make adjustments. The best solution of this intricate problem seems to be found in providing the quality and increasing the price to a point which will not only cover the cost of the improved quality but the cost of selling this knowledge to the trade and through it to the public. The manufacturer who is determined to produce quality goods as the foundation on which he wishes to base his success should set aside as a capital expenditure a substantial sum for advertising purposes, this sum to be written off over a period of years in the same way that depreciation is provided for out of earnings.

It would not take many years to sell quality goods to the trade, because most men in trade are honest and will not knowingly sell an inferior article to a customer. The time will never come when quality goods will be exclusively used, because there is always the outlaw manufacturer, the outlaw jobber and the outlaw contractor who have but one object in life and that is to make the immediate dollar on the theory that after them comes the deluge. The great majority, however, of all manufacturers, jobbers and contractors are honest men who take pride in their business and their self-respect.

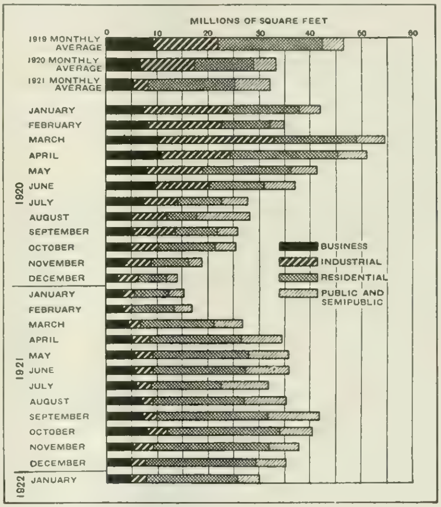
Direct Sales to Dealer and Good Servicing the Key to Large Appliance Business

By a Manufacturer

THERE is nothing more vital to the manufacturer of an appliance than his responsibility to the ultimate user of his goods. He must "make good" to the women who buy his sweeper or his flatiron or his washing machine not only in 100 per cent quality but in all the local service they are entitled to and in a responsibility to stand behind that appliance just as long as it may last in service. It should be the first consideration and the last consideration to every manufacturer and also to every retailer or wholesale distributer who sells the goods.

For that reason it has been my experience that the manufacturer of large electric labor-saving appliances should if possible obtain direct contact with the user by the maintenance of retail stores that may themselves market the goods to the household without any other handling on the way from the factory. Service is so important that every bit of profit which the appliance can pay should be retained by the manufacturer himself for appropriation in local selling and in local service. Not that electrical devices of today are costly in servicing, for the amount of service needed because of defects in the machines themselves is exceedingly small. But the sales opportunity offered by the thorough schooling of this new customer in the use of the machine is of tremendous value. Not only does it insure satisfaction with the appliance but it guarantees other sales as a product of the enthusiasm of every well-schooled user. And it upbuilds a contact and a friendship that inevitably lead to the sale of other appliances needed in the gradual complete equipment of the house.

Volume of Building Contracts Awarded



THE impression is strong in every man's mind that building is increasing, but here is a clear picture of just what is happening. Contracts awarded in January of this year totaled $166,320,000, against $111,608,000 in the same month in 1921, and every new house built adds to the market for electric service, equipment and appliances. This chart is a clear picture of opportunity for electrical men.

It pays, therefore, to put every dollar possible into the servicing of the machine, and it does not seem to be possible to provide sufficient spread to share profit in distribution through the ordinary electrical trade channels and have left to do the local job. If the dealer is established so that he is purchasing in carload lots, the warehouse function of the jobber is, in my opinion, not needed. But the dealer must provide a volume that will hold down the costs of delivery, and he works close enough to the manufacturer to function as his store in all that is needed to maintain the manufacturer's responsibility to the user.

The department store cannot service electrical appliances. The jobber is not equipped or organized to do it either. But the dealer can, and if he does his full job of selling and servicing, his opportunity can be unlimited and he is entitled to all of the profit which the manufacturer can figure in. Volume of sales demands that the price be not too high. Volume of sales is essential if the cost is to be kept low. The development of the largest possible volume of sales depends inevitably on the free flow of goods from the manufacturer to the local store and prompt sales through the skillful servicing of all machines that go into the town.

Large Electrical Appliances Not Profitable to Some Department Stores

MANY and widely varying estimates have been made of the value of the department store as a factor in the sale of electrical appliances. It was reported one New York department store was purchasing washing machines in trainload lots and that another store had sold 60,000 vacuum cleaners in twelve months. Theodore E. Burger, secretary of the Society for Electrical Development, undertook to verify these figures and his comments upon what he found are particularly interesting. He says:

> In investigating these two statements I discovered, in the first instance, that the particular store which was supposed to be doing a land office business in washing machines had never purchased but one carload of washing machines at a time, and when I visited them I learned that they were so disgruntled over the doubtful feasibility of profitably merchandising large electrical appliances that they had but recently decided to discontinue handling both washing and ironing machines.
>
> In the second case cited, I found that the department store which was accredited with having disposed of sixty thousand vacuum cleaners in twelve months had in reality actually marketed only thirty-three hundred during that period, and that a considerable portion of this number had been sold at "sales," meaning at very-much-marked-down prices. I found this same store was displaying an ironing machine on which the customary retail price had been cut one-third. Inquiry led to the discovery that even at this marked-down price they had only sold one machine in thirty days. This store was in the same condition of mind as the former one was with regard to the larger electrical appliances.
>
> Definite information has also been secured from a number of department stores which are losing out in the departments devoted to large electrical appliances because they find an insufficient profit in the line to justify the space occupied by the goods. Pianos occupy more floor space, but the spread for the retailer is sufficiently great to justify the space. This seems to be a definite trend among a number of large department stores which have been disappointed in the relation of the floor space required and the profit on the large electrical appliances.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Transformer Oil Under Low Temperatures.—G. BRÜHLMANN.—An investigation of the effects of thickening upon the performance of oil-insulated transformers and oil circuit breakers is reported in this paper. The thickening or even the freezing of oil in self-cooled oil-insulated transformers is of no great danger, as the overheating, due to the impeded cooling action of thick oil, is of comparatively short duration. It might become dangerous in forced-oil-cooled transformers, as the thickened oil will find a great resistance in the flow through pipe lines. The heat generated by the iron losses alone will prevent a transformer from freezing. In no case should oil be used with a thickening point above 4 deg. C. Far greater is the danger of frozen oil in oil switches, as it will slow down the motion of the contact level and will be much slower in flowing between the contacts to quench the arc. This might cause a destruction of the switch and consequent ignition of the oil. An actual test showed, for example, that a switch takes 80 per cent longer time to open if operated at —8 deg C. with an oil that begins to thicken at —3 deg. Almost twice the normal amount of gates was generated under similar conditions. Six curve diagrams illustrate these different conditions. For the above reason it is essential to examine oils for transformers and switches in a testing apparatus for their characteristics under low temperatures. A simple and reliable "cold test" for oils is described, measuring the time the oil needs at different low temperatures to flow a distance of 40 mm. under a pressure of a 400-mm. water column.—*Brown-Boveri Mitteilungen*, January, 1922.

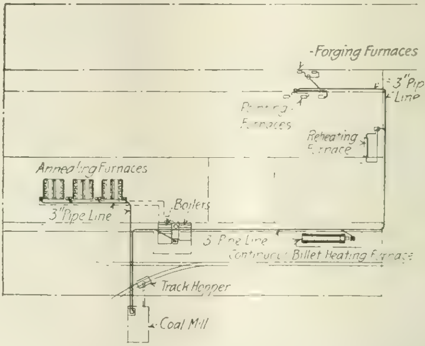
Lamps and Lighting

The Lighting of Retail Stores.—Retail stores may be divided into three classes according to quality and direction of the lighting required. These are (a) those whose unchanging floor or counter operations require a particular location of the light sources, (b) those for which general illumination with the most convenient symmetrical placing of the outlets is satisfactory, (c) those in which artistic and decorative appearance is the chief consideration. For these three classes the article discusses the amount of illumination required, type of lighting unit to use, wiring and control, color matching and color quality.—*Bulletin E-102 of the Westinghouse Lamp Works.*

Generation, Transmission and Distribution

Solving the Problem of St. Lawrence River Navigation.—CHARLES P. LOVELAND.—The author analyzes the shortcomings of the various schemes that have been proposed and questions the value to navigation of side canals. He gives his proposal for the permanent improvement of navigation between Lake St. Peter and Lake Ontario, including the major undertakings necessary.—*Canadian Engineer*, Jan. 31, 1922.

Preparing and Distributing Powdered Coal.—E. C. GREISEN.—A description of the powdered-coal installation tried out at the West Jefferson Avenue plant of the Detroit Seamless Steel Tubes Company. In this system the coal flows into a track hopper and then, by means of a pan conveyor, to a spiked-tooth crushing roll that breaks the coal up into pieces of 1¼ in. and finer. From this crusher the coal is carried by an elevator to the top of the building and then by means of a conveyor is dumped into a bunker. Bin gates allow the coal to flow from here onto a belt conveyor at the end of which is a coal disintegrator which reduces the 1¼-in. coal to ½ in. and finer. It then passes through an Ebro type dryer to an elevator that carries it to the final pulverizer. From here it flows by gravity into the storage bin which feeds the distributing line to the furnace. The results were so satisfactory that this system has been adopted in the plans for the new Warren Avenue plant of this company.—*Iron Age*, Feb. 2, 1922.



LAYOUT OF PIPE LINES AND CONNECTIONS TO DISTRIBUTING SYSTEM IN POWDERED-COAL INSTALLATION

Traction

Mercury-Arc Rectifier for a Swiss Street Railway.—Owing to the large increase of traffic on the Bern-Muri-Worb street-car line in Switzerland, it was necessary to enlarge the capacity of the feeding substation at Worb, which contained two motor-generator sets of 100 kva. each, operating in parallel with a 330-cell, 259-amp.-hr. storage battery. The contemplated augmentation of this station would have called for an additional 200-kva. unit and at the same time an increase of the direct-current voltage from 650 to 750. It was also intended to change over from 40 cycles to 50 cycles. The new generator would have had to be wound so as readily to permit these changes. After studying the situation the railway company decided to install one large mercury-arc rectifier, rated at 225 kw., at 750 volts direct current. The efficiency of this rectifier, measured between the terminals of the 15,000-volt feeding transformer and the 750-volt direct-current busbars, amounts to 94.5 per cent at full load, including the consumption of all auxiliary apparatus, and to 93.7 per cent at one-quarter load. These are values not even reached with a rotary. The rectifier will operate in parallel with the existing motor-generators and the battery. A considerable current economy is expected.—*Brown-Boveri Mitteilungen*, December, 1921.

Installations, Systems and Appliances

Over-All Cost of Heat-Treated Parts.—C. I. IPSEN.—As the higher-priced, improved heat source has successfully withstood the competition of existing fuels, it is evident that there are other factors of greater importance in the heat treatment of steel than furnace operating costs. Most prominent among these other factors are reduced cost of subsequent operation, reduction in the number of rejections and increased life of products, with more satisfactory service. To determine to what extent these factors will overcome higher furnace operating costs an accurate cost analysis is necessary. The accompanying table shows accurate costs of several familiar heat-treated parts, together with the cost of heat treating, as well as the cost of electricity used as a heat source. Attention should be directed particularly to the last column, in which is shown the part that electricity plays in the ultimate cost. The electric power rate for all items in this table is taken at 1½ cents per kilowatt-hour.—*Iron Age*, Feb. 16, 1922.

COST FIGURES FOR HARDENING AND DRAWING STEEL SHOW THAT SUBSEQUENT OPERATION MUST BE CONSIDERED

Item	Part	Factory Cost of Parts	Cost of Heat Treating	Cost of Electricity for Heat Treating	Electricity in Per Cent of Total Cost
1	Segment combination die	$1,380	$13.50	$4.16	0.3
2	Segment combination die	1,138	12.00	3.70	0.32
3	Round blanking die	638	5.03	1.50	0.23
4	Segment blanking die	782	9.45	2.92	0.37
5	Die	795	10.53	3.43	0.43
6	Die	875	8.66	2.67	0.3
7	Gear	234	13.00	3.70	1.5
8	Gear	263	15.00	4.44	1.7
9	Gear	338	21.00	6.25	1.8
10	Gear	391	26.00	7.60	1.9
11	Gear	455	30.00	9.06	2.0
12	Die block	110	1.75	0.65	0.6
13	Gear*	5†		0.03	0.6
Totals of all above		$7,404	$165.92	$50.11	0.68

* Hardening only, without drawing † Estimated

Wires, Wiring and Conduits

Extreme Sensitiveness of the Action of Reducing Atmospheres Upon Heated Copper.—T. S. FULLER.—The breaking of copper, notably in the form of wire, when subjected to constant movement or vibration is a source of much trouble and expense. The author not only explains the reason for this brittleness but indicates the cure. He points out that very slightly reducing atmospheres for long periods of time have much greater effect than highly reducing atmospheres for short periods of time.—*General Electric Review*, March, 1922.

Laying of High-Tension Submarine Cables.—L. KUNST.—This paper contains information on experiences met in installing submarine power cables in Scandinavian waters. Data are given on one 10,000-volt and one 20,000-volt three-phase cable of 1,900 m. and 1,500 m. length respectively. The arrangement of a floating 45,000-volt, 150-kva. testing apparatus used on the 20-kv. cable is of interest.—*Siemens Zeitschrift*, January, 1922.

Units, Measurements and Instruments

Calibration of Electric Meters on the Customers' Premises.—W. JANVIER.—With the aid of one or two small portable instrument transformers an auxiliary current may be superimposed, or, as the author calls it, "injected," into the meter, and by proper arrangements any desired load conditions may thus be obtained from leading to lagging current. Connection diagrams for different cases are given.—*Revue Générale de l'Electricité*, Feb. 4, 1922.

The Essentials of the Radio Compass.—LIEUT. JOHN E. WILLIAMS.—An explanation of the theory and application of the radio compass and the practicability of its use on board ship as a vital element of naval strategy.—*United States Naval Institute Proceedings*, February, 1922.

Telegraphy, Telephony and Signals

Resistance Neutralization.—EDWARD BENNETT and L. J. PETERS.—This paper enters into a detailed and quantitative treatment of resistance neutralization with special reference to its application in increasing the collective properties of radio receiving circuits. The subject is treated under three general heads. First, the general theory of resistance neutralization is developed, the conditions being stated which a device must fulfill in order to function as a resistance neutralizer toward a circuit with which it is associated. The second part shows how triode circuits may be designed to fulfill the conditions developed in the general theory and thus how these circuits may be made to function as resistance neutralizers. The third part treats of the effects of resistance neutralization upon the abstractive and selective properties of radio receiving circuits.—*Journal of the A. I. E. E.*, March, 1922.

Miscellaneous

The Past Year in English Practice.—With a few exceptions the year 1921 was the very worst within memory, industrially speaking. This was caused very largely by the coal strike that lasted for thirteen weeks. Very few extensions were made in power plant practice. The water-power resources commission published its final report during the year, and as a result considerable developments in the use of water power may be expected. The financial devastation caused by the war had a disastrous effect on the fortunes of the smaller electricity supply undertakings, especially those in private hands. Nothing was done about the electric traction problems, several extensions that were planned being held up on account of the financial conditions. There was a decided growth in the Institution of Electrical Engineers, and this is now the largest and most progressive of the great technical bodies in England.—*Electrician* (*London*), Jan. 6, 1922.

Development of Electrical Supply Undertakings in Germany.—The extreme difficulty experienced ever since the conclusion of the armistice in obtaining supplies of fuel, chiefly black coal, has brought about a displacement of economic factors in Germany the effects of which are more especially felt in Bavaria. This has caused a development of all possible water powers, among which is the Walchen Lake scheme, a development of 120,000 kw. Another installation will develop 90,000 kw. on the River Isar between Munich and Moosburg. A project is also under way on the River Inn between Jettenback and Taglid, which will have a capacity of 25,000 kw.—*Beama*, January, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Revival of German Patent Convention Raises Protest

ACTION by the Senate authorizing the President to revive the patent convention entered into with Germany in 1909 has raised a storm of protest. As a result it seems probable that, pending an investigation, the President will withhold the notice reviving that treaty.

The 1909 patent convention with Germany provides that in case the United States should amend its patent laws by the insertion of a working clause this legislation would not apply to patents of German origin. The agreement is reciprocal.

Chief sentiment for the revival of the treaty of 1909 is said in Washington to exist in the electrical industry, while it is being fought by the domestic chemical industry. The situation is made the more serious by the determination of Senator Ladd of North Dakota to push his bill requiring that patents be worked within certain periods or be forfeited. Senator Ladd is convinced that there is a growing sentiment in this country for the addition of a working clause to the patent code.

Chicago Convention of A. I. E. E. to Discuss Broad Subjects

IN CONTRAST with the program of the midwinter convention of the American Institute of Electrical Engineers, held in New York last February, which was made up largely of specialists' papers, the spring meeting called in Chicago for April 19, 20 and 21 will be more than half composed of symposiums on broader subjects. The tentative program for this convention is as follows:

WEDNESDAY, APRIL 19

Afternoon. — "The Electric Hammer," by P. Trombetta; "A Relay Recorder for Remote Control by Radio," by F. W. Dunmore; "Magnetic Flux Distribution in Transformers," by K. B. McEachron.

THURSDAY, APRIL 20

Morning.—"Air-Break Magnetic Blowouts for Contactors and Circuit Breakers, Both Alternating-Current and Direct-Current," by J. F. Tritle; "The Effect of High Current on Disconnecting Switches with Special Reference to the Mechanical Stresses Resulting," by H. C. Lewis and C. T. Sinclair.

Evening.—Symposium on the transmission of energy from coal mines to large centers of distribution.

FRIDAY, APRIL 21

Morning. — "Selection of Electrical Apparatus for Cranes," by R. H. McLain; "Selection of Electrical Apparatus for Cranes," by H. W. Eastwood; "Control Equipment for Cranes," by J. F. Schnabel; "Application of Electric Power to Passenger and Freight Elevators," by H. P. Reed.

Evening. — Symposium on the proposed St. Lawrence seaway.

Some of the phases to be discussed by prominent engineers in the Thursday evening symposium are the transmission of energy in the shape of coal hauled in cars, of powdered coal in pipes, and of electricity. On Friday evening the navigation possibilities of the St. Lawrence project, its power possibilities, engineering plans and the viewpoints of the government, of the New York Barge Canal authorities, of financial interests and of power users concerning it will be discussed. Promises to take part have already been received from Julius Barnes, H. I. Harriman and Hugh L. Cooper.

Wednesday evening will be spent in social enjoyment, and Thursday and Friday afternoons in visits to local places of interest.

New York State Water-Power Act Amended

AMENDMENTS to the New York State water-power act of last year, signed this week by Governor Miller, increase the power of the state in the regulation of rates and service of licensees. Those companies which previously held legislative grants to develop water power and have not developed those projects are brought under the provisions of the water-power act. The state also has tried to safeguard its right of recapture by requiring a deduction of earnings in excess of 8 per cent.

The Governor at the time of signing the bill said that the wise policy is to encourage development by private enterprise in such fashion as to insure the maximum development and the maximum general benefit. Should the amendments prevent capital from investing in the enterprises, the Governor said that it will be necessary to consider the alternative of state development.

Supreme Court Asked to Pass On Valuation Questions

THE Georgia Railway & Power Company, the Atlanta Gas Light Company and the Railroad Commission of Georgia have, owing to confusion in the federal court, jointly appealed to the Supreme Court of the United States to pass on the four following questions:

(a) Whether the State Railroad Commission in fixing the present value of property has the right to disregard the advance in value since 1914.

(b) Whether it is the duty of the State Railroad Commission in fixing the value of the property of public service corporations to consider the value of the special franchises thereof.

(c) Whether the normal federal income tax should be included as part of the operating expenses of public service corporations.

(d) Whether the original cost of financing should be considered by public service commissions in fixing the value of the property of public service corporations.

It is pointed out by the counsel for the appellants as well as the attorney for the appellee in the suit where these issues are involved that they are of great public interest, since they arise in a very large percentage of the cases before public service commissions, and that their final determination is of pressing importance not only to the public service corporations but to the various states as well.

Electric Utilities' Coal Reserve Increased

ELECTRIC utilities as a class have larger reserves of bituminous coal, according to the Geological Survey, than at any other time of record. Reports to the survey from 808 representative plants show a stock sufficient on March 1 for fifty-four days. This is better than the condition on Jan. 1 by a three days' supply. Since March 1 stocks have been still further increased, but no detail figures as to industries are available. The Geological Survey estimates the total bituminous coal reserve on April 1 to exceed that of March 1 by at least 20 per cent.

Broadcasting Over Electric Service Circuits Demonstrated

ELECTRIC light companies will now be able to furnish broadcasting service to their patrons through their lamp sockets, according to Gen. George O. Squier, chief signal officer of the army, who demonstrated the feasibility of this operation in Washington last week. Practically any radio receiving set, it is claimed, can be used without antennas or wave filters by merely plugging into a service outlet. Furthermore, it is contended that the electric service circuits will have no distorting effect on the speech or music transmitted because the broadcasting will not have to extend over a radius of more than five to ten miles on most systems.

The text of the statement given out at the Signal Corps reads as follows:

> A demonstration was given in the office of the chief signal officer of the army of a new development in radio which is believed by experts to promise a great utility to everybody who owns an electric lamp. The congestion which has recently come about in the ether by the increase in the number of broadcasting stations promises to be relieved by this new use of "line radio" or "wired wirless."
>
> The demonstration consisted of receiving news, music, lectures and speech from the electric lamp on the desk of the chief signal officer, it having been broadcasted upon the lighting mains. No headpieces were required, and the standard receiving set with loud-speaking horn as furnished by the Westinghouse Electric & Manufacturing Company was utilized to illustrate the method.
>
> The whole operation of installing the device for receiving purposes merely consists of removing a lamp from any socket and inserting the receiving plug instead, exactly in the same manner as an electric flatiron or carpet sweeper is connected.
>
> This invention brings to every home, and in fact to every room in every home where there is an electric lamp, this broadcasting service. The great feature about it is that it permits local broadcasting service without paying the penalty of broadcasting in space from the usual antenna, which has resulted already in so much confusion.

The office of the chief signal officer is not ready to announce the details by which this service is made possible. A report is expected soon showing how the high-frequency currents will be carried past transformers and other apparatus having high impedance, the methods of avoiding distortion of speech, and the effects of circuit transients on broadcasting service.

Superpower Plants Justify Themselves in Coal Emergency

EVIDENCE as to how a superpower system can meet an emergency and prove to be of great economic value is given in a statement this week by George Otis Smith, director of the United States Geological Survey, one of the functions of which is to gather coal-production statistics for the country. The Geological Survey was also the body that conducted the Boston-Washington Superpower Survey. As the coal strike starts Director Smith points out that the large plants not only use less coal per unit of energy but are also plentifully supplied to withstand a long strike. By storing coal in such large quantities these superpower stations also help to stabilize the coal industry.

"The coal miners' strike," said Mr. Smith, "brings home to the public a clearer realization of what makes the wheels go round. Our dependence upon motive power, and consequently upon coal as the chief source of that power, has given us problems that were unknown to our fathers. Today much of our national welfare depends upon how much coal is in the possession of the consumers and how long it will last them.

"In generating power the big steam plant uses far less coal than the small plant to get the same results —the government's superpower report showed that conclusively—and now the coal-stock returns made to the United States Geological Survey show no less emphatically that the larger power companies have been the most careful in their preparation for the immediate future. Even though most of the coal mines of the country should remain closed down for three months, the citizens of the larger cities need fear no interruption in their light and power service. Analysis of the reports of coal stocks in the five leading Eastern states on March 1 shows that while the state averages for all public utilities ranged from forty-eight to seventy-one days' supply, the fifteen or twenty larger power companies each had enough coal in storage to last them from ninety to 160 days, and the condition of their coal piles today is known to be even better.

"This strong position of the electric utilities not only shows that they are living up to their 'public service' responsibilities but gives point to the claims of the superpower project. The generation of electricity at superpower stations of large capacity will mean using relatively much less coal and storing relatively much more coal than small individual plants. An incidental but no less far-reaching advantage of this proposed large unit electrification of the Boston-Washington Superpower Zone would be the helpful influence of the large storage upon the coal industry itself, tending to shorten the periods of idleness, for it is this seasonal idleness of the mine workers which now adds so much to the cost of coal. So there is large economic significance in the fact that the largest power plants have made the best preparation for the threatened coal shortage."

Bill to Create Public Utilities Commission Defeated in Mississippi

A BILL to establish a public utilities commission in Mississippi to take the place of the Mississippi Railroad Commission was defeated recently in the Legislature of that state. It was proposed to give to the new body, had it been set up, jurisdiction over light, power and street-railway companies, which is not possessed by the existing body. The committee that framed the bill also reported impeachment charges against George R. Edwards, chairman of the Railroad Commission, one of the accusations against him being based upon his attitude toward the Cumberland Telephone & Telegraph Company, to which a 20 per cent increase of rates was recently granted. Mr. Edwards resigned while the proceeding was pending.

Addition to Youngstown Plant Going Ahead Rapidly

THE Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, is rapidly pushing to completion an addition to its Lowellville power generating station to house an additional 18,750-kva. turbo-generator and auxiliary equipment. With the completion of this addition the station will have a generating capacity of 75,000 kva. Additional transforming capacity will also be added, consisting of two 15,000-kva., 2,200-66,000-volt transformer banks with the necessary control equipment.

Pennsylvania Utilities Get Good Start on Business Development Campaign

A MEETING of the Eastern Geographic Section of the National Electric Light Association was held at the Adelphia Hotel in Philadelphia March 23. The meeting was intended as a local starter for the national business-development campaign and was attended by more than 200 representatives of the public utility companies of Pennsylvania.

The first speaker at the morning session was M. C. Huse, assistant to the general commercial manager of the Philadelphia Electric Company, who emphasized the value of selling household appliances as the principal factor in the stimulation of business. The advantages of central plants over private plants were also discussed by the speaker.

Statistics brought up during the discussion showed that in one case there had been an increase of 44 per cent in the use of power through the sale of electrical appliances. The creation of new appliances, chiefly the new application of existing ideas, was advocated as a practical plan in the business campaign. The increase of appliances among industries was strongly favored, as the consensus of opinion showed that the industries do not need an abnormally low rate, but are more willing to spend money for their power than are the householders.

W. C. Wagner, assistant to the chief engineer of the Philadelphia Electric Company and formerly of the Bureau of Standards in Washington, D. C., was the second speaker. His topic was "The National Electrical Safety Code." He outlined the fundamental principles of the code and gave a brief review of its history.

A luncheon was held at noon and was addressed by Joseph B. McCall, president of the Philadelphia Electric Company, who dwelt on the optimistic outlook for the promotion of electrical projects and business expansion as the result of the easier financial situation.

G. B. Regar, illumination engineer of the Philadelphia Electric Company, was the principal speaker at the afternoon session, his topic being "Better Business Through Better Lighting."

Extensive Power Development Program for Northern Illinois

PLANS are being perfected by the Public Service Company of Northern Illinois, Chicago, for extensive power development, with an initial expenditure approximating $5,000,000 and an ultimate investment of more than $20,000,000, the company adding, under the latter cost, about 200,000 kw. in generating capacity. A new station will be constructed at Waukegan, Ill., with a capacity of 20,000 kw., to cost close to $3,000,000. The present transmission system will be increased from 20,000 volts to 33,000 volts. A new 20,000-volt power line will be constructed from Evanston to Desplaines, and a distribution line will be constructed as a loop, to include Evanston, Highland Park and Lake Bluff. A new 12,000-volt line will be built between Maywood, Oak Park, Elmhurst and La Grange, which, with substation equipment, will cost about $125,000.

The work will include an addition to the present generating plant at Blue Island, Ill., to cost in excess of $150,000, while a number of substations will be built at different points. These latter include a second substation in the Chicago Heights section, to cost $150,000; a transformer plant at Highland Park, costing $30,000; a 5,000-kw. substation at Cicero, to cost upward of $140,000; an addition to the transformer plant at Evanston to provide 5,000 kw. and cost $50,000; an addition to the transformer station at Maywood, with line extensions from this place to Oak Park and Blue Island, and the erection of a new substation at Barrington, replacing a plant recently destroyed, estimated to cost $75,000.

General Gas & Electric to Reclassify Stock on Non-Par Basis

TO PROVIDE for the resumption of dividends on its preferred stock and the gradual elimination of its bonded indebtedness and at the same time create a permanent financial structure the General Gas & Electric Company has submitted to its stockholders a plan for the reclassification of its securities. The plan as contemplated calls for the formation of a new corporation to be known as the General Gas & Electric Corporation, which will take over the assets of the present company.

A new collateral trust bond issue, authorized without limit as to amount and issuable in series differing as to maturity, interest rate and tax provisions, is provided for, partly to exchange $5,646,200 bonds now outstanding and to pay part of the cost of securities purchased by the new company to the extent of 75 per cent of the cost. The $816,125 7 per cent income bonds now outstanding are to be exchanged for non-par cumulative stock of the new company, at the rate of ten shares of the new stock for each $1,000 bond.

There will be 200,000 shares of non-par cumulative stock, with preference in event of liquidation, at the rate of $100 a share, divided into Classes A and B, the former entitled in priority to an annual dividend of $8 per share. Class B shall be entitled in preference and priority to any junior stock and to dividends at the rate of $7 per annum. The non-par convertible preferred issue will be limited to 100,000 shares and to 6 per cent non-cumulative dividends, and will have a liquidating value of $100 a share, after the cumulative preferred. The common stock of no par value will be limited to 100,000 shares, 45,154 shares of which will be exchanged on a share for share basis with the present outstanding $4,515,400 common.

In a letter to the stockholders explaining the proposed plan, W. S. Barstow, president of the company, says:

> At the present rate of earnings the receipts of your company are sufficient to leave a balance for the stockholders. In considering the disposition of this balance, the directors have sought in the plan proposed to protect the interest of the stockholders in every way possible. To pay out the entire balance of earnings as dividends on stock, with no provision made for the paying off of the bonded debt, when due, would imperil the principal of the stockholders. It was decided, therefore, that any plan looking to the future success of the company must provide for the gradual and permanent retirement of the bonded debt, while dividends were being paid.
>
> This provides a definite plan for the extension of the company's bonded debt and its gradual payment increases the actual value of the stock. If no such plan is in operation and the necessity of refunding should occur at a time and under conditions such as during the late war period, the principal of the stockholder might be entirely lost. With such a plan no refunding will be required, and every time a bond, which is the evidence of debt, is acquired and canceled, the actual value of the stocks is increased thereby.
>
> The plan also provides for the payment of one-half of the accumulated dividends over an extended period. This is accomplished by raising the dividend rate from $7 per annum to $8 per annum per share, on stock offered in exchange for one-half of the present cumulative preferred stock.
>
> The creation of non-par stock, which has been made possible by new state laws, will enable the company to extend its operations, and thereby increase its earnings. This change will not affect the liquidation value of the stocks as now issued, nor will it have any effect on their actual value.

Connection of City Plants of Seattle and Tacoma Proposed

RECOMMENDATION to connect the municipal electric light and power plants of Seattle and Tacoma, Wash., so that energy produced in either city can be made available in the other has been made by J. D. Ross, superintendent of lighting for Seattle, to the City Council of that place. This project, it is held, would provide an outlet for surplus power from Seattle's hydro-electric plant at Skagit River for two years after it is completed.

Mr. Ross asserts that by this means Seattle would be enabled to purchase from Tacoma considerable hydro-generated electricity during the summer months for about half what it costs to manufacture energy at the city's steam plant and could sell energy to Tacoma in the winter, when there is a surplus at Cedar River. Tacoma, on the other hand, could sell to Seattle its surplus energy at night and on Sundays during the winter, and during the summer could sell to Seattle surplus water power either day or night after Cedar River gets low.

Wisconsin Utility Associations Unite

RATIFICATION of the proposed amalgamation of the Wisconsin Gas Association and the Wisconsin Electrical Association, thus including both the light and power and the railway interests of the state in one association under the name of the Wisconsin Utilities Association, was the important event of the joint convention of the two associations at Milwaukee on Wednesday to Friday of last week. The headquarters of the new association will be at Madison, where the office will be in charge of John S. Cadby as executive secretary.

Inductive interference and overhead-line construction and maintenance problems formed the subject of the central-station group meeting on Wednesday. C. A. Wheeler of the Wisconsin Bell Telephone Company was called on to present the viewpoint of the telephone companies and responded by reading the report of the joint general committee of the National Electric Light Association and the American Telephone & Telegraph Company. Mr. Brainard of the Allis-Chalmers Manufacturing Company was present with a telephone interference-factor meter and described the instrument and its use. Professor Douglas of Marquette University called attention to the need of better design of rotating machinery looking toward the elimination of characteristics in such electrical equipment that might produce harmful harmonics.

TRANSFORMER TESTING

Closer checking of distribution transformer loads was urged, though R. L. Dodd of Milwaukee pointed out that there was no panacea for transformer testing problems in distribution work as none of the instruments used can be relied on alone to care for all conditions. The use of a thermometer, similar to a clinical thermometer, drew considerable attention as a means of checking transformer temperatures because, in using it as a maximum-temperature indicator, it was free from the disadvantage of having to be used in a vertical position. Tied to the end of a piece of cord to prevent losing it in the oil, this type of thermometer can be worked down into the coils and better temperature readings obtained. Another method that attracted considerable attention was one based on a periodical check of transformer loads from maps of the district served by each transformer. Services are counted from the records, and for residences allowances that range around 175 watts per residence consumer for lighting and ordinary load and from 400 watts to 500 watts for appliances are made.

J. E. Davidson, vice-president of the National Electric Light Association, called attention to the constantly improving financial position of the central-station companies, as evidenced by the study of forty-five utility issues of securities that as of July 1, 1920, averaged 7.7 per cent and on March 1, 1922, averaged 6.3 per cent. Attention was called to the move for legalizing utility securities as savings-bank investments and to the need of the central-station companies putting more effort into development of the appliance business as a means of increasing the residence consumption.

The officers elected for the coming year are: President, J. P. Pulliam, Milwaukee; vice-president, Ewald Haase, Milwaukee; treasurer, G. C. Neff, Madison. C. A. Phenacie, Green Bay, and G. A. Mills, Eau Claire, were elected chairman and assistant chairman respectively of the electric division of the association.

Practical Program for Tri-State Water and Light Convention

A VERY practical program has been laid out for the twelfth annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia, to be held at Spartanburg, S. C., April 19, 20 and 21. Among the papers of interest to the electrical group are "Accounting for Public Utilities," by C. L. Vann, certified public accountant, Charleston, S. C.; "Mechanical Aids in Public Utility Accounting," by G. T. Moore, manager Burroughs Adding Machine Company, Charleston, S. C.; "Accounting Forms for Public Utilities," by R. E. Plimpton, manager Library Bureau, Richmond, Va.; "Distribution of Electricity from Central Stations," by H. F. Lee, manager Carolina Power & Light Company, Goldsboro, N. C., and "The Installation of Underground Structures Previous to the Laying of Permanent Roadway Improvements — Upon Whom Should the Burden Be Placed?" by W. S. Tomlinson, city engineer, Columbia, S. C.

During the afternoon of the second day there will be discussions on the following topics: Collection of bills from delinquent customers, collection of bills in case of transfer of property or removal without notice, municipal payment for service, periodic inspection schedules, technical men for boiler-room supervision, kilovolt-ampere or kilowatt basis for power contracts, insulator troubles due to dust or other influences incidental to the industry supplied, joint occupation of poles, and length of time between meter tests and repairs.

Wakefield May Sell Municipal Plant

WAKEFIELD, Mass., will consider selling its town lighting property at an early meeting of citizens, as a result of an offer approximating $300,000 from the Malden & Melrose Gas Light Company and the Malden Electric Company for the physical property and franchise provisions. If the voters decide to give up municipal lighting, plans will be made to supply the town with the best type of modern central-station service, including vigorous commercial development of the community from the electrical standpoint. The town has been purchasing energy for some years, as outlined in the ELECTRICAL WORLD for March 11, page 497, but, owing to depreciation of plant, an expenditure of $4 per capita is now necessary in view of the new business in sight.

Armstrong Radio Feed-Back Circuit Patent Upheld

A DECISION of considerable importance to the wireless art is the recent opinion of the United States Circuit Court of Appeals affirming the decision of the district court in the Armstrong feed-back circuit case. Patent No. 1,113,149 was granted to Edwin H. Armstrong Oct. 6, 1914, on an application filed on the Oct. 13 preceding. The suit was instituted by Mr. Armstrong and the Westinghouse Electric & Manufacturing Company, which controls the Armstrong patent, against the De Forest Radio Telephone & Telegraph Company.

"The invention," says the opinion, which was written by Judge Manton, "though simple in its instrumentalities, is a radical modification of an instrument which was little understood. The action of the audion was very obscure and was not understood in the art, until Armstrong wrote his article in the ELECTRICAL WORLD on Dec. 12, 1914, and later an article in the Radio Institute paper in September, 1915. These articles demonstrated the action of the simple audio detector and of the feed-back audion as a detector, amplifier and oscillator."

Evidence was offered by the defendant company attempting to show that De Forest had conceived the idea of feed-back regeneration in 1912 and 1913. The court, however, after reviewing such testimony as was offered, was of the opinion that De Forest did not have prior knowledge of the feed-back circuit, either how to set it up or how to control it.

New Orleans Commission Council Held to Be Rate-Making Body

IN DECIDING that the Commission Council of New Orleans is a rate-making body, the Louisiana Supreme Court, in an opinion just handed down, sets at rest the contention of the Attorney-General of the state that the state alone is the rate-making body and that the negotiations between the city of New Orleans and the security holders of the New Orleans Railway & Light Company come within the purview of the Public Service Commission recently created by the constitutional convention. The opinion of the court was unanimous, all nine of the judges of the tribunal of last resort concurring in the decision. Under this ruling it is hardly possible that Attorney-General Coco will seek to delay further the conference between the city and the security holders of the railway and light company, which were terminated abruptly by the state last fall through injunction proceedings.

Federal Power Commission Issues Licenses and Permits

CONSIDERABLE business was transacted at the meeting on Monday of the Federal Power Commission. The issuance of a license to the Wyoming Power Company covering a power development at Boysen dam on the Big Horn River was authorized, and a conflicting application which had been filed by John T. Clarke was denied.

The issuance of a license to the San Joaquin Light & Power Corporation of Fresno, Cal., to cover the natural flow in the north and west forks of Kings River was approved.

An extension of six months in the time of the preliminary permit of the Hydraulic Race Company of Lockport, N. Y., was authorized. Article 5 of the water-power act requires that the applicant furnish evidence of state authority to transfer water. This the Hydraulic Race Company has been unable to do in the matter of transporting water through the barge canal and of its release into its canals in Lockport. Its inability to do so has been occasioned, according to data laid before the commission, by divided jurisdiction between the Superintendent of Public Works of New York and the New York State Water Power Commission in regard to the surplus water in the canal. The situation, however, has been modified by the recent passage of legislation by the New York Assembly.

The commission has rejected the application of L. J. Vogter of Tacoma, Wash., for a preliminary permit to develop power at Swan Lake and Fish Creek in Alaska. The application was in conflict with the proposed project of Paul Butler of the Butler Paper Corporation.

The application by Waln & Young for a preliminary permit covering a project on Power Creek near Cordova, Alaska, was also rejected, a permit being issued to the Alaska Public Utilities Company.

The commission found that the interests of interstate commerce were not affected by the proposal of the Caddo River Power & Irrigation Company of Little Rock, Ark., to construct two dams and power houses on Caddo Creek, in Arkansas, or by the proposal of the Iowa Railway & Light Company of Cedar Rapids, Iowa, to construct a dam in Cedar River near Rochester, Iowa, or by the proposal of the Chipola Light & Power Company of Marianna, Fla., to construct a dam in the Chipola River near Marianna.

The Holston River in Tennessee was held to be navigable and to have important power possibilities, and for that reason an adverse report was rendered on a declaration of intention by C. N. Smith of Rogersville, Tenn., who proposed to construct a dam in the Holston River at Kirkpatrick Shoals, 2 miles south of Rogersville.

The following preliminary permits were authorized:

Wrangell (Alaska) Pulp & Paper Company, covering the development of a 12,000-hp. project on Grant and Hardings Creeks.

The Dixie Power Company, covering a dam from 200 ft. to 300 ft. high at the mouth of the north fork of White River.

J. H. Hughes of San Francisco, to develop 4,000 hp. on French Creek for an electrochemical plant.

Benjamin H. Hardaway of Columbus, Ga., to develop 5,000 hp. in the Choctawhatchee River at a point near Geneva, Ala. Another permit covers a proposed project on Pea River in the same vicinity.

The city of Oskaloosa, Iowa, to develop power on the Des Moines River in the vicinity of Harvey, Iowa.

The Caddo River Power & Irrigation Company, Little Rock, Ark., to erect three dams and develop 50,000 hp. on the Ouachita River in the vicinity of Hot Springs. The upper dam will create a reservoir covering 72 square miles.

The Big Horn Canyon Irrigation & Power Company, Hardin, Mont., to construct a dam 480 ft. high for a combined power and irrigation project at the mouth of Big Horn Canyon.

Jail Sentence and Fine for Theft of Energy in Ohio

ONE year in the state penitentiary and a fine of $500 was the sentence imposed in the criminal court in Youngstown, Ohio, upon a man who was convicted on complaint of the Pennsylvania-Ohio Power & Light Company of stealing electrical energy. A motion for a new trial was denied by the court, but an appeal was taken by the defendant which acted as a stay of execution. The maximum penalty prescribed for this offense by the Ohio law is three years in the penitentiary and a fine of $1,000.

Eleven persons have been prosecuted by the Pennsylvania-Ohio Power & Light Company within the last few months for stealing energy. Ten of the defendants pleaded guilty and received sentences ranging from a fine of $50 to $200 and in some instances jail sentences in addition for ten, fifteen and thirty days.

March Yield on New Financing Down to 6.62 per Cent

STOCKS and bonds amounting to $55,160,000 were offered investors by the electric light and power public utilities during the month of March. This figure is the highest total reached this year and represents an increase of more than $30,000,000 over March, 1921. An interesting feature of the month's flotation was the exceptionally long-term issue offered by the Southwestern Power Company, amounting to $3,000,000 and maturing in 2022. The rate of return yielded the investor dropped to 6.62 as compared with 6.90 for the month of February. Long-term securities continue to predominate. The fourteen-million-dollar issue of the North American Edison Company constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Kansas Gas & Electric Co	$8,000,000	Thirty-year	First mortgage sinking fund gold bonds, series A	To refund bonds falling due and to reimburse company for expenditures . .	6	6 25	96½
Pennsylvania Edison Co	1,350,000	. . . .	Cumulative preferred stock		8	8	100
Standard Gas & Electric Co	3,000,000	Fifteen-year	Convertible secured gold bonds	To retire bonds falling due	7	7 50	95
	250,000	Thirteen-year	Gold notes (closed issue of 1915		6	7 70	86
New York State Gas & Elect. Corp	700,000	Thirty-year	First mortgage gold bonds		6	6 40	94½
Luzerne County Gas & Elect. Co	1,000,000	Twenty-five-year	General and refunding mortgage gold bonds, series A		7	7 20	98
Hagerstown & Frederick Railway Co	200,000	. . . .	Cumulative preferred stock		7	7	Par (50)
Public Service Corp. of New Jersey	3,700,000	. . . . .	Cumulative preferred stock		8	8	100
American Public Service Co.	1,000,000	Twenty-year	First lien gold bonds.		6	7	89
Western States Gas & Electric Co	5,000,000	Twenty-five-year	First and unified mortgage gold bonds, series A	To provide funds for extensions	6	6 50	94
Iowa Railway & Light Co	300,000	Twenty-year	First and refunding mortgage gold bonds of 1912	. . . .	5	5 78	91
Northern Ohio Traction & Light Co	7,500,000	Twenty-five-year	General and refunding mortgage gold bonds, series A	To reimburse company for construction expenditures and for debt retirement .	6	6 30	96
Central Illinois Power Co	1,500,000	Twenty-year	First mortgage sinking fund gold bonds (closed issue)	To make additions and extensions	7	7 10	99
Central Maine Power Co	810,000	Twenty-year	First and general mortgage gold bonds, series B.		6	6 12	98
New Jersey Power & Light Co	100,000	Twenty-year	First mortgage gold bonds of 1916	To reimburse treasury for expenditures made	5	6 50	86½
Keystone Power Corp	1,750,000	Thirty-year	First mortgage gold bonds series A.		6½	6 80	96
Municipal Gas Co. (Albany, N. Y.)	2,000,000	Thirty-year	First mortgage gold bonds, series A.	To retire maturing notes and for improvement	[illegible]	[illegible] 20	104½
Southwestern Power & Light Co	3,000,000	One-hundred-year	Gold debenture bonds, series A	. .	6	6 70	89
North American Edison Co.	14,000,000	Thirty-year	Secured sinking-fund gold bonds series A	. . . .	6	6 60	92
Total	$55,160,000						

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

More Census Returns on Electrical Engineers.—Reading, Pa., had 286 electrical engineers and electricians when the 1920 census was taken. This compares with 170 in 1910. Salt Lake City, Utah, had 471, comparing with 448 in 1910.

Street Lights Held to Be Unnecessary.—The streets of Winlock, Wash., were in darkness recently owing to a ruling by the Attorney-General of the state that street lights were not a necessity and must be discontinued when the city had gone beyond its legal limit of resources. Citizens have taken steps to have the lights again turned on even if the cost of operation has to be met by subscriptions of the taxpayers.

Rochester Considering Ordinance for Licensing Electricians.—Mayor Van Zandt of Rochester, N. Y., has announced that an ordinance for licensing electrical workers now awaiting action will be put up to the people and that opportunities for hearings in the matter will be given. City officials and some of the aldermen hold that the proposed ordinance includes provisions which are unfair. This criticism is made particularly with reference to the requirement that an electrical firm shall have been in business for five years before it shall be entitled to a license.

Electrical Developments in Poland.—The building of a suburban electric railway between Warsaw, the Polish capital, and Modlin is in progress, and the line will probably be opened for traffic this spring. It is intended to be the beginning of a program for the construction of a suburban network of railways around the capital. A bank has been organized for the purpose of developing electrical projects. It plans to exploit the water powers of Silesia, and projects for building hydro-electric plants on the Rivers San and Dunajec have been laid before the Ministry of Public Works. The manufacture of electric lamps, telephones and electrical machinery is also being furthered.

Water Power of Denmark.—Denmark, of course, cannot be compared in the matter of water-power sources with the other Scandinavian nations, and her first experiment with hydro-electricity was not made until 1918. Since then concessions have been granted for three large water-power stations, and plans for one station in Zealand and sixteen stations in Jutland have been submitted to the official committee, which has come to the conclusion that eight of these projects could compete advantageously with steam stations. If seven stations are built in Jutland, they will bring the total rating of electric central stations in that part of Denmark to 18,000 kw.

Edison's Birthday Celebration in Japan.—An elaborate celebration of Edison's birthday was, according to *Denkinotomo*, carried out in Japan, the day "happily coinciding with the 2,852d birthday of the empire." Statesmen, business men, scientists and engineers gathered in Tokyo to honor the occasion, an exhibition was held, motion pictures were taken and an announcement of the birthday was made in every street car. "The translation of the word 'Edison' was happily done as 'Mr. Honorable Knowledge Giver,' which is really characteristic of him," says our contemporary.

"Picking Up" Reservoirs for Hydro-Electric Use.—Among the hydro-electric installations begun in Italy is one on the River Sila, in the province of Catanzaro, Calabria, more than 4,000 ft. above sea level. This project has the advantage of ready-made reservoirs, a number of natural basins supposed to have once held mountain lakes being so situated that they can be utilized in connection with falls giving heads of 1,300 ft. and 1,900 ft. The roseate prediction is made that 168,000 hp. will eventually be obtained by impounding nearly nine billion cubic feet of water, permitting the generation of 800,000,000 kw.-hr. a year.

British Railroads Disagree Over Method of Electrification.—Three English railroads—the Brighton, the London & Southwestern and the Southeastern & Chatham—which had formed a group partnership for the promotion of electrification on their lines, are at loggerheads over the best method to employ. The Brighton lines are being operated by the single-phase alternating-current system and the London & Southwestern by the direct-current method. The latter method has also been specified by the third partner, which has not yet installed electricity. In view of the cost of a change-over by the Brighton road, standardized electrification seems impossible at present.

Georgia Company Plans to Carry on Field Work by Wireless.—Plans to carry on field work by wireless are under way in the territory of the Georgia Railway & Power Company, following the erection of a wireless station in the Electric and Gas Building at Atlanta, and work has already started on the erection of a station at Tallulah Falls. Officials of the company are quoted as saying that if wireless communication between Atlanta and Tallulah Falls proves as successful as is anticipated, stations will be erected at other points of operation. It may prove practicable, they think, to have small field sets carried by the troublemen along the high-tension lines which will permit them to communicate with the office at will.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Northwest Electric Light and Power Association.—The annual convention of this association is to be held in Boise, Idaho, on June 7 to June 10.

Electrical Supply Jobbers' Association.—Hot Springs, Va., has been selected as the place for the next meeting of this association, which will be held on May 24, 25 and 26.

Rhode Island Electrical League Celebrates First Anniversary.—Opportunities for new business and the responsibility of the different branches of the electrical industry in public-relations matters were emphasized at the first annual banquet of the Rhode Island Electrical League, held at Providence March 22. The principal speakers were F. E. Watts, Gage Publishing Company, New York; William Gould, commercial manager Gas & Electric Improvement Company, Boston, and Joseph B. Groce, director New England Bureau of Public Service Information, Boston. Officers were elected for the ensuing year as follows: President, H. J. Pettengill, commercial manager Blackstone Valley Gas & Electric Company, Pawtucket, R. I.; vice-president, F. A. Boss, President Boss Electrical Supply Company, Providence, R. I.; secretary, F. A. Gallagher, Jr.; manager lighting department, Narragansett Electric Lighting Company, Providence; treasurer, R. L. Huse of W. A. Huse & Son, Providence.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Section Meetings—Vancouver, April 7; Toronto, April 7.

A. I. and S. E. E. Section Meetings—Cleveland, April 10; Pittsburgh, April 15 and 22; Philadelphia, April 18.

A. I. E. E. Spring Convention—Chicago, April 19-21.

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.

American Physical Society—Washington, April 22.

American Electrochemical Society—Baltimore, April 27-29.

Missouri Association of Public Utilities—Columbia, Mo., May 4-6.

A. S. M. E. Spring Meeting—Atlanta, May 8-11.

Florida Engineering Society—Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

N. E. L. A Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St Paul, June 13-15.

Electric Power Club—Hot Springs, Va., June 5-7.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Contract Entered Into by Electric Plant Prior to Its Dedication to Public Service Not Void.—Premising that the fact that a corporation is, generally speaking, a public service corporation—that is, that its principal business is rendering public service—does not make every act of the corporation the rendition of a public service, the Supreme Court of Washington, in Sunset Shingle Company vs. Northwest Electric & Water Works, declared that where an electric light company before the construction of its plant made a contract with a lumber mill whereby it received the site for the plant and the waste from the mill as fuel in exchange for furnishing steam heat and electricity for power and lighting, as well as repairing the electrical machinery in the mill, the dedication of the electric plant to public service was subject to the contract obligations, so that the contract was not void, even if some of the service to be rendered were public service. (203 Pac. 978.)*

Pre-War Unit of Cost Prices Is Unfair Rate Basis.—Declaring that the rate of return allowed a public utility company should be sufficient to make its securities attractive to investors under all circumstances, the Supreme Court of Appeals of Virginia, in Petersburg Gas Company vs. City of Petersburg, has disapproved the gas rate fixed by the State Corporation Commission and remanded the case to it. The court declares that in determining the rate to which a public utility whose plant is not larger than necessary for the public service is entitled the commission should first ascertain the fair value of the property of the company used or useful in its business, should fix the rate of return which the company is entitled to receive on such valuation above its proper operating expenses, and should then determine the amount to be paid by consumers to pay the expenses and the ascertained return. The cost of reproduction less the observed depreciation is, the court holds, the fairest method of valuation where the utility has not been allowed to earn in the past a depreciation reserve greater than the observed depreciation. The pre-war unit of cost prices is not to be adopted, in view of the known fact that prices have not returned to the pre-war level, and especially where the commission finds there is no probability of such return. The decision asserts also that, though a public utility company is not entitled to relief for losses sustained by it before it applied to the Corporation Commission for increased rates, it is entitled to have losses incurred by it in consequence of a rate fixed by the commission which was too low amortized. (110 S. E. 533.)

Reasonable Rate of Return—Division of Towns Into Two Groups Authorized.—In State ex rel. City of Harrisonville vs. Public Service Commission of Missouri, the Supreme court of Missouri found that the Public Service Commission of that state had power to establish rates higher than those prescribed in a contract between the city and the company by which the city leased its electric light plant to the company, provided that the rates fixed by the commission were reasonable. Rates allowing a return of 6.83 per cent could not, the commission held, be unreasonable. Where the evidence showed that it was impracticable to charge against the various towns served by an electric light company a fixed portion of the expenses of production of the energy at the central plant because of the varying number of customers and quantity of energy used, and that the cost of the energy was greater when the distance of towns from the producing plant was greater, owing to loss in transmission, and that it cost more per customer to furnish a small town than a large one, an order dividing the towns served into two groups and prescribing uniform rates for each group was held to be authorized. (236 S. W. 852.)

Liability of Electric Service Company for Death from Shock When Wire Was Not Installed by It.—In Coleman vs. Iowa Railway & Light Company, a suit for damages because of the death from electric shock of a customer who was endeavoring to connect a washing machine with the circuit by means of a drop cord, it being alleged that current from a high-tension line belonging to the company was carried into the house over the service line, the trial jury found the company not liable, the court having instructed it that if the defendant did not construct or place the service line used by the deceased there could be no recovery. The Supreme Court of Iowa refused to upset the verdict on the claim that this instruction was erroneous, holding that the jury could not have been misled by it as immediately following this direction, and with reference to the same subject-matter, the court proceeded to say it was not necessary for plaintiff to prove that defendant was owner of the line, and that, no matter who was the owner of the line, after it was constructed the company was bound to use ordinary care to avoid unnecessary danger to those who might use the energy, and that failure so to do would be negligence. These directions to the jury, taken in their entirety, involved no prejudicial error, in the opinion of the Supreme Court. (186 N. W. 642.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Abolition of Surcharge.—In abrogating surcharges of 25 per cent still imposed on some classes of customers of the Public Service Electric Company the New Jersey Board of Public Utility Commissioners said recently that, having allowed the surcharge for good and sufficient reason and "it now being apparent from the record that the company is at the present time earning enough without the surcharge to pay its rentals, to pay dividends of 8 per cent on its capital stock, to appropriate an ample amount for amortization of fixed capital, as well as a substantial surplus, the board is of the opinion that with the entire abrogation of the existing 25 per cent surcharge on power bills the company will still have a sufficient net income to assure the continuance of safe, proper and adequate service and to enable it to market its securities and thereby finance the necessary extensions required by the growth of its business."

Federal Income and Excess-Profits Taxes in Relation to Operating Expenses.—The Public Utilities Commission of Hawaii, which had previously, contrary to the views expressed by many other commissions and also to a subsequently rendered decision of a United States district court (see issues of March 12, 1921, page 620, and March 4, 1922, page 451), allowed the Honolulu Gas Company and other companies to include their federal income tax under operating expenses, was recently confronted with an appeal from the gas company against its prior order, in which appeal a similar disposition of the excess-profits tax (now abolished) was requested. The commission said on this point: "We are convinced that Congress did not intend that the excess-profits tax should be shifted to others, for the terminology alone is sufficient to show conclusively that this tax is upon profits and over and above a fair return upon the investment. Is it not rather presumptuous for the company to contend that taxes upon profits which the federal government considers excessive should be passed on to the consumer? The commission is of the opinion that no excess profits should be allowed as a deductible expense. Either the federal government has not allowed the company a sufficient value for its capital investment or the company is earning over and above a fair return upon the amount of its investment—or it would have no excess profit taxes."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

W. H. Zimmerman has been elected president and general manager of the Minnesota Electric Light & Power Company and the Eastern Mountain Light & Power Company, which are controlled by Dodge & Ross, investment bankers of Chicago. Mr. Zimmerman goes to this new position after many years of experience in the design, construction and operation of electric light and power plants throughout the country. He was born in Earlville, Ill., in 1875 and graduated from the University of Illinois as mechanical engineer in 1897. For two years following graduation he was engaged in the design, construction and operation of a power plant for the University of Illinois, after which he became connected with the Big Four Railway as mechanical engineer. He designed, constructed and managed the property of the Urbana Light, Heat & Power Company from 1900 to 1901, then becoming mechanical and electrical engineer with the Arnold Company of Chicago in charge of design, construction and reports on utilities of that corporation. In 1904 he was appointed manager of the De Kalb-Sycamore Electric Company and in 1907 became manager of the Michigan Power Company and also chief engineer in charge of design and construction of the hydro-electric and machine plants of this company. Since 1909 he has followed the engineering profession as consulting engineer in charge of design, construction and operation and management of a large number of industrial and utility properties, excepting fifteen months during the war period when he was connected with Stone & Webster of Boston.

W. H. ZIMMERMAN

L. F. Harza, consulting hydro-electric engineer, has moved his office from 115 South Dearborn Street to 623 Monadnock Building, Chicago.

William J. Clark, pioneer in the commercial development of electric railways in the United States and a member of the staff of the General Electric Company for thirty-four years, has been appointed advisory manager of the company's railway department.

Dr. R. A. Millikan, director of the Norman Bridge Laboratory and executive chairman of the California Institute of Technology, has been selected as foreign exchange professor to Belgium under the C. B. R. Educational Foundation. Dr. Millikan will leave for Belgium in May.

C. W. E. Clarke, power engineer of Dwight P. Robinson & Company, Inc., sailed for Southampton on March 21. Mr. Clarke will spend about six weeks abroad on one of his periodical inspection trips, visiting the central power stations of England and the Continent and making a study of their design and methods of operation. His itinerary will cover the large stations of England, France and Germany.

William McDevitt, formerly chief of the electrical department of the Progressive Fire Underwriters' Association, and at present holding the title of chief inspector of the Philadelphia Fire Underwriters' Association, was tendered a dinner on his eighty-fourth birthday by representative electric utility men of the Philadelphia district. Mr. McDevitt has served the public in fire prevention for fifty years, and the various speakers of the evening paid affectionate tribute to his long record of service. Perhaps the most appreciated tribute was one in the form of a telegram from Thomas A. Edison.

John J. Carty, chief engineer of the American Telephone & Telegraph Company, has been commissioned a brigadier-general in the Officers' Reserve Corps, U. S. A., upon the nomination of President Harding. Mr. Carty's war record is too full to cite in detail, but his work in the army, in which he attained the rank of colonel and where he co-ordinated all systems of communication and perfected methods whereby cable dispatches could be safely and rapidly sent, is one of the most remarkable of scientific achievements in the great struggle. In recognition he received from General Pershing in France the distinguished service medal and was also decorated by two foreign nations.

C. E. Skinner, manager of the research department of the Westinghouse Electric & Manufacturing Company, has been appointed assistant director of engineering in that company. His duties as assistant director will cover research, standards and other work along these lines. He will be connected with the main engineering office of the company at East Pittsburgh, Pa. Mr. Skinner comes to his new work after years of extensive research work, especially on insulation, and his efforts in this direction have had a marked effect on the development of electrical machine design. He was born near Redfield, Ohio, on May 30, 1865, and was graduated with the class of 1890 from the Ohio State University. In that year he joined the Westinghouse organization in the controller department and supervised the construction of the first controller turned out by the company. Soon after he was placed in charge of the testing of insulation, and in 1892 he was transferred to the research laboratory. In 1895 Mr. Skinner was placed in charge of insulation design in the engineering department, taking charge in 1902 of the insulation division of this department together with the chemical and physical laboratories. Four years later he organized the research division, of which he was in charge until his present promotion. Mr. Skinner has contributed frequently to industrial literature and is well known for his researches abroad as well as in this country. In 1915 he was a special representative of the American Institute of Electrical Engineers, of which he is a fellow, at the international conference on electrical standards held in London, and he is now a member of the committee representing the Institute in the International Electrotechnical Commission. He was chairman of the American delegates to the Brussels meeting in 1920. During the war Mr. Skinner was a member of the National Research Conference and also a member of the advisory council of the division of engineering.

C. E. SKINNER

Samuel G. Hibben has recently been appointed manager of the illumination bureau of the Westinghouse Lamp Company, 165 Broadway, New York. In this position he will have charge of matters in connection with incandescent-lamp applications, lighting specification practice, and in general all activities of the Westinghouse companies that are connected with technical lighting service. Mr. Hibben is an electrical engineering graduate of the Case School of Applied Science, Cleveland, and the Sorbonne, Paris. He has been closely indentified with illumination practice in the designing of new lighting devices and is prominently known from his written contributions to the technical press and his position in the Illuminating Engineering Society, as well as for his activities in the N. E. L. A., the A. I. E. E. and others. During the war he was identified with field searchlight engineering in Washington, and later he operated with the Engineer Corps in France on anti-aircraft lights. He retains his military status as captain of engineers, R. C. His former activities include five years as illuminating engineer of the Macbeth Evans Glass Company, Pittsburgh; meter-design engineer for the Westinghouse Electric & Manufacturing Company; consulting engineer, Pittsburgh; war reparations engineer with the Peace Commission, France, and several years as illuminating engineer for the Westinghouse Lamp Company at Bloomfield and in New York.

S. G. HIBBEN

W. J. Metcalf has been chosen as assistant to the president of the Yale & Towne Manufacturing Company, manufacturer of electric industrial trucks and other products, Stamford, Conn.

S. B. Bechtel, formerly vice-president and general manager of S. F. Bowser & Company, Inc., Fort Wayne, Ind., has succeeded S. F. Bowser as president. Mr. Bechtel has been with the company for twenty-three years, entering its employ in 1899 in the collection department. In 1907 he had attained the position of secretary and in 1914 was made general manager. In 1920 he was made vice-president and general manager.

William J. Morris has been elected treasurer of the Youngstown (Ohio) Sheet & Tube Company, succeeding Richard Garlick, who has resigned on account of ill health.

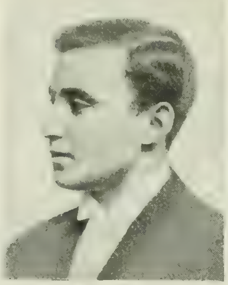
Charles Wiggin of Dunham, Carrigan & Hayden, San Francisco supply jobbers, has been elected president of the Pacific Coast Division of the National Electric Supply Jobbers' Association.

George E. Learnard, president of the International Combustion Engineering Company, New York, sailed March 21 for London on the Aquitania. He will proceed to the Continent when he has finished his business at the London office of the company.

H. C. Hopkins has resigned as head of the promotion and advertising division of the San Francisco office of the Westinghouse Electric & Manufacturing Company to assume active partnership in the advertising firm of Dolman & Hopkins. For the past fifteen years Mr. Hopkins has been associated with the Westinghouse company in the manufacturing, sales, advertising and sales promotion department and during that time has been active in co-operative work with other branches.

G. H. Pfeif has been appointed director of industrial relations at the Schenectady plant of the General Electric Company, succeeding E. B. Merriam, who recently became executive engineer of the switchboard department. As director of industrial relations Mr. Pfeif will have supervision over the employment, education and training, compensation, hospital and safety work of the Schenectady plant. He has been with the General Electric Company since 1905 and for several years past, as secretary of the committee on student affairs, has been in charge of the selection and placing of technical graduates in the student engineering courses of the company. He was born in Terre Haute, Ind., and was graduated from Rose Polytechnic Institute in 1905. The same year he entered the testing department of the General Electric Company. In 1906 he was engaged in the office of the testing department and in 1909 was employed in the office of the general superintendent. The following year he was engaged in engineering work in the Western Electric engineering department at Schenectady. Since then he has given the greater part of his time to the problem of technical education and the engaging of student engineers for work with the company. In this capacity he has visited universities all over the country, selecting the most promising material and co-operating with the other works of the company in the conduct of the student engineering course familiarly known as "the test." During this period Mr. Pfeif was closely associated with President E. W. Rice, Jr., and Francis C. Pratt, vice-president in charge of engineering.

J. M. Fried, who was recently elected president of the Mississippi State Association of Electrical Contractors and Dealers, has been in the contracting industry at Vicksburg, Miss., since 1915. After graduation from the electrical engineering course at Cornell University in 1907, he became connected with the Edison Lamp Works at Harrison, N. J., and served as traveling illuminating specialist in placing the tungsten lamp on the market. In 1910 he joined the Poughkeepsie Light, Heat & Power Company as new-business manager. After staying there a year he accepted the position of electrical engineer for the Massachusetts Lighting Company, Boston. In the summer of 1912 he entered the employ of the Worcester Light & Power Company and became its power engineer. Removing to New Orleans in 1913, he joined the engineering staff of the H. W. Johns-Manville Company and continued with this firm until he opened an electrical contracting house at Vicksburg in 1915.



J. M. FRIED

Ogden R. Adams has been re-elected president and general manager of the Seneca Falls Manufacturing Company, Inc., Seneca Falls, N. Y.

Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, has returned from a trip to Europe and the Near East.

Obituary

William Warren Crosby, a consulting mill engineer of Boston and partner in the firm of Haven & Crosby, died at Arlington, Mass., March 19. He was born in Arlington in 1871 and was educated at the Massachusetts Institute of Technology. For several years he was affiliated with the F. W. Dean Company of Boston in power-plant and mill practice, and prior to that was principal of the Lowell (Mass.) Textile School and also associated with various textile mills.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Blow at Jobber in Mennen Decree of Trade Commission

WHAT is regarded as a move most inimical to jobber interests has just been made by the Federal Trade Commission in its decree directing the Mennen Company to "cease and desist from discriminating in net selling prices, by any method or device, between purchasers of the same grade, quality and quantity of commodities, upon the basis of a classification of its customers as jobbers, wholesalers or retailers, or any similar classification which relates to the customers' form of organization or business methods." Another provision of the order states that nothing contained therein shall prevent discrimination between purchasers on account of grade, quality or quantity or the making of due allowance for differences in sale and transportation costs or price changes made in good faith to meet competition.

The decree is the first application of Section 2 of the Clayton act to price discrimination of the sort prohibited and is considered a test case. If upon review by the higher federal courts it should be sustained, it is clear that a revolution in the distribution system of the country would be necessitated and jobbers of all sorts of commodities would be summarily put out of business. This opinion is expressed by counsel for the Mennen Company, and it is also stated that the commission has indicated all through the matter that the action has been taken in an amicable spirit and merely with the intention of clearing up the law on this phase.

In this particular case the respondent was accused of treating unfairly organizations which bought on a co-operative or mutual basis, chain stores, department stores and other organizations which bought in quantities as large as jobbers but could not obtain jobbers' discounts. This condition is not met with so frequently in the electrical field, where department stores are the only organizations as a rule buying appliances in as large amounts as jobbers and where few contractor-dealers buy heavy stocks. However, it is conceivable that the sustaining of this decree might very easily lead to the formation of such co-operative buying organizations within the electrical industry. It is expected that this decree, fraught with so much significance to jobbers in every line, will be appealed and settled speedily.

February Electrical Exports Only Slightly Under January

ELECTRICAL exports for February may be considered to have held about even with those in January. It is true that the February total, $4,184,677, is $88,571 below the January total, but it must be taken into consideration that February is a short month and in some sections of the country has more than its share of holidays. But while it is evident that the two months differed very little as far as export conditions were concerned, there is little in that fact for electrical manufacturers to exult over. February, 1921, saw more than 300 per cent more electrical goods exported than did this February, and even February, 1920, had 50 per cent more electrical exports.

Comparison, item by item and period by period, will be practically impossible until the new classification has been in effect a year. There have been slight fluctuations in the

ELECTRICAL EXPORTS FOR FEBRUARY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	February, 1921, Value	February, 1922, Value
Electrical glassware, except for lighting		$22,168
Electric porcelain		194,455
Carbons for electric lighting, electrodes and batteries	$62,337	30,536
Insulated wire and cable (iron and steel)		11,867
Other manufactures of aluminum	355,641	56,415
Copper wire (bare)	333,344	71,770
Insulated copper wire and cable	1,123,873	158,078
Generators:		
Direct-current—		
Under 500 kw.		34,631
500 kw. and over		12,189
Alternating-current—		
Under 2,000 kw.		3,009
2,000 kw. and over		49,624
Accessories and parts for generators		18,412
Self-contained lighting outfits		22,498
Batteries:		
Primary—dry		72,770
Primary—wet		718
Storage		84,516
Transforming or converting apparatus:		
Power transformers		231,431
Other transformers		119,397
Rectifiers		1,320
Condensers, double-current and motor-generators, dynamotors, synchronous and other converters		56,148
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone		43,063
Switches and circuit breakers		177,613
Fuses and fuse plugs		13,181
Watt-hour and other measuring meters		68,672
Volt, watt and ampere meters, other recording, indicating and testing apparatus		40,353
Lightning arresters, choke coils, reactors and other protective devices		20,907
Motors, starters and controllers:		
Motors under 1 hp.		30,612
Stationary motors—		
1 hp. to 200 hp.		169,604
Over 200 hp.		54,271
Railway motors		19,963
Electric locomotives—	$123,325	
Railway		
Mining and industrial		$36,329
Other motors	2,426,433	38,655
Rheostats, controllers and other starting and controlling equipment	114,235	63,697
Accessories and parts for motors		57,859
Electric appliances:		
Electric fans	309,373	77,229
Electric lamps—		
Arc	1,234	770
Incandescent—		
Carbon filament	14,804	8,204
Metal filament	597,917	120,830
Other electric lamps		13,888
Flashlights		11,077
Searchlights and projectors		34,567
Motor-driven household devices		39,259
Domestic heating and cooking devices	381,742	30,511
Industrial electric furnaces and ovens		2,647
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.		33,855
Signal and communication devices:		
Radio and wireless apparatus		283,950
Telegraph apparatus		17,688
Telephone apparatus, including telephone switchboards		430,559
Police, fire and burglar alarm apparatus		1,637
Railway signals, switches and attachments		9,338
Bells, buzzers and annunciators		2,641
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	159,513	55,159
Insulating material		50,561
Metal conduit, outlet and switch boxes		24,005
Sockets, outlets and receptacles		13,795
Other wiring supplies and fixtures	377,540	74,063
Other electrical apparatus not elsewhere specified	3,601,491	711,713
Total	*	$4,184,677

* Total electrical exports for February, 1921, amounted to $13,632,478. This figure is not included in the above table on account of the incompleteness of figures for that month under the new classification.

total of various items from January totals, but none of a great deal of importance. The following items for the month stand out as good: Electric porcelain, $194,455; insulated copper wire and cable, $158,078; power transformers, $231,431; switches and circuit breakers, $177,613; stationary motors, $223,875; radio apparatus, $283,950; telephone apparatus, $430,559.

Lamp List Prices Down 10 to 12 per Cent

MANUFACTURERS of large incandescent lamps have announced a readjustment in list prices of substantially all sizes of type B and type C lamps, which becomes effective on April 1. The change in list quotations results in a reduction of approximately 10 per cent in the prices of the lamps used principally by commercial and residential customers and a maximum decrease of 12½ per cent in the prices of the standard 10-watt to 50-watt type B lamps, which are the types principally used in the residential field. This price readjustment follows a reduction of approximately 10 per cent in the list prices of type C lamps which became effective about six months ago. There is no change in the discount schedule and it is stated that none is contemplated. List prices of miniature lamps remain the same.

The reductions on the most popular sizes are as follows: Type B, general, 25-watt clear, from 40 cents to 35 cents; 40-watt clear, from 40 cents to 35 cents; 50-watt clear, from 40 cents to 35 cents; 60-watt clear, from 45 cents to 40 cents; type C, general, 75-watt clear, from 80 cents to 70 cents; 100-watt clear, from $1.05 to 95 cents.

Copper Wire Sales Showing Steady Improvement

ORDERS for copper wire, both bare and insulated, have shown a steady increase since the first of the year, and wiredrawers are experiencing more activity than at any time during the past year, according to a number of large manufacturers recently interviewed by a representative of the ELECTRICAL WORLD. This applies only to domestic business as exports of wire have been falling off every month since last summer. Manufacturers state that public utilities are buying large quantities of transmission cable for maintenance as a result of the recent successful flotation of bond issues. Weatherproof wire has also sold in good volume to central-station companies.

Demand for lead-covered cable is gaining slowly, though until three weeks ago it fluctuated a great deal, many orders being received on one day and only a negligible few the succeeding three or four days. At the present time orders remain small, but they are coming in more steadily and producers have indulged the hope that from now until summer the market will lose its spasmodic characteristics. This better business, it is admitted, is due somewhat to seasonal influence, spring and summer being the time when most cable contracts are closed. One producer declared that, judging by recent inquiries as well as orders, this will probably be a good year for domestic cable business.

Another source of demand has been the telephone and telegraph companies, which have never ceased extending lines, even in a period of slack business, and are always in the market for a large quantity of wire for the purpose of making repairs. There has also been a heavy call for magnet wire, due to the growing public interest in wireless telephony. This was first confined to the East but spread rapidly to the Middle West and the Pacific Coast, and within the last two weeks several large orders for magnet wire have been received from the South.

The construction industry has taken large amounts of rubber-covered wire in the last month, much of this demand being confined to the No. 14 gage. Residence building continues to climb in almost all localities, and the demand for rubber-covered should remain very good for at least the next six months.

Foreign orders for wire of all kinds remain disappointingly small. Europe, South America, China and Japan took large amounts under normal conditions, but since the first of the year Europe and the East have not been so strongly in the market. South America is still taking good quantities of insulated wire. Brazil especially has been in the market for wire for power transmission and rubber-covered wire for building. Chile has given American wiredrawers more business in the first three months of 1922 than during any similar period, and there has been an increase in business with Colombia and Venezuela. Electrification of foreign railroads and proposed electrification of a 65-mile stretch of American railroad have been responsible for some activity in the market for wire and rail bonds. A great deal of electric railway repair work is going ahead at the present time after having been held back for several years, and this has resulted in good business for wiredrawers.

Prices of the various types of wire, after fluctuating with the copper market for a period after the first of the year, have steadied somewhat, though they have not advanced appreciably. Competition on No. 14 rubber-covered wire has been very keen, owing to the large number of manufacturers in the field, and average quantities are reported to be available under the nominal jobber quotation. The situation is not so serious, however, as it was last fall, when stocks were large and demand was relatively small.

Metal Market Situation

DURING the past week the copper market settled down and lack of demand from both domestic and foreign consumers characterized trade. A number of consumers reported that they had been able to obtain copper for delivery through May at 12⅝ cents per pound, but this could not be confirmed among the producers, who averred that they were obtaining 12⅞ cents for that delivery. Domestic business has dropped off more than has foreign. Encouragement is to be found in the fact that while orders booked have shrunk, deliveries against previous orders continue to be very good.

The statistical position of the metal is improving steadily. At the beginning of this week March sales into foreign consumption totaled probably 50,000,000 lb., while sales into domestic consumption probably aggregated 60,000,000 lb. During January and February stocks of refined copper were reduced about 80,000,000 lb. and blister about 85,000,000 lb., so that at the beginning of March stocks of refined copper totaled about 370,000,000 lb. and blister approximately 215,000,000 lb. The Copper Export Association still has about 220,000,000 lb. to dispose of, so that April 1 should see only about 100,000,000 lb. of refined copper available to the domestic market.

The aluminum market is somewhat stronger this week because of advanced prices and better demand abroad. Aluminum company prices have not advanced but those of outside sellers are about ½ cent a pound higher. Demand for lead continues very good, and at present large inquiries are in the market for prompt and April shipment, with, however less tonnage than is usually booked on contracts. Some producers have had so many orders booked at 4.45 cents East St. Louis, April delivery, that they have practically withdrawn from the market.

NEW YORK METAL MARKET PRICES

	March 21, 1922	March 28, 1922
Copper	£ s. d.	£ s. d.
London, standard spot	59 2 6	57 12 6
	Cents per Pound	Cents per Pound
Prime Lake	13.00–13.25	12.87½
Electrolytic	13.00	12.62½
Casting	12.62½	12.37½
Wire, base	14.00–14.25	13.87½–14.12½
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.25	4.40
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.00	7.50
Zinc, spot	5.05	4.97½
Tin, straits	29.00	29.25
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	March 21, 1922	March 28, 1922
Heavy copper and wire	11.00 –11.25	10.75 –11.12½
Brass, heavy	5.00 – 5.50	5.00 – 5.50
Brass, light	4.75 – 5.00	4.75 – 5.00
Lead, heavy	3.75 – 3.87½	3.75 – 3.87½
Zinc, old scrap	2.25 – 2.50	2.37½– 2.60

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A WEEK of slight change and moderate activity succeeded the constant improvement noted in the beginning of March. Building is flourishing everywhere, but most of it seems to be of residences, as has been the case for the past year. Construction prospects appear good in St. Louis, where several of the building trades have accepted wage reductions. Jobbers there report that industrial business is not so bad as it is reported and that several specialties are leaving stock in good volume. In New England basic conditions continue to show improvement, but the textile strike is spreading, and that in itself constitutes a hindrance to business. However, wiring supplies are moving there and prices have stiffened on "Nail-it" knobs and pull sockets. Atlanta has witnessed a slight pick-up in electrical jobbing, and crop prospects there are improving. The 10-amp., two-wire house-type meter is proving popular there. From Utah comes the good news that the Apex mine at Bingham, one of the largest lead and silver mines in that section, will start operations immediately with the employment of 500 men and that the Utah Copper mine will probably have 300 to 400 men employed and five steam shovels in operation by April. Building and retailing have slowed up slightly, but a strenuous electric range campaign is in preparation there. Alaska electrical business is reported to be picking up, with two large private power plants planned there. Prices have dropped 5 per cent in Seattle on loom, friction tape and strain insulators.

NEW YORK

Business in the electrical trade continues to show gradual improvement and jobbers in this section expect that March sales will show up much better than those for February. The increase in residential building activity has been chiefly responsible thus far for the demand for wiring supplies. Indications, however, point to the resumption of commercial construction, as already excavations have been started for a number of buildings in the business sections. Activity along industrial lines still lags, but this should not be taken too seriously, as many industrial plants have no immediate need for further expansion. With the exception of lamps, on which a reduction of approximately 10 per cent becomes effective April 1, there was no change in the general line of prices.

Appliance sales are somewhat better, and jobbers report that dealers are increasing the quantity of individual orders. Vacuum cleaners and washers also show a slight improvement. Advance orders for fans have come through very well, and jobbers appear to be well satisfied with the volume of business already contracted for.

Radio outfits and parts are still in strong demand, and jobbers have been unable to build up any stocks. The demand appears to be equally great for separate parts and for complete sets.

With the increased activity in wiring materials and the advent of the wireless apparatus business, electrical credit men state that they are exercising unusual care in opening new accounts and extending credits. Collections show little change, running from forty-five to sixty days for current billings.

Rigid Conduit.—Demand has been moderate but steady, with no change in prices. Jobbers' quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50; ¾-in., $58.10, and 1-in., $82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $50, $64.50 and $92.20 per 1,000 ft. Stocks are ample to meet the existing demand.

Rubber-Covered Wire.—Sales have been fair the past week and prices have been steady with no tendencies to weaken. Quotations on No. 14 rubber-covered range from $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks generally are in good condition.

Flexible Armored Conductor.—The latter part of last week saw some price cutting on this material and quotations dropped to almost $40 per 1,000 ft. on No. 14, single-strip. However, prices have stiffened sharply and the lowest quotation on No. 14, two-wire, single strip, was $42.50 per 1,000 ft. in that quantity and $45 per 1,000 ft. for double strip. Demand has been very active because of the increase in building activity, but jobbers' stocks seem to be in fairly good shape.

Lamp Cord.—Demand has improved moderately while prices remain stationary. No. 18, cotton, twisted, is quoted from $11.65 to $12.75 per 1,000 ft. in that quantity. No. 18, cotton, parallel, is quoted at $14.50 to $15.45 per 1,000 ft. Stocks are fair to good.

Tape.—Friction and rubber tape are both quoted at 36 cents per pound in 100-lb. lots. Demand is somewhat better along with items of wiring supplies.

Loom.—This material, never very active in this territory, is moving slightly better. In 1,000-ft. lots the $\frac{7}{32}$-in. size sells for $13.50 to $14 per 1,000 ft. The ¼-in. size is quoted at $16.20 to $16.50 per 1,000 ft.

Fans.—From present indications this should be a very good year for fans. Jobbers, who last week stated that their fan business was then equal to last year's, report that orders are still being placed by dealers, whose total initial orders now show a considerable increase over those for 1921.

CHICAGO

Only slight changes in the electrical trade have been noticed during the week. The call for wiring materials, while not showing any remarkable spurt, is gradually increasing. Small orders are prominent and price competition is still continuing. A good movement of No. 14 bare wire is being caused by the demand for radio equipment. The radio business is increasing daily. All stocks are low in the appliance lines. Ironers have been selling well and some good business on washing machines and vacuum cleaners has been produced by strenuous and persistent sales efforts.

Flexible Armored Conductor.—Most jobbers report a sustained steady business on this conductor. The No. 14 two-wire single-strip in 5,000-ft. lots is available at prices varying from $42.50 to $43 per 1,000 ft. Dealers' stocks are fair but not excessive.

Rigid Conduit.—Only a fair call is noted for this material, and the keen price competition has forced prices down until the 72-in. black pipe is available at $40 to $41 per 1,000 ft. in 5,000-ft. lots. The supply of conduit is good.

Wire.—The movement of wiring materials has maintained its steadiness of the past few weeks, and few jobbers report an increase in sales. The bulk of sales is of the small-order variety, very few dealers buying in large quantities. No. 14 rubber-covered wire is selling around $6.35 per 1,000 ft. in 5,000-ft. lots. Stocks are ample. The demand for bare wire is still continuing, especially for sizes around No. 14, because of radio requirements. Weatherproof wire is moving steadily, but with few pronounced large sales. Stocks of weatherproof and bare wire are in fair condition. No price changes have been noted.

Fans.—Nearly all dealers have signed up their contracts and are putting in good stocks, the 1921 fan business having reduced stocks very appreciably.

Heating Appliances.—While this market has fallen off, it is not actually sluggish, a few dealers still reporting good activity on ironers, curling irons and grills. Open-air heaters are moving slowly.

BOSTON

A pronounced betterment in basic conditions continues except in the textile field, where labor troubles have not abated. Further wage reductions in the Merrimac Valley have been followed by walkouts, and so far general resumption of production in other areas suffering from strikes has been delayed. Building operations are opening rapidly with favorable weather. In thirty-four Massachusetts cities building permits in February exceeded those of January by 14.7 per cent and exceeded February, 1921, by 92.4 per cent. Building and engineering contracts in New England for the week ended March 21 totaled $7,225,000, compared with $4,097,300 for the same week last year. Some improvement appears in the paper and shoe manufacturing industries, and in the metal field an upward trend in business is evident. Electrical supply jobbers report that business maintains considerable vitality, wiring supplies moving a little better and radio equipment, as usual of late, being in great demand. Prices stiffened last week on pull sockets and "Nail-it" knobs. A turn for the better is reported from a large electrical porcelain plant in western Massachusetts. Little anxiety is apparent as yet regarding the threatened coal strikes, leading New England utilities having from two to three months' supply on hand April 1.

Sockets.—Prices increased on pulls last week in case lots from 31½ to 32 cents net out of Boston stock. Keys and keyless sockets also have risen ½ cent, the former moving at 18½ cents and the latter at 17 cents. Competition is sharp for moderate volumes of business.

Shade Holders.—Discounts have been cut on less-than-carton lots on certain types of schedule material, such as plates and shade holders, to encourage carton-lot purchases. The new discount on less-than-cartons is 33⅓ per cent off double-list against 40 per cent previously, the carton and standard package discounts remaining at 50 and 57½ per cent respectively.

Radio Equipment.—The demand for radio-telephone sets and aërials is rapidly increasing, and new distributing agencies are coming into the field. Stocks cannot be built to any size under the present demand, but some jobbers look upon this as no great evil in view of the development work in progress in the design of radio apparatus. Prices are none too easily maintained, and the prospect for cheaper sets for wide distribution is receiving some discussion.

Fixtures.—The demand quickened somewhat toward the end of last week. Business is extremely varied and somewhat spotty.

Lamp Cord.—Moderate sales are reported, with good stocks. No. 18 cotton-covered cord is quoted around $22 per 1,000 ft. in less-than-coil lots, $17.50 per 1,000 ft. in 250-ft. to 1,000-ft. lots, and $14.50 in 1,000-ft. to 5,000-ft. lots.

Wire.—The market is non-spectacular. No. 14 rubber-covered wire is selling at $6.25 per 1,000 ft. in 5,000-ft lots, building requirements taking fair quantities in irregular orders. Central-station extension work is picking up a bit in the weatherproof line.

"Nail-it" Knobs.—These rose from $14 to $15.50 per 1,000 in barrel lots last week, the demand being fair. The outlook for porcelain movement is perceptibly better.

ATLANTA

Improved weather conditions have lent a more optimistic tone to business in general, and while building construction has not been under way sufficiently long to stimulate buying to any great extent, nevertheless anticipation of better conditions is being reflected in the pick-up in the building material and electrical jobbing lines. Business in the cities continues to be fairly satisfactory, as illustrated by the building permits for February in the seven leading Southeastern cities, the valuation amounting to $4,058,806 as against $1,974,804 for the same month in 1921. Activities in the rural sections are still at a low ebb as inclement weather brought all farm activities to a standstill and the ground is still too wet to be worked. Money is very scarce in the small centers and business of course is very sluggish as a result. The peach crop in middle Georgie has bright prospects, there having been no killing frosts to date, and unless some unexpected event occurs, this section should be in fine shape within the next ninety days.

Poles.—The movement of poles can be reported as only fair, spring construction not yet having got under way. Prices remain steady with yard shipments fairly good.

Floodlighting Equipment.—Little or no activity has been reported in this line for several weeks past, the purchases being very scattered and of small volume. Local stocks and shipments are both reported as satisfactory, with prices steady.

Pole-Line Hardware.—Like poles, this line is not moving as well as was anticipated, though the activity is greater than in the pole line.

Lamps.—The past winter has seen a very satisfactory turnover, but approaching summer is, as usual, reducing the volume of sales. Jobbers have stocks of all sizes on hand in ample quantities.

Dry Batteries.—The volume of sales is considerably reduced, the bell-ringing transformers having cut into their usage in the cities and the dullness in the automobile and stationary-engine trades in the rural districts having curtailed that market.

Battery-Charging Outfits.—A slight improvement is to be noted in this line, the second-hand equipment which was on the market in such quantities six months ago seeming to have been about absorbed. Sales, however, have not yet returned to the basis of eighteen months ago. Local stocks are reported quite satisfactory.

Meters.—A fairly satisfactory turnover is reported, with the 10-amp. two-wire type growing in popularity. A number of the largest companies show a tendency to standardize on this type, instead of the 5-amp. Local stocks are in fine shape throughout the entire range of sizes.

ST. LOUIS

Further wage reductions in the building trades were announced last week, the concrete workers, laborers and excavators having made agreements on the basis of about 15 per cent lower than last year's scales. The carpenters were also notified by the contractors that, effective April 1, the wages paid them would be reduced from $1.25 per hour to 95 cents per hour. It is quite possible that resistance will be made to this reduction. The reduced labor costs are stimulating construction activity, but the full effect of it has not yet reached the electrical interests.

A good indication of the expected electrical development in this territory is the announcement made last week by the Union Electric Light & Power Company of its plans to start construction immediately on a 240,000-kw. power plant, 60,000 kw. of which are to be available in about eighteen months and another 60,000 kw. within four years thereafter. The construction has been deferred as long as possible, but the continued growth of power and lighting business has made the additional power imperative.

Jobbers report business better than a month ago and continually improving. The general public seems more willing to spend now, and the industrial concerns, with business better, are more inclined to make necessary improvements in their plants. One jobber predicts that this fall will see business as good as it has ever been in normal times. However, until that condition obtains all jobbers are from necessity maintaining stocks at the minimum consistent with giving good service.

Washing Machines.—The distributors of one well-known machine are making a special price reduction of about $25 and as a result are moving machines in good volume. Other distributers report that business shows improvement. Dealers have increased their stocks to some extent, and jobbers are maintaining a satisfactory amount on hand.

Vacuum Cleaners.—With the advent of spring the demand for cleaners is showing a healthy condition for the first time in months. What business was formerly found was quite spotty, but all jobbers now report steady sales. Local stocks are maintained at a minimum.

Lamps and Fixtures.—With increased building and more manufacturing, the demand for lamps continues to be very active. A large manufacturer last week gave demonstrations of the value of the various types of lighting equipment for industrial and commercial purposes and succeeded in creating considerable interest in improvement of lighting conditions, but there has been insufficient time to note any appreciable effect on sales.

Radio Equipment.—With the increased public interest in broadcasting service, the demand is increasing in proportion. Sales are apparently limited only by the slow deliveries, but on account of the delivery condition it is possible that there are a good many duplications of orders.

PORTLAND—SEATTLE

General business conditions show little change from week to week. Reports, however, indicate an earnest struggle on the part of industry to get fully under way, with varying degrees of success. While those well informed in business circles are optimistic as to the future, no spectacular improvement is looked for. Alaska has been pretty dull for the past year and a half, but business there is beginning to go forward again. A Seattle engineering firm which does a great deal of work up and down the Alaskan coast states that pulp and paper as well as canning interests are developing one small and one moderate-sized power project, with work to begin this summer. The employment situation shows signs of improvement throughout the Northwest.

Building construction, which is quite active, creates a demand for certain kinds of electrical material. This demand is reflected particularly in house wiring and fixture sales. Sales of electrical appliances, with the exception of ranges and vacuum cleaners, continue to be rather sluggish.

Electrical jobbers report that activity in general materials is somewhat improved, although still only moderately good. Bad weather has delayed some work that would otherwise have developed. Demand for radio material is far in excess of the supply and apparently will continue to be for some time. The only price changes during the week were drops of about 5 per cent on loom, friction tape and cement strain insulators.

Vacuum Cleaners.—The market on cleaners has been rather quiet since Christmas time. Prices are firm.

Washers.—Sales of washers have picked up somewhat during the past weeks. The last price adjustments reported were made effective about March first, but considerable diversity in quotations still exists.

Ranges.—A somewhat better tone in ranges exists as indicated by improved sales. A new type of automatic range with definite temperature and time adjustments has just appeared. Prices on these ranges are $223 and $245 for the open and closed element types respectively.

Flatirons.—The new type of iron provided with automatic cut-out has just appeared on the local market and seems to have been well received. The new 6-lb. automatic sells at $8.89 as compared with the old type at $6.75.

SAN FRANCISCO

Many larger buildings have reached a stage where they are ready for electrical material. Building is good, but retail business slowed up during March. Most dealers report inordinately low daily receipts and are inclined to blame it on the income tax and municipal tax. Government business is small because of the uncertainty attending the future policy in the Pacific. State business is very good, with a great amount of scattered building on state projects such as hospitals and office buildings, on which the bidding is exceedingly keen. Country business is rather quiet. This is the off-peak buying season for the country, for the banks are rather cautious with loans before May of each year.

Local stocks have been low occasionally, but Eastern shipments both by rail and by boat have been so prompt and stock systems have been so well organized in these days of hand-to-mouth buying that a constant succession of small shipments from the factory rather than a few spectacular large ones is now the rule.

Ranges.—Within the next thirty days it is figured that an active campaign will be begun based upon range list prices, with an equal chance for the central-station company and dealer to make the same profit on each sale to the consumer. Various systems based upon cost at a small profit to the central station, with the virtual elimination of the dealer, have been tried out during the past six months, with the object of popularizing electric ranges without considering profits, but the result has been to emphasize the need of dealer co-operation.

Water Heaters.—A campaign such as the above will also include water heaters, which, on account of rate provisions, carry a sliding scale that helps the entire installation. It is noteworthy that during 1921 the percentage of increase of water-heater installations was almost triple that of the increase in range installations.

Flexible Conduit.—Non-metallic flexible conduit is selling about 50 per cent better now than during the average 1921 month. Stocks and shipments are all that could be desired. Metallic flexible conduit is in spotty demand in some districts, such as San Francisco, where the half-inch conduit style is requested instead of the twisted-wire style conduit. Orders placed for carload shipment from the East run about one-quarter of the entire demand, the balance being in smaller lots for shipment out of Coast stocks. Sales are very good.

Boxes and Covers.—Here is one roughing-in line on which there has been an occasional shortage. Stocks are satisfactory now, however.

Schedule Material.—The convenience-outlet campaign inaugurated in California and intensified by such publicity as that accomplished by a well-distributed series of electrical homes has resulted in new and standardized designs which are ready for distribution now. Definite increases are noted from month to month in demand and in public interest.

SALT LAKE CITY—DENVER

Beginning April 1, there will be a gradual resumption of copper production in Utah. On that date the first five hundred of thousands of men who have been idle for one year will go back to their jobs, and it is expected that the ranks of the unemployed will be steadily depleted. Since these mines operate electrically, this is big news to the electrical industry in the Intermountain region. From the central station to the smallest jobber of supplies business is sure to show a better volume. This would enable distributers of supplies to thin out their stocks in lines that of necessity have been held in abnormal quantities. Besides toning up the electrical market, the resumption of work in the copper mines should have an invigorating effect on business generally.

Other hundreds of unemployed men are being absorbed in construction projects, both municipal and state. The weather is favorable in many parts for the launching of building programs that have been pending throughout the winter months. Real estate firms are unusually active, one concern alone announcing that it has available for building of homes $1,000,000 of insurance company money. When the Intermountain States get their road-building programs under way it is believed that non-employment will become a thing of the past.

A more favorable money market is reflected in a steadily declining interest rate, and it is easier to contract loans than it has been in the past two years. Some improvement in collections is being noted. The beet-sugar industry is getting back to something like a stable basis and the wool market is exceptionally strong, showing prices from 50 to 100 per cent above those at shearing time last year.

Ranges.—Retail sales are at low ebb. Summer is the season for the movement of electric ranges, and jobbers and dealers are preparing accordingly. There has been advance notice of reduction in price in some lines and this is counted on to stimulate sales.

Flatirons.—Movement of irons is steady and consistent, though no records for volume are being broken. The emphasis that was put on reduced price several months ago has shifted to improved mechanical features with good effect.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Kelman Electric & Manufacturing Company Enlarges Plant

The Keiman Electric & Manufacturing Company of Los Angeles, manufacturer of oil switches, has completed the construction of an addition to its factory which was necessitated by the largely increased demand for oil switches. With the increase in facilities the organization of the company was also increased, and plans are being made to supply a market which is expected to be very active.

Larger Quarters for Chicago Radio Company

The Chicago Radio Apparatus Company increased its floor space about five times when it recently opened a new store at 415 South Dearborn Street. C. C. Klentz, the manager of this company, told a representative of the Electrical World that he had added four persons to his office force in order to take care of the demand for radio equipment. Mr. Klentz also stated that his stocks for building radio sets were in good condition and that he was now receiving his shipments on past orders.

Irvington Varnish & Insulator Under New Control

A complete change has taken place in the ownership of the common stock of the Irvington Varnish & Insulator Company, Irvington, N. J., according to an announcement made by D. Frederick Burnett, treasurer under both the old and new managements. The entire issue of the stock has been acquired by a syndicate composed of William F. Hoffmann, Arthur E. Jones and Carl Egner. The estate of Carl Berger and a Miss Heinrichs, Mr. Burnett stated, are no longer interested in the stock.

A new board of directors was elected at the annual meeting held March 21 and includes two members of the old board, Andrew Young and D. F. Burnett, as well as Messrs. Hoffmann, Jones and Egner. Officers were elected as follows: Mr. Jones, president; Mr. Hoffmann, chairman of the board and vice-president; Mr. Young, vice-president; Mr. Egner, secretary, and Mr. Burnett, treasurer. Mr. Hoffmann has numerous other business connections and is actively connected with the American Oil & Supply Company. Mr. Jones has been vice-president and sales manager of the American Supply & Oil Company, but henceforth will devote practically his entire time to the duties of his position as president of the Irvington Company. Mr. Young remains as general manager as well as vice-president and will have charge of production, in which he has had long experience. Both Mr. Egner and Mr. Burnett are actively identified with several other manufacturing and business institutions.

Alpha Electric Buys Out Westinghouse Agent-Jobber

Announcement has been made by the Alpha Electric Company, electrical jobber, 151 West Thirtieth Street, New York, that it has bought the stock and good will of the Northwestern Electric Equipment Company, 379 Washington Street, New York. The Alpha company by this move becomes Westinghouse agent-jobber in the metropolitan district instead of specialty jobber as formerly, since the Northwestern company has held that relation to the Westinghouse company for a long period of years.

The Alpha company has had a remarkable growth since its founding in 1912 and now ranks with the largest jobbers in the metropolitan district. It was established first at 116 West Twenty-ninth Street, but outgrew these quarters and later moved to its present location, with a warehouse at 216 West Thirtieth Street. Warehouse space has been increased 750,000 sq.ft. or about 40 per cent in anticipation of the present move.

There will be little change in the Alpha company personnel due to the new development, though some members of the Northwestern company's sales force have been retained. The officers of the Alpha company are: M. Coleman, president; G. E. Coleman, vice-president and treasurer; A. F. Thatcher, secretary, and Walter Williamson, general manager.

General Electric Establishes Radio Station

The establishment of a radio broadcasting station at its plant in Schenectady, N. Y., has been announced by the General Electric Company. This station is said by the company to be the most powerful broadcasting station in the country and has been assigned the call numbers WGY. Beginning its service unheralded a few weeks ago, the station has been picked up by amateurs in Santa Clara, Cuba, 1,450 miles south, and as far west as Cedar Rapids, Iowa, despite the fact that no attempt has been made to obtain a long-distance range. It is equipped with the multiple-tuned antennas used on the large transoceanic stations.

Art Lamp Company Takes New Manufacturing Space

The Art Lamp Manufacturing Company, 6 North Franklin Street, Chicago, manufacturer of portable lamps and shades, has leased additional manufacturing space. The entire six-story building at 218-220 Madison Street has been taken over by the company and will be fitted out for the production of the lighting specialties composing the company's line. The lease runs for twenty years. H. A. Vernon has recently been appointed sales manager.

Broderick & Bascom St. Louis Plant Destroyed by Fire

The rope-making departments of the St. Louis plant of the Broderick & Bascom Rope Company were virtually destroyed by fire last week, and the loss is estimated to be about $300,000. This causes a complete cessation of its St. Louis manufacturing activities until the plant can be rebuilt. In the meantime all work will be handled from its Seattle plant. A large foreign order and several large domestic orders were ready for shipment and were destroyed in this fire.

This is the second fire at this plant in the last six weeks. The loss in the first one amounted to about $75,000, and the output of the plant was reduced by only about 20 per cent. The company makes a specialty of stranded-steel wire rope.

Erie Equipment to Keep Plant at Johnstown

After long consideration the directors of the Erie Electrical Equipment Company, Johnstown, Pa., have decided to refuse the offer of outside interests to buy the company and will continue operations at the Johnstown plant. The company manufactures switchboard equipment and material for power-house, railway and signal construction.

The offer to buy the plant came on Jan. 15 of this year from a large company in another section of Pennsylvania, and if the offer had been accepted these interests would have purchased all the stock of the Erie company and removed the equipment to the home plant of the purchasing corporation. A campaign to dispose in the open market of a block of the Erie company's preferred stock was discontinued on receipt of the offer, but it is understood that it is to be renewed now.

On rejection of the purchase proposition the stockholders reorganized the company for the year and elected the following directors: J. L. Hershberger, J. F. Kress, J. J. Mulvehill, M. D. Beaver and H. A. Selah. J. L. Hershberger was elected president, M. D. Beaver, vice-president, J. F. Kress, treasurer, H. A. Selah, sales manager and consulting engineer, and Charles G. Kress, secretary. Mr. Selah has since resigned his position as sales manager but remains a member of the board of directors. He has been succeeded as sales manager by S. R. Burd, and an announcement is to be made later concerning the position of consulting engineer.

The officers of the company express themselves as optimistic about the prospects of the company and are considering plans for its future development.

Eureka New England Meetings Optimistic

In preparation for a national campaign to extend from April 10 to May 13, the Eureka Vacuum Cleaner Company, Detroit, opened a series of sales meetings in New England March 20. More than 125 dealers and salesmen met at the Parker House, Boston, with Arthur M. Beveridge, New England manager of the company, presiding. The principal address was given by A. L. McCarthy, vice-president and general manager of the Eureka organization. Discussing business conditions, Mr. McCarthy said that the company's sales were only 9 per cent less in 1921 than in 1920, compared with a shrinkage of 40 per cent in the vacuum-cleaner field as a whole.

He maintained that 1922 offers opportunity for record-breaking sales through hard and persistent work. The speaker said that factory costs are less influential than sales costs at the present time in maintaining prices, owing to the expense of today's sales efforts in comparison with the "easy" business of 1920. The entire organization was urged to merchandise its product on a service basis, and it was announced that the bogie in the coming sales drive will be 35,000 outfits in thirty-five days. Other meetings were scheduled at Providence, R. I., and Hartford, Conn., 135 representatives being listed to attend.

War Contract Claim of General Electric Settled

The General Electric Company has just been a party to an unusual settlement of a claim against the federal government for closing out of war-time contracts. The company originally presented a claim of $7,560,645 against the Emergency Fleet Corporation due to cancellations of orders for turbine engines for the ship-building program. The Shipping Board contended that progress payments had more than offset the amount of the General Electric Company's claims. When the attorneys representing the two sides checked over the accounts it was found that the company, instead of being entitled to more money from the government, actually owed the board. The company then agreed to wipe out its claim of over $7,000,000 and to pay the Shipping Board $2,013,569. A check for $1,494,411 of this amount has already been tendered the Shipping Board by the company.

Westinghouse Makes Personnel Changes

Several changes in personnel have been announced recently by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., among them being transfers of various managers of district offices. R. L. Rathbone, formerly manager of the Cleveland office, has taken up special duties in connection with merchandising matters, but will continue to make his headquarters in Cleveland. J. Andrews, Jr., manager of the industrial division, Pittsburgh office, has been appointed manager of the Cleveland office, and C. D. Taylor succeeds Mr. Andrews in the Pittsburgh office. R. Seybold has been appointed manager of price statistics and among other duties will act as secretary of the domestic sales committee and will assist W. S. Rugg, assistant to the vice-president, in general duties connected with the vice-president's office. W. R. Keagy has been appointed office manager of the Cincinnati office, and J. R. Deering office manager of the Los Angeles office. H. S. Walker succeeds M. E. Lanning as promotion man in the Denver office, and I. G. Cline takes up the promotion work vacated by R. A. O'Reilly in the Chicago office. K. L. Graham succeeds to the post vacated by H. C. Hopkins as promotion man in San Francisco.

Program for National Foreign Trade Convention

Presentation of practical export subjects by experts will be one of the features of the National Foreign Trade Convention to be held in Philadelphia on May 10, 11 and 12. The program includes one session to be devoted to taxation and currency questions. "The Effect of High Taxation on Exchange," "Factor of Depreciated Currency in Competition" and "Why We Must Have Foreign Trade" are the subjects.

Shipping matters will be taken up at another general session under the heads of "The Merchant Marine," "Inland Waterways as Developers of Traffic," "Shipbuilding Prospects" and "Factors in Marine Insurance Rate Fixing." President James A. Farrell of the United States Steel Corporation will make a talk on "A Foreign Trade Policy" for Americans at another session. Topics covering all the angles of foreign trade from the viewpoint of the manufacturer, the shipper, the banker, the exporter and the importer will be taken up at the group sessions.

A method of providing means to finance foreign trade that will be stressed is the employment of the gold surplus accumulated in this country. A resolution also will be proposed asking the government to incorporate in all foreign loan agreements the condition that part of the proceeds be spent for American goods.

The United States Department of Commerce will be well represented at the convention as will be various state governments and city chambers of commerce. About one hundred trade advisers will be available to business men attending the convention.

Western Electric Reorganizes Administrative Departments

A reorganization of the administrative departments of the Western Electric Company has been announced and by this the operating functions of the company are divided into four major departments. Dr. F. B. Jewett, vice-president, is now in charge of the telephone department, which includes the engineering department, the telephone sales department and the manufacturing department. The other divisions are the general staff department, in charge of Vice-president H. A. Halligan and including the purchasing, traffic, legal, accounting, treasury and publicity personnel; the supply department, in charge of F. A. Ketcham, general sales manager, and the foreign department, under G. E. Pingree, vice-president and general manager International Western Electric Company.

W. A. Huse & Son, Providence, R. I., have been appointed Rhode Island distributers for the Monarch Refillable Fuse Company, Jamestown, N. Y.; the Howell Motor Company, Howell, Mich., and the Chicago Flexible Shaft Company's line of domestic heating appliances. The firm's headquarters are at 128 Empire Street, Providence. N. I. Allen is sales manager.

The Moe-Bridges Company has completed the construction of an enlarged branch of its factory at 933 Mission Street, San Francisco.

The Electric Specialty Company, manufacturers' agents, 525 Market Street, San Francisco, will remove its headquarters to 75 Fremont Street.

The Philadelphia Electrical & Manufacturing Company, Philadelphia, and the Electric Power Equipment Company, Philadelphia, have appointed as San Francisco district representative C. E. Ingalls, formerly San Francisco manager for the Crocker-Wheeler Company. He will have offices in the Rialto Building.

The Ajax Battery Company, Rochester, N. Y., is planning to build a new factory in that city at Norton and Hallenbeck Streets, the capacity of the present plant having been booked over a year ahead.

The Morgan-Gardner Electric Company, Chicago, has opened a Cleveland office at 1605 Williamson Building. N. Bonnist is in charge.

The Fulton Iron Works Company, St. Louis, has closed a contract with the city of Amory, Miss., for the installation of two of its Fulton Diesel engines in the new municipal central station.

The Peerless Light Company is planning a considerable enlargement of its factory branch at 149 Second Street, San Francisco.

Foreign Trade Notes

LAMPS AN IMPORTANT INDUSTRY IN HOLLAND.—The manufacture of electric incandescent lamps, the *Electrician* states, is now one of the important industries of Holland. During the first seven months of 1921 the value of the lamps exported was about £1,000,000. The exports were mainly to France, Great Britain, Spain, Argentina, Belgium, Italy and Sweden.

DECREASE IN DEMAND FOR CABLES, MOTORS AND METERS IN GERMANY.—There has been a drop in the internal demand, according to recent reports to the *Electrician*, for electric cables and wires, motors, meters and installation material in Germany, but the activity in large steam and hydro-electric plants and for telegraph and telephone apparatus continues unabated. There has also been a drop in the demand for incandescent lamps for export.

INCREASE IN PRICE OF COOKING AND HEATING APPARATUS IN GERMANY.—Owing to the general increase in prices of raw materials and advances in wages and salaries, according to the *Electrician*, the Union of Manufacturers of Electric and Cooking Apparatus of Charlottenburg, Berlin, has authorized substantial increases in the prices of electric cookers, flat iron, etc.

GERMAN INDUSTRY NOT ABLE TO COMPETE WITH OTHER COUNTRIES ON EQUAL TERMS—The industrial production efficiency of Germany is sinking more and more, the New York *Times* reports Dr. Karl Friedrich von Siemens, head of the Siemens & Halske Company, as stating in an address to the stockholders at the annual meeting. He declared that he was convinced that German industry would no longer be able to compete in the world market under equal conditions such as formerly existed between competing countries. This insufficient productivity is momentarily concealed by the difference between the purchasing power of the mark at home and abroad. He also stated that in the last business year relatively quiet working conditions had prevailed. All hopes pinned to this quieter development were destroyed with one blow, he said, by the fall of the mark, and in economic calculations chaos set in much greater than ever before. The Siemens-Halske Corporation declared a 20 per cent dividend on its 130,000,000 marks capital stock. Mr. Siemens pointed out to the stockholders that this 20 per cent paper-mark dividend was equivalent to only 0.4 per cent in gold on the par value of the stock, or 1.8 per cent in paper marks on the stock at the present market price.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Spain (No. 1,155) desires to secure an agency for the sale of electrical materials, supplies and appliances, etc.

An electrical supply firm in Brazil (No. 1,157) desires to secure agencies for the sale on commission of electrical machinery and supplies.

There is a market in Spain (No. 1,158) for electric piano players, etc.

A manufacturer in Brazil (No. 1,165) desires to receive quotations from American firms for the electrification of a cigarette factory. The material desired consists of small motors and control apparatus.

A firm of general merchants in the Netherlands (No. 1,217) desires to purchase electric vacuum sweepers.

TELEGRAPH APPARATUS FOR BRISBANE, AUSTRALIA. — Tenders will be received at the Postmaster-General's Department, Brisbane, Australia, until April 19, according to the *Empire Mail*, for furnishing testing and telegraph instruments, including direct-current ammeters, alternating-current bridge condenser coils, condensers, cross-talk meters, detectors, milliammeters, artificial telephone cable boxes, etc. Tenders to be addressed to the Deputy Postmaster-General, Brisbane, Australia.

ELECTRIC CABLES FOR SWISS FEDERAL RAILWAYS.—Tenders are being asked, according to the *Electrician*, for furnishing electric cables in connection with the project for the electrification of the Swiss Federal Railways. Foreign tenders will be considered on this occasion. The scheme will involve the ultimate electrification of 3,000 miles. The adoption of electric traction on branch lines is also under consideration.

New Apparatus and Publications

BOXES.—A line of pressed-steel switch boxes has recently been placed on the market by the Ward Electric Company, Otis Building, Philadelphia.

TESTING DEVICE.—A device for testing electrical parts and locating faults in all makes of electrical systems of automobiles ("Tes-tor") has been developed by the Plucker Electric Products Company, New Britain, Conn.

BELL.—The Schwarze Electric Company, Adrian, Mich., has placed on the market an electric bell ("Cyclone") designed for fire-alarm use in schools and industrial plants.

RECTIFIER.—The France Manufacturing Company, Berea Road and West 104th Street, Cleveland, has recently placed on the market a continuous-charge ("F-F") rectifier for floating battery systems.

MAGNETIC WAVE GENERATOR.—The Bachelet Medical Appliance Company, Inc., Kingston, N. Y., manufacturer of electrical therapeutic apparatus, has brought out an electromagnetic therapeutic wave generator.

RADIO APPARATUS.—A complete wireless-telephone receiving set has recently been developed by the Radio Receptor Company, 126 Liberty Street, New York City.

SWITCH.—The Union Electric Manufacturing Company, Milwaukee, has recently placed on the market the "Unelco" safety motor-starting switch.

CONNECTOR. — The Magnus Electric Company, 115 Broad Street, New York City, has recently developed an extension-cord connector.

FIXTURE. — The Will-Burt Company, Orrville, Ohio, has recently placed on the market a new lighting fixture ("Flexolite") for lighting mills, factories and shops.

HOT PLATE.—The Liberty Gauge & Instrument Company, 6545 Carnegie Avenue, Cleveland, has put out an electric hot plate.

WASHING MACHINE. — The Cadillac Washing Machine Company, 325 West Ohio Street, Chicago, has brought out a new washing machine with a folding, swinging wringer.

KITCHEN APPLIANCE.—An electrical appliance, known as the "Kitchen Girl," which may be used for many kitchen duties, has been placed on the market by the Kitchen Appliance Corporation, Marsh Building, Pontiac, Mich.

PLATE PRESS.—The Battery Equipment & Supply Company, 1458 South Michigan Avenue, Chicago, has placed on the market the "Besco" plate press.

CRANES. — The Whiting Corporation, Harvey, Ill., is distributing a four-page circular and a desk calendar calling attention to its complete line of equipment, including electric and hand power travelers, bucket-handling and gantry, jib, pillar and bracket cranes, foundry equipment, trolley systems, etc.

COUPLINGS. — The Thomas Flexible Coupling Company, Warren, Pa., is distributing a catalog covering the Thomas flexible couplings for all direct-connected machines.

COMMUTATOR STONES.—The Martindale Electric Company, 11737 Detroit Avenue, Cleveland, has issued a new four-page circular on commutator grinding and slotting, which describes its "Imperial" commutator stones and three devices for undercutting mica.

MOTORS.—The ALP Electric Manufacturing Company, 325-327 East Ferry Street, Newark, N. J., has issued a bulletin on its "ALP" alternating-current motors in sizes 1 hp., to 50 hp. Both ball and sleeve bearings are embraced.

INDUSTRIAL TRUCK. — The Elwell-Parker Electric Company, Cleveland, has perfected and placed upon the market a drop-frame electric industrial truck for low-loading of heavy materials.

CARBON ELECTRODES.—The National Carbon Company, Inc., New York, has issued a second edition of "The Carbon Electrode," a seventy-nine page booklet on the history, manufacture, handling, care and use of carbon electrodes.

PORTABLE TOOLS.—The Black & Decker Manufacturing Company, Towson Heights, Baltimore, is distributing a miniature catalog covering its various portable electric tools.

HIGH-VOLTAGE DETECTOR.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, have put on the market an instrument for detecting the presence of high potential on lines, transformers and other apparatus.

RADIO APPARATUS. — The "Aeriola, Sr.," a regenerative radio receiver, and the "Vocarola," a radio reproducing apparatus which serves the purpose of a sound chamber, have been put on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Companies

THE WINDHAM VALLEY ELECTRIC COMPANY, Windham, N. Y., has been incorporated with a capital stock of $25,000 to operate in Green County. The incorporators are E. E. Munson, S. A. Moseman and W. W. Vining. B. I. Tallmadge, Windham, is attorney.

THE INLET LIGHT & POWER CORPORATION has filed articles of incorporation with a capital stock of $50,000 to operate in Herkimer County. The incorporators are J. and E. Routstone and E. C. Baker. Colegreve & Baker, Utica, are attorneys.

THE RIPLEY POWER & WATER COMPANY, Riverside, Cal., has been chartered with a capital stock of $70,000 by J. N. Hesley, J. O. Phillips, A. Villman, Frank Sabathe and Harris Hollenbeck.

THE KEYSTONE POWER CORPORATION OF DELAWARE has filed articles of incorporation with a capital stock of $11,000,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington, Del.

THE EXCEL ELECTRIC COMPANY has been organized at Muncie, Ind., by James H. Reichart, Samuel W. Huffer and Samuel A. Martin. The new company is capitalized at $20,000 and will engage in the electrical supply business.

Record of Electrical Patents

Notes on United States Patents

(Issued March 7, 1922)

1,409,061. Electromechanical Power Transforming, Converting and Regenerative Device; Howard J. Murray, Brooklyn, N. Y. App. filed Nov. 21, 1918. Alternating-current railway motor.

1,409,124. Method of Producing Nitrogen Compounds; Heinrich Specketer, Griesheim-on-the-Main, Germany. App. filed Jan. 6, 1922. By heating metallic oxygen compounds with coal and nitrogen.

1,409,131. Electric Iron; Frank B. Widmayer, New York, N. Y. App. filed Nov. 20, 1920. Detachable section converts light iron to heavy one.

1,409,135. Signal; John A. des Rosiers and Martin W. Webb, Edmonton, Alberta, Canada. App. filed May 11, 1920. Danger light for automobiles.

(Issued March 14, 1922)

15,310 (reissue). Machine-Switching Telephone-Exchange System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed March 11, 1919. Prevents hunting in trunk selection.

1,409,147. Battery Handlamp; Ernest Alschuler, Chicago, Ill. App. filed April 30, 1919. Constructed to prevent accidental lighting.

1,409,173. Trolley Construction; James F. Healy, Chicago, Ill. App. filed June 18, 1921. Pole forms plunger in vertical tube and is held in contact by fluid pressure.

1,409,216. Race Totalizator; George A. Julius, Sydney, New South Wales, Australia. App. filed April 30, 1919. Electric totalizing machine for recording ticket sales of several booths.

1,409,253. Spark-Plug Intensifier and Tester; James H. Smith, Elza, Ga. App. filed Oct. 31, 1919.

1,409,341. Submarine Signaling; Henry C. Harrison, Fort Washington, N. Y. App. filed July 12, 1919. For detecting other vessels while submerged.

1,409,362. Telegraph System; George E. Cummings, East Orange, N. J. App. filed May 28, 1918. Balancing on duplex equipment.

1,409,365. Maximum-Demand Meter; Leo Dorfman, Pittsburg, Tex. App. filed April 21, 1919. Logarithmic type.

1,409,376. Attachment for Trolley Poles; James F. Healy, Chicago, Ill. App. filed June 20, 1921. To prevent accidental disengagement.

1,409,383. Chemical Rectifier; Thomas M. Lane, Alameda, Cal. App. filed Feb. 9, 1920. To rectify alternating current.

1,409,386. Telegraph System; James L. McQuarrie, Montclair, N. J. App. filed July 1, 1918. Arrangement for blind or deaf person receiving by sense of touch.

1,409,439. X-Ray Machine; Charles Fayer, New York, N. Y. App. filed Aug. 2, 1917. Breaking of secondary circuit to be positive and uniform.

1,409,460. Pressure Regulator for Vacuum Tubes; Arthur Mutscheller, New York, N. Y. App. filed Nov. 4, 1918. Adapted for use in X-ray tubes.

1,409,502. Time-Indicating Apparatus; Henry E. Warren, Ashland, Mass. App. filed June 18, 1920. Means for accurately setting a timepiece.

1,409,561. Automatic Multiple-Switch Controlling Machine; Everett A. Margeson and Charles D. Herrold, San Jose, Cal. App. filed Aug. 4, 1920. Automatic street indicator for trolley car.

1,409,586. Apparatus for Controlling Movements at a Distance; Joseph L. Routin, Paris, France. App. filed June 24, 1919. Indicates and repeats angular movements.

1,409,637. Meter-Test Apparatus; Fredrick Zenker, Highland Park, Mich. App. filed July 26, 1917. Safety-cabinet switch device.

1,409,647. Heating Transformer; Paul H. Bardill, Dubuque, Iowa. App. filed March 1, 1921. Portable electrically heated hot-water radiator.

1,409,669. Electric Furnaces; Cranston H. Carpenter, Irwin, Pa. App. filed Aug. 6, 1920. Current flows through material receptacles.

1,409,670. Control Apparatus; Lewis W. Chubb, Pittsburgh, Pa. App. filed June 9, 1919. Variable liquid rheostat.

1,409,681. Starting Mechanism for Engines; Edward A. Dickey, Wireton, Pa. App. filed June 28, 1920. Electric motor for combustion engines.

1,409,717. System of Transforming Energy; Peter Hewitt, Ringwood Manor, N. J. App. filed Oct. 29, 1915. By mercury-arc tube.

1,409,727. Method of Producing Pure Zinc Solution; Emanuel Kardos, Newark, N. J. App. filed Dec. 20, 1919. By electrolysis.

1,409,736. Power Plant; John M. Lea, Detroit, Mich. App. filed Aug. 8, 1919. Separate gas engine for automobiles to run storage-battery generator.

1,409,737. Automatic Telephone System; Thomas Lenaghan, Croydon, England. App. filed Nov. 2, 1920. Refers to contact switches.

1,409,782. Electrolytic Apparatus for Preparing Hypochlorite Solutions; David McG. Rogers and Arthur T. Masterman, London, England. App. filed Nov. 30, 1921. For bleaching and disinfecting.

1,409,788. Measuring the So-Called Firing Delay for Naval Guns; Ludwig Schon, Essen, German. App. filed Nov. 19, 1920.

1,409,839. Speed Indicator; William A. Erner, Dubuque, Iowa. App. filed Nov. 1, 1920. That traffic officers may know speed without pacing a machine.

1,409,874. Street Register or Indicator; Edward T. McCabe, Cleveland, Ohio. App. filed June 10, 1919. Trolley-car automatic street indicator.

1,409,879. Register; Henry E. Manley, Olean, N. Y. App. filed April 25, 1919. Used with orifice meters.

1,409,889. System of Electrical Regulation; William A. Turbayne, Niagara Falls, N. Y. App. filed Jan. 24, 1920. For operating automobile storage-battery generators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BURLINGTON, VT.—The Electric Light Department contemplates the installation of an ornamental lighting system on Church Street. M. G. Clark is superintendent.

NORTH TROY, VT.—The Blair Veneer Company has applied to the Public Service Commission for permission to amend its charter so as to enable it to generate and distribute electricity for lamps and motors in North Troy and vicinity.

BOSTON, MASS.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until April 12 for the installation of coal-handling equipment at the post office power plant. (Specification 4583.)

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., about April 15 for construction and equipment of a substation, distributing system and first-aid station at the South Boston Navy Yard (Specification No. 4550). The equipment will include a three-unit motor-generator set, 250-kw., 2,300-volt alternating-current to 140-volt direct-current, a 2,300-volt alternating-current to 250-volt direct-current, an exciter set and a nine-panel switchboard, with accessories. The cost of the entire work is estimated at about $100,000.

LOWELL, MASS.—Application has been made to the Department of Public Utilities by the Lowell Electric Light Corporation for permission to issue $297,200 in capital stock, the proceeds to be used for extensions and improvements.

MARION, MASS.—At the town meeting held recently the citizens voted to install fifty additional street lamps in East Marion.

MERRIMAC, MASS.—At a recent town meeting the proposal to extend the commercial electric lighting service on the Lake Attitash Road was carried.

MITTENEAGUE, MASS. — Motors and other electric equipment will be installed in the four-story mill addition, 25 ft. x 200 ft., to be erected by the Strathmore Paper Company.

SHIRLEY, MASS.—The Tyngsboro Electric Light Company, which serves the towns of Shirley, Dunstable and Tyngsboro, and the Pepperell (Mass.) Electric Light Company have been consolidated under the name of the Middlesex County Electric Company. The new company contemplates improvements to the service.

PROVIDENCE, R. I.—The Narragansett Electric Light Company is taking bids for the erection of its proposed plant on Melrose Street, consisting of a one- and two-story power plant, 40 ft. x 56 ft.; two service buildings, one of which will be equipped with two electric traveling cranes, and other miscellaneous structures. Jenks & Ballou, 1035 Grosvenor Building, are engineers.

HARTFORD, CONN.—The Fuller Brush Company, 547 Asylum Street, will build a power house at its proposed plant on Windsor Avenue. Buck & Sheldon, Inc., 60 Prospect Street, are engineers.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack & Southern Power Company is being organized by interests connected with the United Hudson Electric Corporation, Poughkeepsie, and the Adirondack Power & Light Corporation, Amsterdam, to build a transmission line connecting the systems of the two companies at Coeymans and Bethlehem town lines.

BROOKLYN, N. Y.—The Brooklyn Edison Company, 360 Pearl Street, contemplates the erection of a two-story power house 79 ft. x 127 ft., on Wakeman Place, to cost $300,000.

BROOKLYN, N. Y.—The new plant of the Brooklyn Yarn Dye Company, Neptune Avenue and Twenty-third Street, will include a one-story power house, 50 ft. x 50 ft. Arthur J. Adams is treasurer.

BUFFALO, N. Y.—The National Biscuit Company, New York, will erect a power plant at its factory on Belt Line Street, Buffalo, to cost about $1,000,000, with machinery.

CASTILE, N. Y.—The Board of Trustees has contracted with the Long Island Lighting & Power Company for commercial electric service.

CHAZY, N. Y.—W. H. Miner will build an electric power plant in Chazy for commercial service, to cost about $45,000.

DUNKIRK, N. Y.—Bonds to the amount of $65,000 have been voted for the installation of a fire-alarm and police-call telegraph system.

NEW YORK, N. Y.—Bids will be received by James A. Hamilton, commissioner of correction, Room 2402, Municipal Building, until April 4 for furnishing and installing one two-unit motor-generator set with switchboard, transformer and all necessary wiring in dynamo room at the Reformatory Prison, Hart's Island, Bronx.

NEW YORK, N. Y.—Bids will be received by the Board of Purchase of the City of New York, Room 526, Municipal Building, until April 4 for furnishing electric lamps to Bellevue and Allied Hospitals. Bids will also be received until April 3 for furnishing lamppost castings to the Department of Water Supply, Gas and Electricity.

NEW YORK, N. Y.—The Long Island Lighting Company, 50 Church Street, has acquired the plants and properties of the Southold Lighting Company, the Riverhead Light Company and the Consumers' Gas Company and will merge the plants with its system. A number of improvements will be made.

SCARSDALE, N. Y.—The contract for the electrical and mechanical equipment for the new pumping station has been awarded to John R. Proctor, Inc., 120 Liberty Street, New York City. The George A. Johnson Company is engineer.

SYRACUSE, N. Y.—A power plant will be established in connection with the hotel to be erected at East Onondaga and South Warren Streets by the Syracuse Hotel Corporation, Gurney Building, to cost $3,000,000. George B. Post & Sons, 101 Park Avenue, New York, are architects.

WATERTOWN, N. Y.—Work will soon begin on the construction of a hydro-electric plant at Browns Falls, near Watertown by the Northern New York Utilities, Inc. The cost is estimated at $100,000.

CAMDEN, N. J.—The seven-story furniture factory to be erected by the J. B. Van Sciver Company, adjoining its present plant, to cost about $500,000, will be equipped throughout with electrically driven machinery. The Ballinger Company, 105 South Twelfth Street, Philadelphia, is architect.

FRENCHTOWN, N. J.—Plans are being prepared for an extension to the municipal electric light and power plant. The Causbey Engineering Company, 1011 Chestnut Street, Philadelphia, is engineer.

JERSEY CITY, N. J.—The Lehigh Valley Railroad Company, 143 Liberty Street, New York, will build a substation in connection with a mechanical shop at the foot of Chapel Avenue, to cost $150,000.

NEWARK, N. J. — George C. Bergen, county purchasing agent, Court House, will receive bids until April 25 for furnishing incandescent lamps for county institutions for a period of one year.

SERGENTSVILLE, N. J.—The Eureka Power Company, Trenton, contemplates extending its transmission line from Stockton to Sergentsville. The company has contracted to supply power for the new plant of the American Clay Products Company, New Hope, Pa.

ALLENTOWN, PA.—The Council contemplates the installation of an ornamental street-lighting system on North Sixth Street from Linden to Chew Street.

CARLISLE, PA. — The Electric Light Committee will soon call for bids for an ornamental lighting system on Hanover and High Streets. O. H. Starner is chairman.

KANE, PA.—The Keystone Power Corporation has preliminary plans under way for a 15,000-kw. electric plant. The company has issued $1,750,000 in bonds, part of the proceeds to be used for plant and transmission-line construction. N. M. Argabrite is vice-president.

PHILADELPHIA, PA. — The Collins & Aikman Company, 4,675 Nixon Street, will build a one-story power house at Viola and Leidy Streets.

SHAMOKIN, PA.—The Roaring Creek Water Company is planning to install an electrically operated pumping plant at its waterworks. William H. Dechant, 632 Washington Street, Reading, Pa., is engineer.

SUNBURY, PA. — The Sunbury Water Company is having plans drawn for a one-story power house, 50 ft. x 50 ft. William H. Dechant, 632 Washington Street, Reading, Pa., is engineer.

UPPER DARBY, PA.—The Philadelphia & Garrettford Street Railway has applied to the Public Service Commission for permission to issue $165,000 in bonds for improvements to its electric system.

WILBURTON, PA. — The Pennsylvania Power & Light Company, Allentown, will extend its transmission line to Wilburton and vicinity.

WILMINGTON, DEL.—The Street and Sewer Department is considering improvements to the street-lighting system.

HAGERSTOWN, MD. — The Western Maryland Railway Company has contracted with the Hagerstown & Frederick Railway Company to supply electricity for its local yards. The present power plant will be dismantled. New motors from 600 hp to 350 hp., an air compressor, etc., will be installed.

CHESAPEAKE, W. VA.—A. C. Singer and associates contemplate the construction of an electric power plant in Chesapeake, to cost about $40,000. A franchise has been granted.

FAIRMONT, W. VA.—The Virginia & Pittsburgh Coal Company will electrify all departments at its Kingmont mining plant. Electricity will be secured from the Monongahela Power & Railway Company.

MADISON, W. VA.—The Kentucky & West Virginia Power Company, Logan, has applied for a franchise to supply electricity in Madison.

RIVESVILLE, W. VA. — Motor-driven centrifugal pumps and other electric machinery will be installed at the municipal waterworks, at a cost of about $50,000. B. Kress, Elkins, is engineer.

WEST SPRINGDALE, W. VA. — The American Gas & Electric Company, 30 Church Street, New York, will soon commence work on an addition to its local plant, to cost about $1,000,000, including transmission-line extensions. Sanderson & Porter, 52 William Street, New York, are engineers.

WHEELING, W. VA. — The Wheeling Machine Products Company contemplates the installation of a new power plant.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, War Department, until April 7 for a large quantity of switchboard and lineman's tools (Circular PR, 10340-9CP); also until April 8 for 562 condensers for signal service (Circular 10370-1CP).

WASHINGTON, D. C.—Bids will be received at the office of the District Commissioners, District Building, until April 10 for one motor-driven multistage centrifugal pump for the District Workhouse.

North Central States

DETROIT, MICH.—The Council is considering a recommendation of Mayor Couzens for an appropriation of $4,000,000 in the annual budget for the construction of an electric generating plant for the municipal transit system.

EVART, MICH.—The Council is considering rebuilding the municipal power plant.

MARQUETTE, MICH.—The Council has authorized bids to be asked for the installation of an additional generating unit at the municipal hydro-electric plant on Dead River.

OWOSSO, MICH.—The Council contemplates the installation of an ornamental street-lighting system in the business district.

ROCKFORD, MICH.—The Kirth-Krause Company contemplates building a power plant, to cost about $55,000. B. Parks & Son, Michigan Trust Building, Grand Rapids, Mich., are engineers.

AKRON, OHIO. — The Northern Ohio Traction & Light Company has issued $7,500,000 in bonds, part of the proceeds to be used for extensions to its system.

BELLEFONTAINE, OHIO. — Improvements are contemplated to the municipal electric light plant, including the installation of a 600-kw. turbo-generator unit, an additional boiler and condenser equipment, etc. The cost is estimated at $91,000. The proposal to issue bonds for the above will be submitted to the voters at a special election to be held April 4.

CLEVELAND, OHIO.—The Western Reserve University, Euclid Avenue, will build a power plant in connection with a five-story medical building at Cummington and Abbington Roads, to cost in excess of $2,000,000. Coolidge & Shattuck, Ames Building, Boston, are architects. Sidney S. Wilson, Ninth Street and St. Clair Avenue, Cleveland, is secretary and treasurer.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 219, City Hall, until April 7 for furnishing and delivering to the various departments of the city, Board of Education and public library all the lamps required for a period of one year, to cost approximately $50,000.

HAZARD, KY.—The Kentucky & West Virginia Power Company, Logan, W. Va., has completed plans for the construction of a three-story addition to its local power plant. F. R. Weller, Mills Building, Washington, D. C., is consulting engineer

CAMPBELLSBURG, IND. — The Interstate Public Service Company contemplates extending its transmission line from Salem to Campbellsburg, a distance of about 12 miles.

AURORA, ILL.—The Western United Gas & Electric Company contemplates extensions and improvements to its system in the Fox River district, to cost about $1,000,000.

CHICAGO, ILL. — The Chicago, Rock Island & Pacific Railroad, LaSalle Street Station, contemplates the installation of radiophone and radiograph apparatus on its passenger trains.

ROCKFORD, ILL.—The Rockford Electric Company plans extensions to its power plant and distributing lines, to cost about $350,000.

ASHLAND, WIS. — Contract has been awarded by the Ashland Light & Power Company to the L. E. Meyers Company, 53 West Jackson Boulevard, Chicago, consulting and contracting engineers, for the construction and equipment of a hydro-electric plant on the Flambeau River, near Tony, to cost about $3,500,000. The equipment will include three 5,000-hp. turbo-generating units. About 150 miles of transmission lines will be erected.

MADISON, WIS.—The Madison Gas & Electric Company, it is reported, will soon ask for bids for an addition to its steam generating plant to increase the output by 5,000 kw. New equipment, including a 1,000-hp. Stirling boiler, automatic stoking equipment, coal-handling machinery, etc., will be installed. Mead & Seastone, Madison, are consulting engineers.

MARSHALLTOWN, IOWA.—Plans are being prepared for a one-story power house at the Deaconess Hospital, for which bids will soon be asked. H. E. Reimer is architect.

KANSAS CITY, MO.—Contracts for cable, conduit, instruments, etc., it is understood, will soon be awarded by the Fire and Water Board for a new underground fire-alarm system.

MARSHALL, MO.—The Board of Works has plans under way for an addition to the municipal power plant, to cost about $25,000. An engine-driven generator and other equipment will be installed.

ST. LOUIS, MO. — The Union Electric Light & Power Company has secured a site on the Illinois side of the Mississippi River, near the city limits of East St. Louis, Ill., on which it proposes to erect a power plant, to cost, including equipment, more than $6,000,000. McClellan & Junkersfeld, 45 William Street, New York, are engineers.

WINFIELD, MO. — The Winfield Levee and Drainage District will install an electric pumping plant in connection with an irrigation development. W. H. Jackson, Sr., is secretary.

VELVA, N. D.—The Velva Coal Products Company, Valley City, is planning the construction of a power plant at Velva, to cost about $750,000. The Dakota Engineering Construction Company, Valley City, is engineer. W. J. Bliss is head.

HOLTON, KAN.—The Council will receive bids until April 10 for a 100-kw. generator and other equipment for the municipal power plant. Black & Veatch, Mutual Building, Kansas City, Mo., are consulting engineers.

KANSAS CITY, KAN.—The Council will install an ornamental street-lighting system on Kansas Avenue and Packard Street.

SEDAN, KAN.—The Council will install an ornamental street-lighting system, to consist of fifty-four lamp standards, in the business district.

WALDRON, KAN. — The Council has awarded a contract to the Tri-State Electric Company, 1,002 Southwest Boulevard, Kansas City, Mo., for the construction of a transmission line to Anthony. A local distributing system will be installed. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

SAVANNAH, GA.—The Savannah Electric Company contemplates additions and improvements to its system during the present year, to cost about $360,000. R. C. Brooks is manager.

PALATKA, FLA.—The Council is considering the erection of a municipal electric plant, to cost about $25,000.

SAFETY HARBOR, FLA.—The Council has authorized plans for an addition to the municipal electric lighting plant.

GERMANTOWN, TENN.—The construction of a municipal lighting plant, to cost about $25,000 is under consideration.

VICKSBURG, MISS. — New equipment will be installed in the power house at the municipal waterworks. J. J. Hayes, Mayor, is in charge.

DONALDSON, ARK. — The Arkansas Light & Power Company will install a local distributing system. Service will be furnished from the transmission line now being built from Little Rock to Malvern, Ark. C. P. Couch is manager.

FAYETTEVILLE, ARK. — The Council will install an ornamental lighting system from the business district to the University section.

HAMMOND, LA.—Plans are being prepared for the installation of a new street-lighting system, to cost about $25,000.

LAFAYETTE, LA. — A committee has been appointed to investigate the proposition of leasing the municipal electric plant to private interests.

MUSKOGEE, OKLA.—The Council has authorized estimates of cost made for a municipal light and power plant.

PONCA CITY, OKLA.—The City Commissioners are having estimates of cost made for the construction of a transmission line to Redrock, Bliss and vicinity. With the building of this line the Redrock Council will abandon its tentative plans for the installation of a municipal lighting plant.

WOODWARD, OKLA.—The Council has awarded a contract to Carrothers & Pitburn, Commerce Building, Kansas City, Mo., for a power house for the municipal electric plant. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are consulting engineers and will receive all equipment bids.

FORT BLISS, TEX.—The Quartermaster Supply Office will receive bids until April 6 for 5,900 electric meters (Circular 61).

FORT WORTH, TEX.—The Southwestern Power & Light Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

Pacific and Mountain States

MILTON, ORE.—The Council has filed an application with the State Engineer for permission to use water from the Walla Walla River for a municipal hydro-electric plant. The project will include a 60-ft. dam and 2½-mile pipe line.

TACOMA, WASH.—The Council has authorized the Commissioner of Light and Water to call for bids for 500 ornamental lamp poles and 50,000 ft. of armored cable.

CORONA, CAL.—The installation of an ornamental lighting system on Sixth and Main Streets and Grand Boulevard is under consideration. E. F. Clarke, secretary of the Chamber of Commerce, is in charge.

SACRAMENTO, CAL.—Plans are being prepared by Albert Givan, city engineer, for the installation of an ornamental street-lighting system in lighting district No. 10.

SAN FRANCISCO, CAL.—The Board of Public Works, it is reported, will receive bids until April 12 for equipment for the Moccasin Creek power plant of the Hetch-Hetchy project in Tuolomme County, to cost about $1,000,000. The equipment will include four electric generating units, having a capacity of 25,000 hp. each. This is the first of several large hydro-electric installations in connection with the Hetch-Hetchy project. M. O. Shaughnessy is city engineer.

SAN PEDRO, CAL.—Steps have been taken by the residents and property owners on Sixth, Seventh and Palos Verde Streets for the installation of an ornamental street-lighting system.

BRIGHAM CITY, UTAH. — The City Council has decided to install a new street-lighting system on North and South Main Streets.

SALT LAKE CITY, UTAH.—The City Commission has voted to advertise for jurisdiction and to call for bids for the installation of a residential lighting district on Yale Avenue for four and one-half blocks. The plans call for forty-two ornamental standards. Bids will be opened April 4.

Canada

BRANTFORD, ONT.—The establishment of an auxiliary lighting plant at the General Hospital is under consideration by the board of trustees.

TORONTO, ONT. — The Hydro-Electric Commission is arranging a program for extensions and improvements to its system to cost approximately $3,500,000.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary. H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa. Annual convention, Baltimore, April 27-29.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Niagara Falls, Ontario, June 26-30.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 26 to July 1.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, Spring Lake Beach, N. J., June 19-25.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Hot Springs, Va., May 24-26.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo. Annual meeting, Columbia, Mo., May 4-6.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Convention, Atlantic City, May 15-20.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting, St. Paul, Minn., June 13-15.

Northwestern Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 11-14.

Oklahoma Utilities Association. Acting secretary, O. D. Hall, Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal. Annual meeting, Los Angeles, May 31-June 3.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla. Annual meeting, San Antonio, Tex., May 3-6.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex. Annual meeting, San Antonio, Tex., May 3-6.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Convention, Spartanburg, S. C., April 19-21, 1922.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Secretary-treasurer, Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington, W. Va.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, W. M. Chester, 1408 First National Bank Bldg., Milwaukee, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

Electrical World

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Volume 79 New York, Saturday, April 8, 1922 *Number* 14

Our Cliques in Corners

FOUR kinds of electrical men make up the electrical industry. They represent the interests of central stations, manufacturers, jobbers and contractor-dealers. They are organized into groups and as groups they operate. But the electrical industry is bigger than any group.

For the electrical industry is engaged in the development of our greatest natural resource and in rendering a service to the people of America that is vital to their present and to their future. Electrical men have built up a great science and a great art, carried it through successive eras of research, invention and engineering, and now stand just within the threshold of a great commercial era, possessed of a great business. The proper co-ordination of these four functioning groups is necessary to the progress and prosperity of all. The responsibility of each group to the industry and to the people must outweigh all selfish class purposes or considerations.

REPRESENTING these four classes of electrical men we have several associations. These class associations are discussional bodies. Having large membership, they work by committees and the limit of power in committee work is usually to develop information and to determine policies. But to represent all these classes and to receive, coordinate, apply and promote these policies to the common purpose and the common interests of the industry as a whole some neutral agency is needed that may provide a working organization capable of carrying out a five or ten-year program. For such a function the Society for Electrical Development was established.

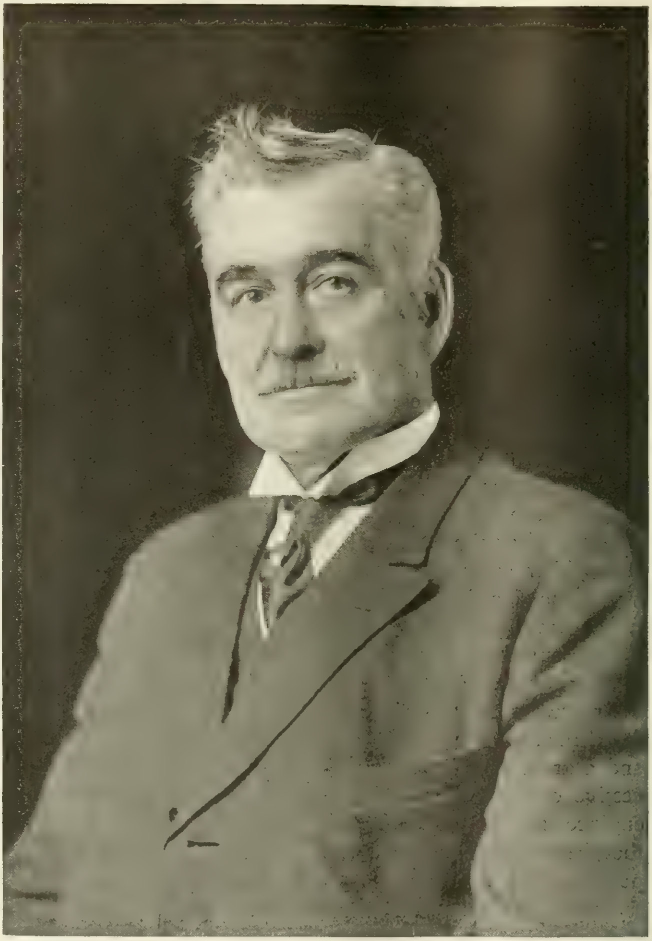
This balanced organization of our industry, however, has never been realized. Each class clique still clusters in its corner, busy about itself and its own class affairs. No single group can ever dominate all. No one class association, however powerful, can successfully assume the authority to speak for all. But to no one is the opportunity given to act for all in the co-ordination and advancement of the common aims.

GOOD times are now returning to America. Tremendous expansion and activity lie ahead for the electrical industry. Never in our history has there been so great a need for a smooth-running, well-functioning organization to carry forward, in honest balance, the plans and purposes of each electrical group for the developing of the common aim and opportunity.

If the Society is not the instrument we need, let us decide it so and cast it out. But we must be prepared to set up something better as a working force to serve all classes of electrical men and to promote this industry progressively.

William Jared Clark

Pioneer in the commercial development of electric railways and physical valuation of utilities



BACK in the eighties when the street cars were hauled by horses it required no small amount of courage to follow the vision of electric traction. Power houses were in their infancy, investment had been made in many places in horse-car systems, and the electric installation was comparatively costly. When, however, the vision had once captivated its beholders it never faded, but grew constantly clearer till it turned into reality. With this realized vision the life of W. J. Clark, recently made advisory manager of the General Electric Company's railway department, has been bound up. Mr. Clark originated the project for the first electric railway in the world intended for freight traffic and was instrumental in obtaining the legislative charter authorizing its construction at the cities of Derby and Ansonia, Conn.

It was upon the advice of the late William Wallace, pioneer in arc lighting and motor production, that Mr. Clark, attracted by the possibilities presented by electric traction, entered the electrical industry in the spring of 1888. He has since participated in the commercial expansion of almost every phase of the Thomson-Houston and General Electric companies' business throughout the world. He has been manager of both the railway and foreign departments and of the Cincinnati and London offices of the General Electric Company, managing director of the British Thomson-Houston Electric Company, and has held several other positions of importance.

One of the first things he did after joining the company was to induce it to purchase the Van Depoele electric railway patents, which from a patent standpoint were essential to the fullest possible development of that industry. He early realized the value of certain fundamental patented electrical inventions and was an active worker in bringing these under the control of the corporate interests he represented. Mr. Clark played an important part in the commercial exploitation not only of the Van Depoele patents but of Potter's series parallel control, Sprague's multiple-unit train control, Curtis' steam turbine and other inventions as well. In 1896 at Milwaukee he made, for the first time in this country, what is now termed the "physical valuation" of a large electric public utility. This work was highly complimented by the United States circuit court under whose scrutiny it came, and the general plan then inaugurated has since been frequently followed by others.

In 1906 and 1907 Mr. Clark was the chairman of the ways and means committee of the National Civic Federation, in which connection he financed the extensive investigation of municipal ownership conducted by the federation in this country and in Europe, and he was as well a member of the commission which made the investigation. In 1908 he acted as an expert on Cuban affairs for the War Department.

Mr. Clark was born in Derby, Conn., in 1854 and prior to entering the electrical field at the age of thirty-four had been engaged in the coal business and as postmaster in his native town. Since 1888 he has devoted his entire time to the electrical industry, with particular attention to the development and progress of electric traction. He is a member of a number of national electrical and railway engineering societies, in the work of which he has been actively interested.

Editorial Comment

Electrical World, April 8, 1922

Volume 79

Number 14

Challenge to Private Enterprise

GOVERNOR MILLER in his memorandum attached to New York's amended water-power act was careful to outline the Empire State's policy with reference to water-power development. Outwardly at least it is the wish and intention of the state to encourage development by private enterprise, and, failing in this, state development is the alternative. The law is patterned largely after the federal water-power act and brings under it all legislative grants to develop water power on which no work has been done. To have and to hold henceforth is taboo. The new order is to have and to develop.

What, then, shall the answer be? An enterprising and far-sighted industry will accept the invitation and thereby make null the threat. Water powers are becoming increasingly valuable, and their development is a social and national necessity. The obligation to develop them is clearly the duty of the electrical industry, and this duty must not be shirked.

Another Case of Mixing Dates

DURING the week of May 15 the National Electric Credit Association will hold its summer convention at Detroit. The National Electric Light Association will be gathered at Atlantic City at the same time. Here is another case of mixing dates of the meetings of large groups of electrical men that should be so arranged that they will not conflict. To this end it was suggested some weeks ago by the ELECTRICAL WORLD that a clearing house be set up to which tentative dates may be referred before conventions are definitely scheduled so that previous datings can be compared and such complications avoided. The Society for Electrical Development has acted on this suggestion and assigned a member of its staff to function in the way proposed.

It is doubtful if any of the central-station executives who will be in Atlantic City would be likely to attend the Detroit meeting, but there are many of the jobbers and manufacturers dated up for the N. E. L. A. convention who should sit in with their credit men and give active thought and personal support to this most important work. And there will be many executives of jobbing and manufacturing houses at Detroit, because they themselves carry the credit functions for their companies, who should be at Atlantic City. They would be welcome. They would contribute a valuable point of view to the discussion of common problems. They would meet many of their central-station customers who will be there.

It is unfortunate that the presence of these men at both conventions should be prevented by the mere fact that in the arranging of the dates the conflict was not avoided. It will probably not be possible to end all parallel meetings, but there will be many cases where a simple, sensible precaution of this kind will enable men interested in two gatherings to attend them both, to their own good profit and the distinct advantage of the conventions. It cannot be repeated too often that we need more contact between the different classes of men in the electrical industry.

Dignified Appeal to Public Opinion

WE CANNOT refrain from expressing admiration for the appeal to the public conscience made by the New York Telephone Company last week. Sensing its obligation to furnish comprehensive telephone service of a high quality to the public and feeling that the rates allowed by the Public Service Commission would mean deterioration as well as stoppage of expansion, the utility for the first time and with reluctance appeals to the courts for relief. It is not our purpose to delve into the merits or demerits of the case. Our interest is in the public announcement made by the company to its patrons. It is dignified, frank and to the point. No earmarks of deception are discernible, and it must impress the average reader favorably. That, after all, is the end sought, and as an example of public utility advertising for establishing good public relations it is most effective and warrants the emulation of other public utilities confronting similar conditions.

Central-Station Companies Contemplating Use of Radio Must Experiment

THE central-station manager who desires to use the radio telephone for operating purposes must be prepared to go into the project on an amateur basis because too many things are involved at the present time to determine with authority whether and in just what way it is practically applicable to the requirements of the central-station company. The reliability of operation, the range of transmission and government regulations are too uncertain for any one to reach definite conclusions yet. Interference, irregularity and discontinuity of reception are just a few of the problems which must be faced. Plenty of apparatus for the construction of radio sets is available, but the exact character of apparatus which will be suitable for commercial application to central stations has not yet been determined. This is largely due to the fact that manufacturers have had to confine themselves to supplying amateur demands. When the present radio fad subsides or becomes stabilized, they will be able to give more attention to the commercial requirements of the central-station field and other would-be customers than is just now possible.

Therefore, we repeat, if central-station companies desire to adapt radio to their operating requirements, they must play with the apparatus to find its limitations and weaknesses. Some of the problems outside the purely technical features of the work that the experimenter must be prepared to face are told of elsewhere in this issue.

Outdoor Versus Indoor Installations

AN ANALYSIS of the factors that determine the decision to install outdoor or indoor switching and transformer installations in this country today would show, without doubt, that many inconsistencies exist in practice. It is true that in the case of older installations there was no choice to be made, indoor equipment being generally all that was available; but in the last years, with both indoor and outdoor equipment on the market, and both of proved worth, it is evident that nationally a uniform or consistent viewpoint has not been reached. In the most rigorous climates we find sometimes an abundance of outdoor installations, while in many places where the climate seems to lend itself ideally to outdoor installations nearly all transformers and switches are found indoors. Allowance must, of course, be made for diverse opinions among engineers and for prejudices that possibly may come from a long and successful operating career. None the less, an effort to crystallize knowledge and experience into a more uniform policy should be made. A great deal of good could be accomplished by the free exchange of data and comparison of results.

Inconsistency on the part of engineers as a class is not productive of good and is not in keeping with their training or their purpose. Sound analysis of costs and operating conditions would clear away much of the disagreement that exists today. Were it only to present a solid front to the prospective investor in transmission securities and thereby obviate the answering of difficult questions, would it not be well for engineers to get together and formulate a policy regarding outdoor and indoor switching and transformer installations that will be consistent with engineering principles?

Most Economical Utilization of Steam Is Deciding Factor

ENGINEERS, like other people, may be divided into optimists and pessimists. The former cultivate faith in apparatus, the latter deep-rooted distrust. The former are willing to follow Mark Twain's injunction to put all their eggs in one basket and then watch that basket; the latter pack each egg in cotton wool and intrust it to a special conveyance without further care. The optimist builds a station with few but independent units and with a plan of construction as simple as practicable; the pessimist provides for universal interchangeability of everything and is unhappy unless there are at least three automatic contraptions, each watching the one nearest it.

This difference of temperament is apparent in the types of auxiliary drives now attracting so much attention. Beginning with a power house in which everything was independently steam-driven because of a pessimistic frame of mind handed down from the last generation which whispered always that the motor might burn out, we have gradually cheered up until we have almost reached the point of faith where we are ready to drive the auxiliaries straight from the turbo-generators. Those affected with spasms of caution have tried out mixed methods, generally with intermediate results. From our own viewpoint the more direct the drive and the simpler the equipment the less likelihood of trouble —on the whole. Working from the main turbines at a voltage high enough to make distribution easy has much to be said in its favor, for the electrical drive is extremely reliable in these days. In efficiency small reciprocating engines are bad and small turbines possibly worse unless all the exhaust steam is utilized. Even then the over-all plant economy must be carefully analyzed to make certain that what appears to be an economical use of steam is not productive of lower plant economy than could be obtained by a more judicious selection of auxiliary drives.

The great variations of current practice show the many minds in these matters, but on the whole the fashion of extreme complication, based on the plea of reliability, is passing away, because the most serious failures have come from somewhat trivial causes, that are too often traced back to a complication of apparatus so great as to increase rather than decrease the possibility of failure.

Efficient Service from Mine Locomotives

CONSIDERABLE progress in the design and utilization of electric locomotives for mining service has been achieved in recent years. The contrast between old-time equipments and later apparatus for this severe work reflects no little credit upon manufacturing engineers. If users will now do their part in intelligent selection and thorough supervision of this class of motive power after installation, gains in economy through better utilization of energy and through increased production can readily be attained.

Industrial engineers without experience in the traction field are liable perhaps to consider the buying of a haulage equipment on the basis of sustained capacity and tractive effort—two most important factors in electrifying mine transportation, but by no means the only requirements. After very little investigation, the necessity of close co-operation with manufacturing engineers is evident, for the mechanical features of the equipment and the electrical characteristics of the mine railway system are closely tied in with successful service.

The choice of the number of motors, the advisability of dynamic braking with its price of increased motor sizes, the type of control best suited for particular cases, clearance limitation, framing structure and ventilating characteristics desirable, the alignment and grade of the trackage, all bear heavily upon the proper selection of equipment. Engineers with an analytical turn of mind find the plotting of speed-time-distance curves, current and voltage graphs, etc., helpful when selecting electric locomotives for specified service in mining, and thorough studies of this kind enable more intelligent relations to be established and maintained between manufacturer and buyer, despite the fact that the engineers of the former are naturally specialists in the use of these analytical tools.

Increased efficiency through the use of accessible running gear, open-side frames, alloy-metal resistor units and the contactor type of control cannot overcome the bad effects of a poor distribution system, and the importance of insuring a decent working voltage under extremely unfavorable conditions can hardly be overestimated. There is little excuse today for letting the voltage at the motors drop to 50 per cent of normal with the economies of distribution now available through the automatic substation. In many cases low voltage causes more abuse of equipment than all other factors, and reserve capacity is oftener needed for this than for other causes. As a result of automatic control at well-planned distribution centers, safe and more constant power conditions can be maintained, and this means increased output at the mine. Regular tests of energy consumption, track and line conditions by portable instruments on electrically hauled trains demonstrate the value of technical supervision in this field of electrical service, which is one of no small importance.

Light Railway Equipment as a Step Toward Railroad Electrification

TRUNK-LINE electrification of railroads is no longer a question of engineering but strictly one of finance. The economy of main-line electrification under certain conditions is recognized, at least by those who are fully informed. The problem is how to undertake the herculean task of raising funds for electrification even in the certainty that the change can save money.

The Chicago, Milwaukee & St. Paul electrification, a very fine job from the engineering standpoint, ran toward $30,000 a mile without the development of power or the building of power houses, the energy being purchased. Had these other items entered, the cost would have gone above the figure just mentioned. When one realizes that some of the long Western lines were originally built and equipped completely for a figure no greater, it is self-evident that the chance for rapid development of electric service is very small until the railroads shall have recovered enough from the desperate condition into which government mismanagement plunged them to take advantage of the opportunities for improvement that electrification offers.

With reasonably heavy traffic there is no doubt as to the issue. So long as traffic is light, however, the odds are against success unless the situation is squarely met by adopting some such method as the light electric railway—that is, converting an ordinary railroad into a system resembling the less heavily equipped interurban systems. This step might now and then be a very useful and profitable one, but on the whole the tendency in this country has been, perhaps unwisely, directly against what are known elsewhere in the world as light railways.

By "Hire" and "Hire Purchase"

THOSE who still disapprove of the installment selling of household appliances by the central-station company or hesitate to embark on this commercial venture, new to them, should lift their minds a moment out of the habit-formed groove of their selling experience and consider these facts: Already 90 per cent of the large appliances introduced into American homes today are being sold on easy payments. Many central-station companies are doing it. Many contractor-dealers and electric shops are doing it. Many department stores are doing it. Many manufacturers are doing it. Books are sold that way. Pianos are sold that way. Furniture is sold that way. Phonographs are sold that way. It has become standard practice in the selling of all kinds of household equipment that costs a considerable sum. It will be no new experiment in merchandising.

Before the central-station industry stands a tremendous opportunity. Five million homes wait to be wired and equipped and connected to existing lines. Seven million other households need more appliances. They can be sold and the selling can begin right now if the hard times are met with easy terms. But the hard times are passing away. Good times are slowly unfolding. Good selling will come with them. The volume of this selling, however, will be in direct proportion to the ease of buying.

In England, where the "electricity undertakings" are far more backward in commercial development than are the utilities of America and where electrical appliances have not won anything like the popularity they enjoy here, they are meeting the hard times with easy terms in two ways. They are both advocating and applying two methods of sales which they call "hire" and "hire purchase." In other words, they are selling appliances by installments and they are renting them. Surely, if this is being recognized as necessary and desirable in conservative old England, we should not falter here. The purpose is to get appliances into common use and build up a universal popularity. Why should we question any honest method of selling that experience has proved to be profitable?

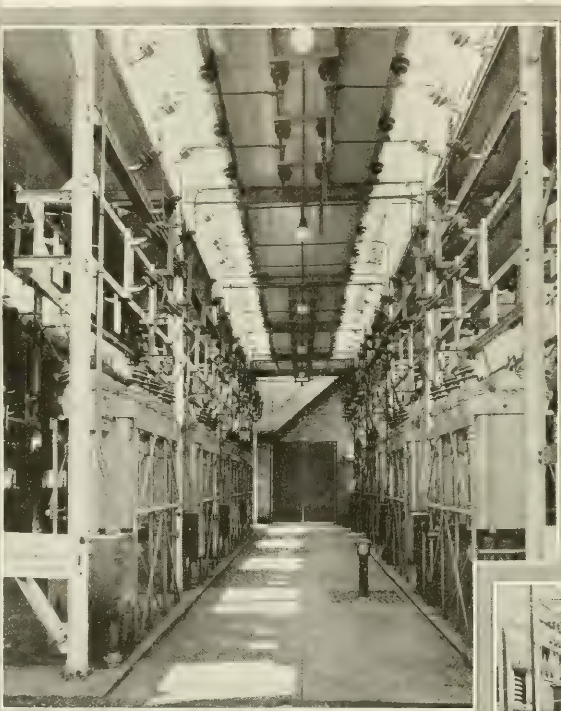
Small Reserve Is Striking Evidence of Service Reliability

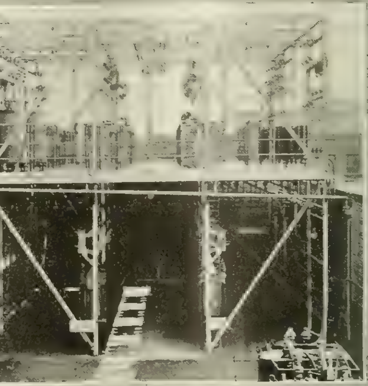
THE total rating and distribution of electric plants, which we publish this week, gives serious food for thought. The aggregate capacity of the generators running today reaches the enormous figure of more than 14,450,000 kw., distributed in more than 5,500 stations. Of these stations more than a quarter are hydro-electric, representing a still larger proportion of the total energy, but with this there are more than 4,100 central stations operating with coal or oil as a fuel and facing the uncertainties of future supply. Of the total capacity of the country New York has more than 10 per cent, Pennsylvania nearly as much, while Ohio is a good third with above a million. A very striking feature of the situation is the small amount of reserve equipment, showing how closely central stations have been living to their limited capacity. The total reserve is only a little over 1 per cent of the capacity operating, and west of the Rockies no actual reserve is reported, the factor of safety lying chiefly in interconnection.

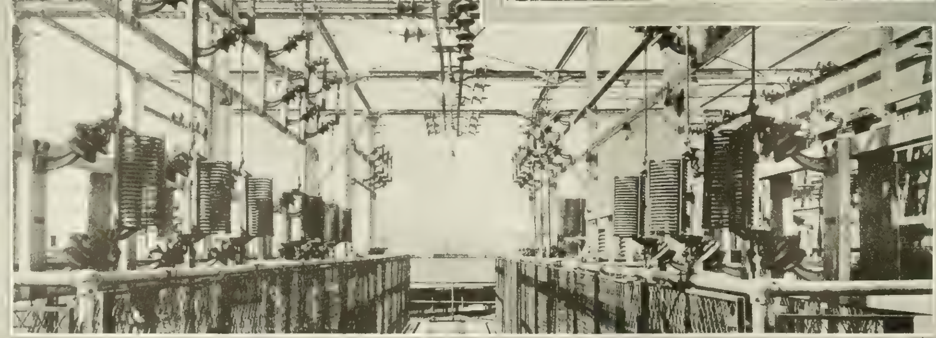
It is a very impressive list, this of the great central-station industry, representing as it does huge investment of private capital and prodigious possibilities of industrial usefulness. The municipal stations are fairly numerous but represent a comparatively insignificant part of the total output. We know of no stronger evidence of the growth of the industry than is furnished by such data as these. The possibility of operating with such a small reserve as is here shown is indisputable evidence of the general reliability of the electrical equipment as well as of that rapid growth which has made keeping ahead of the demand a practical impossibility.

Entire Electrical Bay of El Paso Station Built Outdoors

INCREASED space between conductors and between apparatus, greater accessibility for inspection and maintenance and reduction in cost of building foundations, walls, roofs and isolating barriers are some of the advantages which were realized by building the entire electrical bay of the El Paso Electric Railway Company outdoors. A general view of it is shown in the illustration immediately below, while glimpses of the ground floor and second floor are shown at the left and at the bottom of the page respectively. On the ground floor are the oil circuit breakers with their disconnecting switches, the former on pipe frameworks and the latter on hot-galvanized structural steel well above the floor. The control wiring is entirely in rigid conduit. On the floor above are buses, disconnecting switches, current-limiting reactors, choke coils and oxide-film arresters. The reactors were especially designed for outdoor service by being treated with linseed oil and covered with either paint or baked enamel. Circuits connecting the electrical bay with the generators are run underground through single-conductor, rubber-sheathed cable in fiber conduit, while those leaving the station are overhead or underground as required.







"Family Spirit" in the Public Utility

Humanizing the Organization Without Departmentalizing Employee Relations—Mutual Confidence Held to Be a Greater Power than Excessive Systemization—No "Little Jobs"

By **H. A. LEMMON**
Personnel Department, Stone & Webster, Inc., Boston

THESE pungent thoughts from Mr. Lemmon on the subject of the spirit within the organization of a utility company follow quite naturally his previous article which discussed the relationship between the public service company and the people. It was entitled "What the New Customer Thinks on the First Day," and because it painted a very human picture in a very human way of the costliness of bad first impressions it has occasioned much interested comment. This paper must not be taken as a general indictment of group insurance, but rather of the halting spirit and foreshortened vision which are content with nothing more than an artificial and impersonal relationship between a company and its employees and then wonder why the kind of loyalty and service thus begotten has little heart in it. Group insurance where it is but one feature of an organized family relationship, in which the bonds of interest, mutual service and interdependence are forged of human feelings, is something else. In a word, Mr. Lemmon's thought is that no family can do its best if it is unhappy, and he shows that happiness among the members of a "utility household" must be builded of those selfsame human factors that make happiness within a home.

I AM GOING to speak very frankly to the readers of the ELECTRICAL WORLD about the importance of "family spirit," or, better still, "gang spirit," within the company. Before our public utilities can even hope to take their proper places as givers of real service and earners of fair return, they must be imbued with this most powerful incentive to play their part after the fashion of man to man and with the minimum of mechanism designed to better human relations. The first organization and the only one which has survived throughout the ages was invented by Nature—we call it the family—and no genius or industry of man directed against it has ever been able to break it down. Therefore it must be a safe organization to accept as a model, and when we do that we can hardly be accused of yielding to a passing fad.

Why don't we get this spirit in so many of our modern utilities? We fail to do so simply because we don't really desire it hard enough. Yet the office force cannot handle the public intelligently unless its members know their work, and they cannot know their work if the manager runs his business like a secret society of which he is the sole member. Information within the family circle is the first step toward public relations.

"Public relations!" They're all doing it. The shelves are fairly loaded with volumes prepared willingly and anxiously to instruct harassed corporation managers how to attain good public relations. The magazines are full of suggested methods and experience, and if only you will send $6 and get Professor Splifkins' book on "The Unit in Industry" and follow its precepts, your employees will immediately begin sitting up nights knitting "God Bless Our Home" mottoes for your office. I will not attempt to describe Professor Splifkins nor relate the sum of this actual experience with the problem he handles so learnedly. If the reader who is a manager lacked imagination, he would not be holding his present post.

When Did Group Insurance Ever Reduce Labor Turnover?

I have had the pleasure of discussing the subject of family spirit with some of the distinguished gentlemen who are engaged in this work for a number of great industrial organizations. Of course they have group insurance, which bids fair to become very popular during the next few years. Group insurance is a wonderful thing. All the employees are bunched and for approximately $10 a head each will receive a beautifully lithographed certificate or policy from the Panacea Insurance Company entitling a man's widow to $1,000 if he dies on her hands during the ensuing year. Life insurance is a splendid thing, no doubt of it; but the beauty of group insurance is that you do not have to die to begin receiving benefits. For while you are still alive that insurance company will from time to time send you little pamphlets such as "How to Keep the Baby Well," "Infantile Paralysis Is Dangerous," "All About Milk," "Health and Happiness in the Home," and so on; and if the group is large enough, it may occasionally include medical examinations and free advice. The insurance companies are a unit in their declaration that group insurance will help all domestic troubles and will reduce the labor turnover—magic phrase! I know of no statistics which show how much group insurance has reduced the labor turnover in any plant, nor of any actual proof that it has reduced it at all. Nor do I know of any instance where the employees indicated that they even wanted group insurance. They never do if they have to pay any portion of the premium. The man who wants life insurance is the old employee with a family and other nearby responsibilities. There is not a bit of danger that he will ever leave your employ voluntarily, and the young man whom you would like to nail down to your own particular service does not care a snap whether you give him life insurance or not.

You Cannot Buy Loyalty

Just as soon as all companies in your field have adopted group insurance it can yield no particular advantage to any of them. To carry out this paternal effort to purchase loyalty, you, Mr. Manager, will have to add accident and health insurance and thus set a pace which all of your rivals must follow. When they catch up with you in this it will be time to incorporate an old-age pension scheme, and so the race will go on progressing and no final goal be reached.

A lot of companies have officials whose sole job is to bring about the family relationship in corporate organizations. These men are called "industrial relations managers." Is that not a title to cover a department which presumably is trying to make an organization human? What a wonderful thing it would be if a manager could set up a machine in his office, and whenever he felt the need of injecting some real, garden variety of human spirit into his organization drop a ten-dollar bill or a thousand-dollar check into it and accomplish the desired result! Yet the insurance company and the industrial relations managers are attempting to perform just the functions of that machine and in virtually the same manner. The "automat" doesn't seem to have displaced the personal-service restaurant—yet.

If I were a manager with a free rein, I would not under any circumstances permit an insurance company or a nickel-in-the-slot machine to get in between any of my men and myself. I would never promise any of them to endeavor to compensate their widows. But a few days after Jim Smith's funeral I would drop in upon Mrs. Jim Smith—and it would not be the first time I had called since Jim's death, either—and I would sit down and talk things over with her. I would let her talk about Jim too if she wished, and if it made the world any brighter for her to cry, I would not mind, because if Jim had been working for the company for twenty years or any considerable time, he would have been more or less of a comrade to me as well, and I would not feel so cheerful that his widow's tears would seem entirely out of place. Then I would talk with her about the future and the future of the children, would meet her fear that little Jimmy junior would have to quit high school and begin to earn money with a suggestion that I guessed we could see that James junior finished school. I would find out all about her affairs, financial and otherwise, and I would advise her just a bit more carefully than I advised my board of directors about company business and together Jim's widow and I would plan out the things she and hers must do. And then before I left I would like to hand her a check for $1,000, and that check would not be signed by the Panacea Insurance Company, 2,000 miles away, either. It would bear the legend "Ringville Power Company, by H. A. Lemmon, Manager." It isn't so much what you do as how you do it.

LET US LEARN EVEN FROM TAMMANY

It is very interesting to learn what this company and that company are doing to tie their workers to them, but my own personal opinion is that I shall seek for knowledge in an entirely different quarter—Tammany Hall. Give me twenty minutes' observation and study of the history of Tammany Hall, and as far as I am concerned you can burn the libraries on industrial relations, and the country's greatest industrial organizations won't need to copyright their own pet systems on my account. Tammany Hall does not send booklets about the cold-pack method of preserving tomatoes where the family of a faithful follower is out of food or requires medicine. Instead, it sends food and shoes and money when it's needed. Now, of course, if I knew anything about the financial end of operating a company, I would know that it is not business to loan money to employees, that you will lose most of it if you do, and, besides, the act will accomplish no good purpose. The whole thing is unsound and unscientific. There is nothing wrong about this statement as an item of news except that it is old. It is strange that some managers have been so slow in comprehending a fact as self-evident and so generally conceded, and just because they are not losing any considerable amount of money they make loans to distressed employees, and I suppose they will continue to go through life not knowing how impossible their success is.

Tammany Hall holds its rank and file through thick and thin because it treats them in a thoroughly human manner and because it does not know the meaning of the term "industrial relations." Tammany does not always capture enough votes on the outside to win every election, but it goes into the fight with a united family, and, come to think of it, its batting average is not so far from 1,000 at that. And so, as between the professors who really would not know a family spirit if they met one in a bottle or in a churchyard, and the very wise, subtle, human politicians who handle Tammany Hall, my money goes on the Hall.

THE INDUSTRY MUST BE HUMAN

The public utility industry has tried politics and failed; it has tried legal battle and failed, and now if it is to survive, it will try the only thing which has ever had a chance to win and which since man was first created has never failed—the human touch. If we think people are fundamentally unfair, dishonest or unintelligent, then we should immediately get out of the utility business, for as the people are, so they have been since the beginning and so they will presumably be to the end. We must climb down from our high horse and get to earth. We must put something besides brains and money into our business. Our most famous American of recent years is remembered because he was human, and paradoxically his human weaknesses were his transcendent strength.

Very frequently some man or some corporation or some government thinks it can ignore human nature and the human touch. Disastrous failures follow, and they always will. Every manager today is confronted with the choice of humanizing his organization or of wrecking it. He cannot drive his public, but he can lead it. A community is built up by men who give more to it than they take out. Companies will be built up by managers who put more of themselves into their organization than they take out. To accomplish what we are seeking we must know the human side of our business—not only the managers must know it, but the cashiers, meter readers, collectors and clerks. These people are really the company to the public, and it is that same public which pays or refuses to pay our salaries and a return upon our stockholders' investment. We must abandon the idea that these are little jobs and that any one can fill them. In all solemnity, it is easier to furnish a manager for a new company than a telephone girl who will handle that job as it should be handled.

The secret of the whole thing—if it be a secret—is to be found in taking care of the little things, the minor points of contact with people. Very small keys will unlock very large doors both in an organization and in a community. If the little things are perfected there will not be any big problems to solve. We cannot properly exist on legal battles, on increasingly vicious legislation, on unwarranted financial assistance, on mistrust, on misunderstanding. We *can* prosper and give real service to the public when we gain its confidence—its good will. We can gain good will by being human. The man who does not recognize this fact was behind the times the very moment that Eve threw away the first apple core and human nature became an established fact.

Possibilities in Radio for the Central Station Company

Radio-Telephone Broadcasting Apparatus on a Commercial Basis—Some Difficulties the Central-Station Experimenter Must Face—Problems of Regulation

By J. C. MARTIN
Western Editor Electrical World

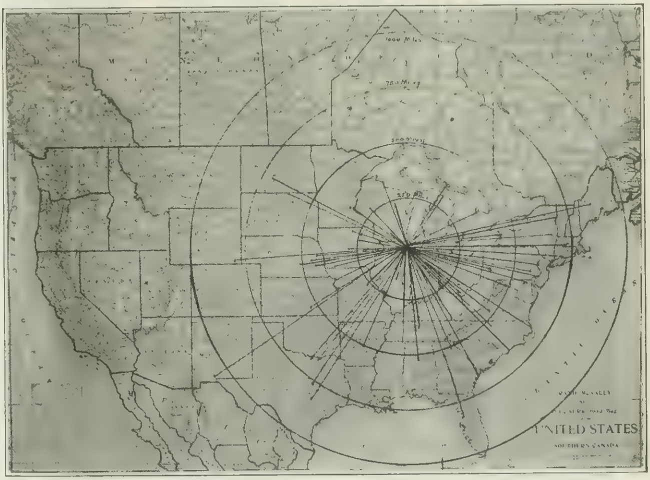
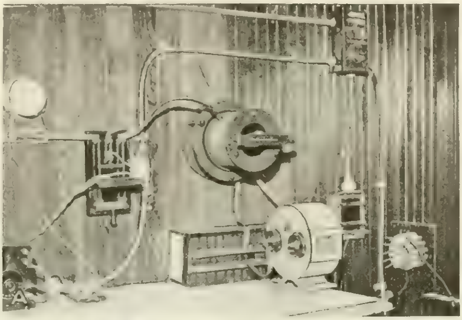


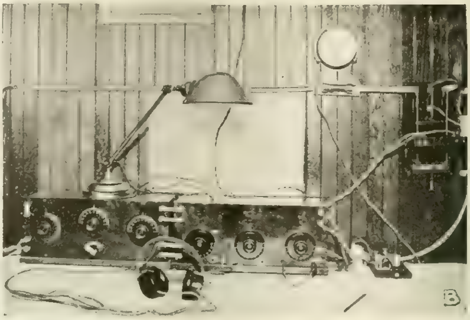
FIG. 1—SOME OF THE POINTS THAT HAVE BEEN REACHED BY BROADCASTING FROM THE WESTINGHOUSE RADIO TELEPHONE STATION IN CHICAGO

WHAT possibilities has the radio telephone for use in the operation of transmission systems? The answer depends on the answers to two other questions. The first concerns the percentage of perfect operation that can be obtained, and the second the distances that can be covered at the given percentage of reliability. There can be no question as to the value of the radio telephone if it in any way approaches the wire signal systems in reliability. Some of the experiences of the past year in the broadcasting of musical and other entertainment may shed light on the problem. Before considering the results of this work it should be noted that there are two classes of so-called wireless-telephone uses that present advantages from the standpoint of the transmission system operator. The first is the "wired wireless" (really carrier current) in which a high-frequency current is imposed on the transmission line itself and the messages are in turn superimposed on the high-frequency current. An arrangement of filters separates the message at its destination from the carrier current and permits its delivery to the proper destination. The carrier current is not confined strictly to the conductors of the transmission line, but these conductors act as a guide. Messages can be picked up a short distance from the line, and in case of breakage of the transmission conductors the gap can be bridged by retuning the circuit, though some knowledge and skill is required of the operator. In general, the system as far as its present development is concerned gives promise of being extremely useful. It may be limited to the work that is now done by wired circuits along transmission or distribution lines, but owing to the ability to bridge gaps, the saving in investment in the cost and maintenance of wire lines and the ability to reach some distance away from the wire-line guide, it may be an improvement on the present system. Its freedom from interference such as is experienced in straight radio work and the fact that licensed operators are not needed are added advantages. It also insures secrecy of the messages, a result that is not possible so far with the radio telephone.

The other system is the radio telephone, which has developed from the radio telegraph. The development of the vacuum tube as a transmitter, detector and amplifier has given an impetus to this form of communication which has proceeded so rapidly in the amateur field that in the last six months the more important commercial phases have been temporarily lost in the effort of manufacturers to supply the overwhelming demand from the amateur trade. It is estimated roughly that there are 25,000 amateur radio transmitting stations in the United States. Several months ago it was estimated that there were at least eight receiving stations for each one transmitting, but Secretary Hoover has recently made an estimate indicating there are more than 600,000 stations, including transmitting and receiving, in the United States. In this fact resides one of the difficulties that the central-station company experimenting with the wireless telephone must reckon with. The commercial broadcasting stations have become sufficiently numerous, in view of the wave length to which they are restricted, to encounter difficulties due to direct interference or "blanketing." The direct interference is manifested in the picking up and intermingling of two programs that may be sent out at the same time on the same wave length. The "blanketing" effect is noticed in the lesser volume of sound in the receiver from a given station and in "whining"

Applicability of Radio to Utility Requirements Is Attracting Widespread Attention





MANY public utilities, both electric service and railway, have become intensely interested in the radio telephone as a means of transmitting operating instructions. Although a number of the companies have been experimenting to determine the limitations of this form of communication and methods of overcoming the problems encountered, none are ready to announce their conclusions up to the present time. The transmitting and receiving apparatus and antennas at two termini of the San Joaquin Light & Power Corporation's system are shown in A, B, D and E respectively. C shows a radio installation on one of the Chicago, Milwaukee & North Shore trains.

or "howling" in the detector and amplifying tubes when the other broadcasting station is at such a distance or the atmospheric conditions are such that its signals are not directly audible. A concrete illustration of this was noticed lately in Chicago when the effect of a station several hundred miles away was felt. The distant station was operating on a schedule that only slightly overlapped that of the Chicago station. When the distant station shut down an immediate increase of volume of transmission from the Chicago station was noted and a loud speaker that had been rather unsatisfactory in its operation performed beautifully for the remainder of the program. On another occasion, with exceptionally clear atmospheric conditions, the two programs came in in almost equal volume so mixed as to be indistinguishable. Some of the practical difficulties that must be faced by the experimenter follow:

Operating Limits

Present radio laws were established before the time when the radio telephone came into the field on a basis that would permit of more than experimental work. The restrictions and license requirements are therefore based largely on the needs of the radio telegraph. Since the use of the telegraph for central-station work does not offer any advantages over the present wire telephone systems, because it must, in the nature of things, be confined to those who understand the telegraph code, the restrictions that must be met in the use of the radio telephone are the only ones of interest to the central-station men contemplating the use of radio. Recently it has been thought necessary for the Department of Commerce to suspend broadcasting of musical and other programs by amateur stations because of interference with other radio traffic. Some difficulties have been experienced between the commercial broadcasting stations because of the limitation placed on the wave length they can use. The result was the calling of a conference in Washington which it is hoped will result in new regulations and legislation.

At present central stations undertaking to use the radio telephone would do so under limited commercial licenses of the second class, and operation would be at wave lengths of under 600 m. or over 1,600 m. The usual arrangement on an operating property would be the installation of a few fixed stations at the principal operating points where dispatchers are stationed, with the use of a number of movable stations with transmitting and receiving apparatus carried by construction or repair gangs. Under present laws each station, fixed or portable, must have a second-class operator. Understanding of the international code is an absolute requirement, so that in cases of interference with telegraph stations the interfering station can be informed of the fact and obey the regulations that govern such cases. The fact that small power may be used cannot be relied on for prevention of such interference with distant stations. So-called "freak" cases of long-distance radio transmission with low power are frequent enough to be embarrassing and suggest a suspicion that they may not be so freakish as they seem. Recently a Middle Western radio station that is experimenting along the general lines that central stations must follow was working with a portable station less than 20 miles away. It was found necessary to desist for the time being because of interference with an Atlantic Coast commercial station that was working on the same wave length and using the international code.

The question has been raised whether control over portable stations by the fixed stations on a system would not be sufficient to eliminate the need of there being some one at the portable station who understands the international code. While this is theoretically possible and might be practicable if applied to only one class of users, the argument against it is that it opens the way to the removal of restrictions in other directions on grounds just as logical, and that such action would eventually produce confusion due to the number of excepted stations and the certainty that at least a portion of them would be out of control at some time and there would be no means of reaching them. Interference with important naval, government or commercial stations that may be handling distress or other important messages is one of the points that cannot be lost sight of in the formulation of regulations and in the face of the operation of an increasing number of stations. Any one going into the operation of the radio telephone should carefully study the laws and rules laid down by the Department of Commerce and consult the radio inspector for his own district.*

Stations operating on the international telegraph code are numerous enough in the class in which central stations are interested to make it likely that some one will be working on any particular wave length at almost any hour of the day. In the case of distant stations the interference may not be experienced constantly, but it may often be enough to become decidedly embarrassing. With nearby stations it may be necessary to make some adjustments of wave length or time of operation that will eliminate the trouble. Another problem is that of interference from or with amateur stations operating theoretically at 200 m. or less. The word "theoretically" is used advisedly, because there are many of the amateur stations that are not equipped so that they know exactly the wave length they are operating on, and provisions for sharp tuning are inadequate. Even with a radiophone station operating at somewhat above the amateur wave length and provided with the best of equipment, there is the possibility of some interference with the neighboring stations.

Interference from Amateurs

Interference from amateur stations will come from those with poor facilities for tuning or those that may be willfully violating the law. In congested districts this trouble will be annoying and sometimes very serious, particularly during the evening hours, when the amateurs have the most time for their experimental work. In many localities the air is a perfect hubbub of radio-signals at short wave lengths, particularly between 7 p.m. and 10 p.m. Another source of interference will be from the presence of buildings or other structures containing large masses of steel. In the establishment of stations some of the difficulties of securing satisfactory operation will be eliminated if such localities can be avoided.

Still another trouble that will be met with is the "dead" spots that are frequently found in a territory in which it is sought to work. The experience in broadcasting of entertainments has shown, for example, that in some localities a station approximately a hundred miles away will be picked up with difficulty while one several times that distance will be picked up with ease. In other cases it may be almost impossible to pick up a given station, although in localities much farther away it may be picked up easily. No satisfactory explanation has been given for the phenomenon. In the latter case the difficulty has been encountered under circumstances that have led some to ascribe it to the presence of large power distribution systems that act as a screen both to blanket the transmission from stations in the area and to deflect the waves over the area until they are reflected toward it again by some atmospheric or other condition. The formation of the earth has been blamed, but occurrences of this nature in perfectly flat country have been noted. These seem to support the theory first mentioned, though power systems are not the only cause, as such troubles have been encountered where no extensive systems exist.

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*Copies of the law may be secured at 15 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Taking these two factors together, the biggest single influence will probably be the atmospheric conditions at any given time. During violent storms, particularly the summer storms that prevail in some sections of the country, the interference from atmospheric disturbance may put the radio telephone out of commission completely for short periods. In the early days of the radio telegraph the same experience was gone through, but with the developments that have taken place the percentage of perfect operation approaches a figure that compares favorably with other methods of communication. Telegraph stations now work through atmospheric conditions that a few years ago were thought to make operation impossible. The present situation with the radio telephone is not so good as this, though there is no reason to suppose that reliability will not be developed as experimental work proceeds. The experience of the broadcasting stations is a guide by which the matter of distance can be judged.

RELIABILITY AND DISTANCE

In the area around Chicago such a thing as failure to receive the radio concerts is virtually unknown, if the right sort of apparatus and a decent antenna are employed. In one case, at a distance of 18 miles, the broadcasting has been received without one failure night after night with a single tuning-circuit home-built receiver employing a vacuum-tube detector and first one and later two steps of amplification. The antenna is a makeshift and consists of two No. 12 stranded phosphor bronze conductors, 25 ft. (7.5 m.) in the air and 50 ft. (15 m.) long, strung between two trees and shielded by rather heavy trees. Close proximity to the house is also a detriment. Under these circumstances there has not been the slightest hint at failure in reception, and the concert is usually audible all over the house with a two-stage amplifier set and a cheap horn. Occasional interference from other stations and annoyance from static discharges are the worst that have been experienced.

In a case of experimental work in the Middle West in which the conditions to be met are similar to those in central-station work communication is carried on between a fixed station and portable stations carried on movable vehicles over distances up to 20 miles, without any difficulty and with a percentage of reliability that, it is claimed, is more than 90 per cent. One difficulty encountered is that of dead spots that seem to have some relation to the wave length on which transmission is being made. The distances over which consistent transmission and reception can be expected with well-designed apparatus seem to be somewhat uncertain, though the percentage of perfect operation up to 100 or 150 miles (160 to 240 km.) seems to be fairly high with the present commercial stations.

In general the central-station company taking up the radio telephone for use in its operating work must expect to do a great deal of experimentation and to face some rather discouraging failures. The apparatus is in its development stage. Some things are known and some extremely encouraging results in the experimental work done by amateurs have been achieved. The statement has been made that the commercial broadcasting work is distinctly out of the experimental stage and that the apparatus used is on a real commercial basis. This assertion seems to be fairly well backed by the experiences of those who have been fortunate enough to enjoy the results.

Inductive Interference as a Business Problem

Solution of Legal and Technical Problems Necessary to Intelligent Business Solution—Public Must Be Considered—Full Knowledge of Factors Necessary

THAT the inductive-interference problem is a business matter and will be settled by business men who will decide what concessions shall be made by those whose property is involved is a contention that has been made rather frequently. With a few important qualifications the assertion may be taken as correct. In the minds of many who have rather carelessly repeated the assertion the thought has existed that nothing more than a few matters that will be the subject of compromise are to be considered.

The first and important consideration from the standpoint of the business man directing the destinies of a public utility is the service that he is able to give the public. Unless the field is broad and restrictions are at a minimum, the profits that he must obtain to make the business successful will either be non-existent, thus making a continuation of the business impossible, or will be reduced to a point allowing the business only to limp along in a lame-dog fashion that will not make its maintenance an attractive problem. The first problem that the business man of the signal or power company is interested in is seeing that the development of the service he proposes to render is unhampered to the largest possible degree.

As has been indicated in previous articles, the factors that will determine the limitations to be placed on either power or signal service will depend on the success which the technical branches of the industry will have in the development of methods of control of the forces that have caused the embarrassment. This success will depend on two things, the first being the degree of restriction that is placed on the development of each class of service in its technical development. This success will be in inverse ratio to the degree of restriction. The second condition is the commercial restrictions involved in the cost of control measures that shall be eventually found necessary. Of these two the business man is interested primarily in the latter, since in the final analysis he must think in terms of dollars-and-cents cost of service. The answer that the technical men must furnish him will, therefore, be the kind and cost of protective measures that he must expect to employ in any system he expects to build and operate. Not only must he have this information for his own system, but he must have the same information for the systems with which he must work and live in close proximity. And finally he must have the cost of co-ordination of the control measures for the different systems with which his must be co-ordinated. Then and only then will he be able to sit down with the men responsible for the opposing systems and intelligently compromise on the measures that he must use.

He still lacks one element, and that is the answer to questions that have a legal phase. It is at this point that the entire problem presents an appearance that, while present in all phases of business, takes a peculiar turn in the public utility business. The utility man is engaged in a business that, for one reason or another, has been deemed by the public to be a proper subject of special regulation. Essentially it must be a monopoly if it is to give the greatest possible service in an efficient and satisfactory way. Whether the regulatory policy of the present day is the proper one or not needs no discussion here. So far as utilities are concerned, it is a settled policy that is receiving their support and is therefore an accomplished fact. Whether for good or bad, it must be considered.

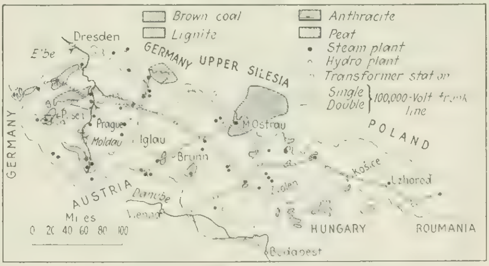
PUBLIC RELATIONS ASPECTS

With public control recognized and monopoly established, the rights of the public enter in an extremely direct way and the problem is no longer one of the rights of two individuals. It has become a problem of the rights of three, with the third holding the priority on any question directly affecting its interests. The problem therefore becomes an important one in its public-policy phases, and whatever settlements are made must be of a character that will at the end give the public the greatest possible service at the least possible cost. It is consequently necessary that the business men who will have the final say in the compromise settlement shall have before them the answer to the problems that must finally, in one way or another, take the status of law, either through practice, legislative or court channels. The questions cannot and will not be answered in a short time or in a body. Some of them have already developed and need answer at the present moment. In fact, the attempt to find the answer has already been too long delayed, and some of the troubles of the moment are attributable to that fact. Many of the important problems are yet to be developed and will be reached as the electrical industry proceeds in its course. The important thing is to be up and doing. The answer to present problems must be found and the service needs of the moment cared for. Inevitably the problems of the future will be indicated in the work of solving the problems of today. The greatest need now is the support of the business man in the working out of the problem. Neither the technical nor the legal phases can be worked out so long as the men who are the final arbiters refuse to recognize the problem in its entirety and refuse full support to the work needed to find the solution. At the bottom the problem is not an unnatural one.

Industries as directly related to the interests of the public as the electrical industry is cannot afford to take part in any controversies that may in the end deprive the public of something it wants. The only result of a course of this kind would be an invitation at some stage for the public, through its authorized representatives, to step in and settle the controversy in its own way. For this reason, if for no other, the settlement of the problem through courts or commissions is a questionable course. It means a long and expensive fight with a burden on the industry as a whole for which little or nothing would be received. The standing of the contestants in public estimation would suffer, and the hard-won public respect that the industry has gained in the past ten years might be completely sacrificed. For this reason it is important that the work undertaken jointly by the National Electric Light Association and the American Telephone & Telegraph Company be given the undivided support of the entire industry. Across the table, with all the facts in the open, is the only sane way to handle the problem. "Button, button, who has the button?" has no place in the negotiations. Settlement is not possible on the basis that it is a game in which the keenest brain can win and the loser must take a handicap. The forces involved are those that answer to no master except the one who handles their controlling laws in such a way as to prevent harmful manifestations and confine their effects to useful channels. Playing a game of compromise, except on a basis of real and known facts in which the compromise follows paths that will bring results, will not control these forces. In the final analysis the solution that makes for the greatest interest of the public will make for the greatest interest of the entire industry.

Czechoslovak Republic's Plans for Electrification

SYSTEMATIC plans for the electrification of the Czechoslovak Republic have been made by a specially appointed consulting board, as was fully explained in an article by Prof. Fernando Pietsch in the Aug. 20, 1921, issue of the ELECTRICAL WORLD. The accompanying map shows the system of trunk lines and interconnections upon which the work will be developed. A study of the map indicates the scattered location of the coal fields, and, in fact, a large portion of the electric generating plants will be built at or near coal fields. All the trunk lines are three-phase, 50-cycle, 100,000-volts, and all the plants are to be tied in to form one great uniform national system.



RELATION OF PROPOSED CZECHOSLOVAK TRANSMISSION SYSTEM TO COAL FIELDS

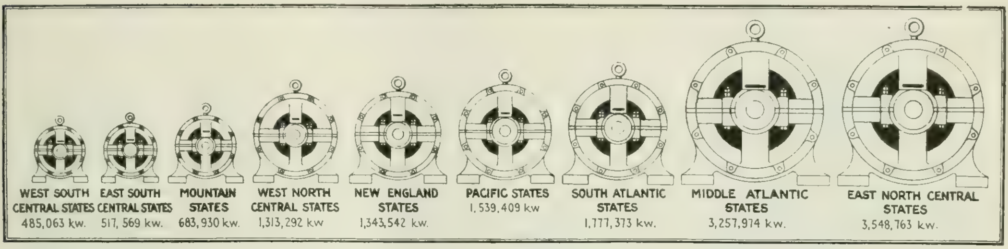
The cost of the new steam station, the trunk lines and the feeder lines is estimated at 1,500,000,000 crowns. These stations and the network should be completed in twenty years and the hydro-electric development in fifty years. The state will build all the water-power plants in co-operation with the county administrations, and the steam plants will be erected by public utilities.

Installed Generator Rating of Central Generating Stations and Distribution of Operating Companies and Plants

State or Section	Rating of Installed Generators (Oct. 1, 1921)			Operating Companies		Companies Generating Their Energy		Companies Purchasing All Energy				Companies Generating and Purchasing		Companies Purchasing Energy (Reserve Equipment)		Generating Stations				Hydro-Electric Plants	
								Private		Municipal						Private		Municipal			
	Operating Kw.	Reserve Kw.	Total Kw.	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
United States	14,297,338	169,577	14,466,915	5,624	100.0	4,460	79.5	748	20.5	416	20.9	359	6.4	193	3.4	3,543	64.1	1,989	35.9	1,421	25.7
SECTIONS																					
New England	1,287,725	55,817	1,343,542	350	6.2	228	65.2	89	31.1	33	51.6	46	13.2	20	5.7	277	81.3	64	18.7	222	65.1
Middle Atlantic	3,229,814	28,160	3,257,974	592	10.5	422	71.4	140	29.2	30	26.5	59	10.0	27	4.6	462	80.3	113	19.7	198	34.5
South Atlantic	1,761,025	16,348	1,777,373	659	12.8	539	81.9	62	15.9	58	21.5	32	4.9	36	5.5	363	55.8	270	44.2	160	25.3
East North Central	3,524,032	24,731	3,548,763	1,174	20.9	873	74.4	204	28.4	97	21.2	75	6.4	40	3.4	638	58.3	457	41.6	278	25.4
West North Central	1,295,927	17,365	1,313,292	1,419	24.2	1,137	80.0	134	17.8	148	22.2	70	4.9	43	3.0	619	48.2	667	51.8	127	9.9
East South Central	497,344	20,225	517,569	358	6.4	329	91.9	21	9.7	8	5.6	16	4.5	6	1.6	226	61.4	142	38.6	33	9.0
West South Central	478,132	6,931	485,063	545	9.7	514	94.4	23	6.0	8	4.8	14	2.6	7	1.3	405	70.8	167	29.2	17	3.0
Mountain	683,930	0	683,930	300	5.3	256	85.3	32	13.4	12	19.7	20	6.7	8	2.7	304	83.3	61	16.7	182	49.8
Pacific	1,539,409	0	1,539,409	227	4.0	162	78.9	43	24.0	22	45.8	27	11.9	6	2.6	249	83.8	48	16.2	204	68.7
NEW ENGLAND:																					
Maine	116,011	270	116,281	75	1.3	55	73.4	20	28.1	0	0.0	8	10.7	4	5.3	78	95.2	4	4.8	69	84.2
New Hampshire	51,077	1,080	52,157	49	0.8	37	75.5	12	26.0	0	0.0	2	4.1	2	4.1	53	94.8	3	5.2	38	67.9
Vermont	87,344	275	87,619	56	1.0	42	75.0	10	23.8	4	28.6	8	14.3	1	1.8	58	80.5	14	19.5	66	91.7
Massachusetts	689,375	50,542	739,917	119	2.1	63	52.8	32	39.1	24	64.8	14	11.7	12	10.1	45	54.8	37	45.2	30	36.6
Rhode Island	143,283	0	143,283	12	0.2	4	33.3	6	60.0	2	100.0	3	25.0	0	0.0	4	66.7	2	33.3	2	33.3
Connecticut	200,635	3,650	204,285	39	0.7	27	69.3	9	25.7	3	75.0	11	28.2	1	2.6	39	90.8	4	9.2	17	39.5
MIDDLE ATLANTIC:																					
New York	1,573,968	12,475	1,586,443	306	5.4	222	72.7	69	27.4	15	27.8	34	11.1	14	4.6	247	82.1	54	17.9	141	46.8
New Jersey	347,486	2,070	349,556	60	1.1	46	76.7	11	24.5	3	20.0	3	5.0	1	1.7	53	77.9	15	22.1	9	13.2
Pennsylvania	1,308,360	13,615	1,321,975	226	4.0	154	67.4	60	32.9	12	27.3	22	9.8	12	5.3	162	78.7	44	21.2	48	23.3
SOUTH ATLANTIC:																					
Delaware	34,050	265	34,315	13	0.2	9	69.3	3	42.9	1	16.7	0	0.0	2	15.4	4	40.0	6	60.0	0	0.0
Maryland	190,523	1,000	191,523	45	0.8	35	77.8	7	20.6	3	27.3	4	8.9	2	4.4	26	70.3	11	29.7	10	27.0
Dist. of Columbia	90,000	0	90,000	3	0.0	2	66.6	1	33.4	0	0.0	0	0.0	0	0.0	3	100.0	0	0.0	0	0.0
Virginia	167,941	0	167,941	92	1.6	84	91.3	6	8.3	2	10.0	5	5.4	1	1.1	79	79.8	20	20.2	36	36.4
West Virginia	347,382	4,238	351,620	64	1.1	48	75.1	15	26.4	1	14.3	4	6.3	3	4.7	48	87.3	7	12.7	7	12.7
North Carolina	218,312	2,805	221,117	140	2.5	103	73.5	15	19.5	22	35.0	7	5.0	10	7.2	58	47.9	63	52.1	43	35.5
South Carolina	395,694	1,125	396,819	72	1.3	62	86.2	4	9.3	6	20.7	3	4.2	6	8.3	44	60.3	29	39.7	33	45.2
Georgia	243,853	6,865	250,718	152	2.7	124	81.5	7	14.0	21	20.6	8	5.3	10	6.6	42	29.2	102	70.7	28	19.4
Florida	73,270	50	73,320	78	1.4	72	92.1	4	8.8	2	6.3	1	1.3	2	2.6	59	64.8	32	35.2	3	3.3
EAST NORTH CENTRAL:																					
Ohio	1,094,698	3,735	1,098,433	271	4.8	189	69.7	49	31.0	33	29.2	18	6.6	6	2.2	121	51.8	113	48.2	18	7.7
Indiana	368,518	4,595	373,113	199	3.5	135	67.9	44	34.9	20	27.4	6	3.0	4	2.0	90	55.2	73	44.8	12	7.4
Illinois	959,464	2,350	961,814	247	4.4	184	74.3	56	34.7	7	8.1	16	6.5	5	2.0	169	66.3	86	33.7	15	5.9
Michigan	712,197	427	712,624	190	3.4	174	91.8	12	11.9	4	4.4	11	5.8	3	1.6	128	59.0	89	41.0	115	52.9
Wisconsin	389,155	13,624	402,779	267	4.8	191	71.6	43	25.1	33	34.4	24	9.0	22	8.2	130	57.5	96	42.5	118	52.3
WEST NORTH CENTRAL:																					
Minnesota	288,252	10,879	299,131	219	3.9	167	76.3	21	21.4	31	25.6	17	7.8	14	6.4	78	39.2	121	60.8	39	19.6
Iowa	296,481	1,763	298,244	224	4.0	155	69.3	40	30.1	29	31.5	18	8.0	9	4.0	123	57.3	92	42.7	30	14.0
Missouri	396,327	1,584	397,911	234	4.2	189	80.8	34	21.2	11	14.9	13	5.6	4	1.7	124	62.7	74	37.3	5	2.5
North Dakota	24,299	1,134	25,433	119	2.1	117	98.5	1	1.0	1	4.4	1	0.8	3	2.5	103	80.5	25	19.5	0	0.0
South Dakota	30,529	231	30,760	112	2.0	104	92.8	6	8.1	2	5.3	1	0.9	2	1.8	72	65.4	38	34.6	7	6.4
Nebraska	111,076	1,030	112,106	251	4.5	203	80.9	16	14.9	32	22.2	4	1.6	6	2.4	82	36.3	144	63.7	32	14.2
Kansas	148,963	744	149,707	260	4.6	202	77.8	16	18.4	42	24.3	16	6.2	5	1.9	37	17.6	173	82.4	14	6.7
EAST SOUTH CENTRAL:																					
Kentucky	109,408	75	109,483	111	1.9	100	90.2	9	10.2	2	8.7	2	1.8	1	0.9	96	80.6	23	19.4	0	0.0
Tennessee	171,730	550	172,280	92	1.6	81	88.1	10	16.9	1	3.0	8	8.7	2	2.2	58	63.8	33	36.2	21	23.1
Alabama	173,318	19,600	192,918	62	1.1	55	88.8	2	6.6	5	15.6	5	8.1	2	3.2	32	49.9	32	50.1	12	18.8
Mississippi	42,888	0	42,888	93	1.6	93	100.0	0	0.0	0	0.0	1	1.1	1	1.1	40	42.6	54	57.4	0	0.0
WEST SOUTH CENTRAL:																					
Arkansas	58,418	859	59,277	82	1.5	74	90.3	7	11.1	1	5.3	2	2.4	4	4.9	67	77.8	19	22.2	2	2.3
Louisiana	87,674	0	87,674	67	1.2	64	95.6	3	9.1	0	0.0	1	1.5	1	1.5	30	46.9	34	53.1	0	0.0
Oklahoma	102,403	1,925	104,328	156	2.8	151	96.8	1	1.4	4	4.7	3	1.9	0	0.0	79	47.8	86	52.2	2	1.2
Texas	229,637	4,147	233,784	240	4.3	225	93.8	12	5.7	3	10.7	8	3.3	2	8.3	229	89.1	28	10.9	13	5.1
MOUNTAIN:																					
Montana	227,791	0	227,791	58	1.0	52	89.6	6	11.5	0	0.0	0	0.0	1	1.7	61	91.0	6	9.0	27	40.3
Idaho	121,160	0	121,160	39	0.7	28	71.8	7	22.6	4	50.0	7	17.9	1	4.3	46	85.1	8	14.9	39	72.2
Wyoming	21,699	0	21,699	34	0.6	34	100.0	0	0.0	1	14.3	0	0.0	5	14.7	31	81.6	7	19.4	7	18.4
Colorado	136,605	0	136,605	64	1.1	53	82.8	10	20.4	1	7.5	6	9.4	0	0.0	58	79.4	15	20.6	31	42.4
New Mexico	10,506	0	10,506	27	0.5	26	96.4	1	4.3	0	0.0	0	0.0	0	0.0	23	85.2	4	14.8	5	18.5
Arizona	58,439	0	58,439	30	0.5	23	76.8	5	18.5	2	66.7	2	6.7	0	0.0	28	90.3	3	9.7	10	32.3
Utah	85,380	0	85,380	36	0.6	30	83.3	3	15.8	3	17.7	4	11.1	0	0.0	41	70.7	17	29.3	54	93.2
Nevada	22,350	0	22,350	12	0.2	10	83.3	1	9.0	1	100.0	1	8.3	1	8.3	16	94.1	1	5.9	9	52.9
PACIFIC:																					
Washington	416,278	0	416,278	86	1.5	59	68.6	19	26.8	8	53.3	10	11.6	3	3.5	77	83.8	15	16.2	57	62.0
Oregon	144,708	0	144,708	58	1.0	55	94.9	2	4.4	1	7.7	5	8.6	1	1.7	57	81.4	13	18.5	57	81.5
California	978,423	0	978,423	83	1.5	48	57.8	22	35.0	13	65.0	12	14.5	2	2.4	115	85.3	20	14.7	90	66.7

Rating of Generators in Central Stations Totals 14,466,915 Kw.

Analysis of Central-Station Development Indicates a Total of 5,532 Electric Generating Plants, of Which Almost 65 per Cent Are Privately Owned—Hydro-Electric Plants Total 1,421



HOW THE VARIOUS SECTIONS OF THE COUNTRY COMPARE IN INSTALLED GENERATOR RATING

ON OCT. 1, 1921, there were 5,532 central generating plants in the United States, with a total installed generator rating of 14,466,915 kw. The total installed generator rating of the central stations in 1902 was only 1,212,200 kw., indicating an increase during the nineteen-year period of 1,092 per cent. The increase during the period from Jan. 1, 1920, to Oct. 1, 1921, was 1,706,015 kw., or at the rate of 7.6 per cent per annum. This yearly increase is about 2.2 per cent below that reported for 1919.

Detailed data on the central generating plants of the country will be found in the accompanying table. A similar analysis covering the period from 1902 to 1919, inclusive, appeared in the Aug. 14, 1920, issue of the ELECTRICAL WORLD. These data have been based almost entirely on reports submitted in connection with the preparation of the 1921 McGraw Central Station Directory and Data Book.

RESERVE EQUIPMENT TOTALS 169,577 KW.

The rating of the generators actually operating was reported as 14,279,338 kw., and the amount of reserve generator equipment was given as 169,577 kw. The indications are, therefore, that of the total generator installation in the central generating plants of the country almost 99 per cent is actually operating. The New England States reported by far the largest installation of reserve generator equipment, with 55,817 kw., or 4.2 per cent of the total generator installation of that section. No company in the Mountain or Pacific States reported reserve equipment. It appears from the reports received that the amount of reserve equipment in the various sections is largely dependent upon the growth of interconnection and the elimination of small generating plants in favor of some large central generating stations.

Of the 5,532 operating stations in the United States, almost 65 per cent are privately owned. The Pacific States show the largest percentage of privately owned plants, with 83.8 per cent, and the West North Central States reported the largest percentage of municipal generating plants, with 51.8 per cent.

Although the East North Central States record the largest number of hydro-electric plants, yet of central generating plants hydraulically operated in whole or in part, the Pacific States had 68.7 per cent. In the West South Central States 97 per cent of the plants are other than hydraulic.

There are 5,624 operating companies in the United States, of which almost one-quarter are serving communities in the West North Central States. The three Pacific States report only 227 operating companies, or about 4 per cent of the total reported for the whole country.

New York State reports the largest number of operating companies with 306, or more than either the Mountain or Pacific sections. Ohio is second with 271 operating companies. California presents an unusual situation, however, in that while standing twenty-fifth in the number of operating companies, the rating of the installed generators is exceeded only by New York, Pennsylvania and Ohio. A similar situation pertains to several other Western states.

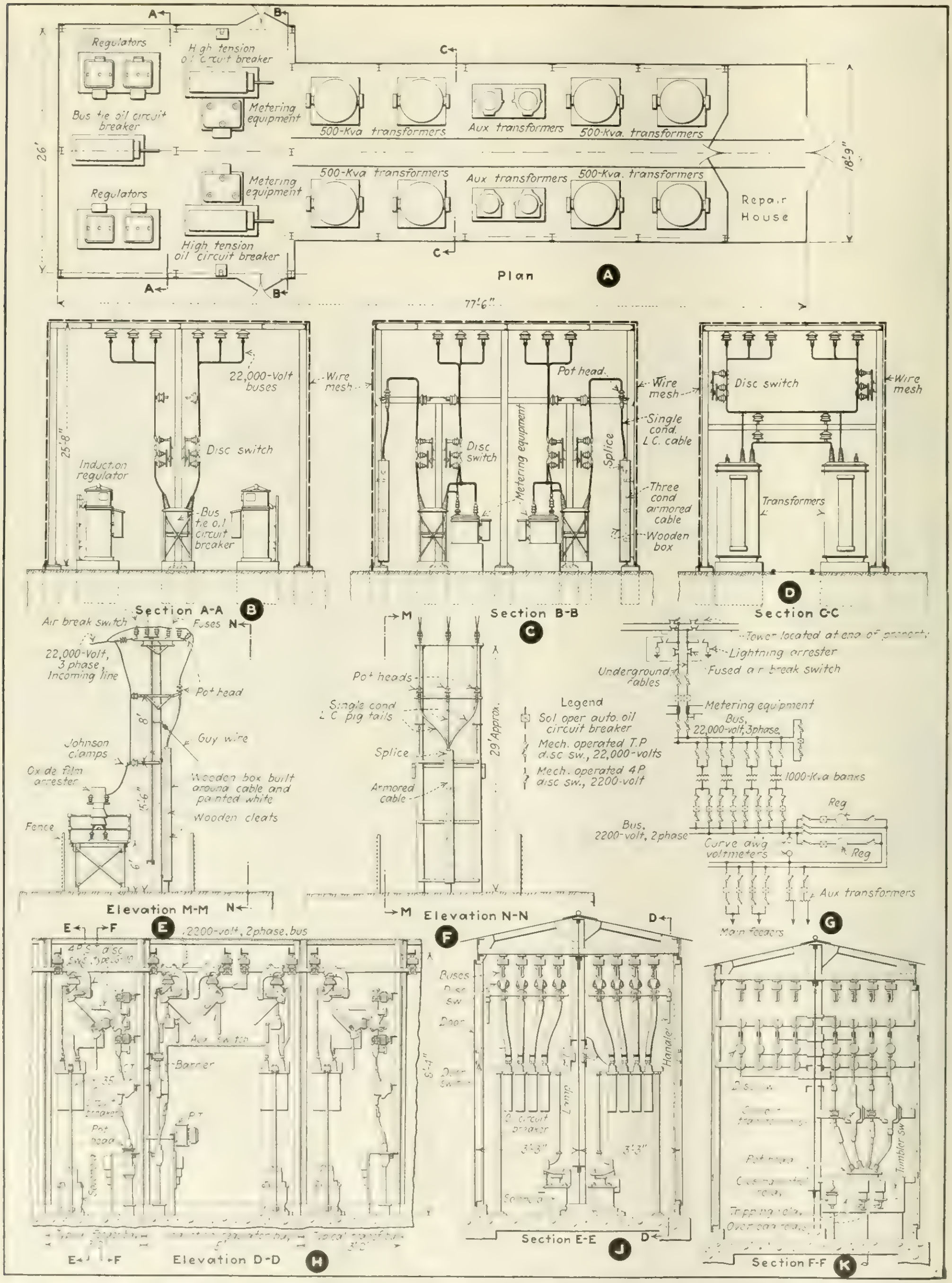
Almost 95 per cent of the operating companies in the West South Central States generate all or a portion of their energy. On the other hand, only 65.2 per cent of the companies in New England generate all or a portion of their own energy, Rhode Island reporting the lowest percentage—33.3.

TWENTY PER CENT OF PLANTS PURCHASE ENERGY

More than 20 per cent of the private and municipal companies purchase all their energy for resale, that is, do not generate any energy at all. This is most pronounced in the New England States, where over half of the municipal companies merely act in the capacity of distributing companies.

There are 193 companies purchasing energy and having reserve equipment. To a large extent these are small companies which have been purchased by large operating and distributing companies, the purchasing company supplying the old company with energy from the central generating plant and the old equipment in the local plant being left standing as reserve.

Construction Features of Outdoor Substation Serving Rocky Point Radio Station



A—Mechanically operated disconnecting switches make this outdoor station compact and safe. B—Section across the bus tie circuit breaker and regulator. C—Section across high-tension oil circuit breakers and metering equipment. D—Section across a bus with which transformers are connected. E and F—Dead-end structure where overhead lines connect 25,000-volt underground armored cables. G—Simplified connections of equipment in the outdoor station. H, J and K—New type of 2,300-volt outdoor steel bus structure made possible by use of new types of mechanically operated disconnecting switches.

Safe, Simple and Compact Construction

Stereotyped Construction Is Avoided—Overhead Service Terminates at a Distance from Station, Which Is Entirely Covered with Wire Mesh—Underground Circuits to and from Station—Steel Housing for 2,300-Volt Equipment

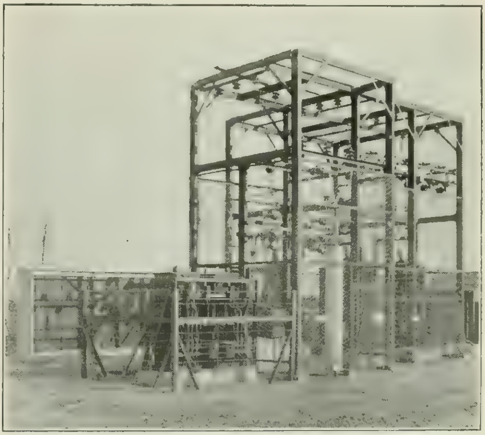
By **M. M. SAMUELS**
The J. G. White Engineering Corporation

COMPACT and simple substation construction that does not sacrifice safety was employed in serving the Rocky Point (Long Island) receiving station of the Radio Corporation of America, many features of which may be incorporated to advantage in other outdoor stations. It is particularly interesting because a departure has been made from the usual stereotyped construction. Owing to the possibility of the electric service equipment interfering with radio reception, the 22,000-volt transmission line serving the station is not carried directly to it, but is terminated about 1,300 ft. (395 m.) away, the circuits to and from the substation consisting of underground cables. In addition, all of the station electric equipment is electromagnetically shielded.

The overhead terminal structure consists of a two-pole dead-end on which are mounted fused air-break switches, one side being connected to the open-wire circuits and the other side to the underground cable leading to the substation. Instead of using one triple-conductor pothead three single-conductor units were employed, a short length of single-conductor cable being wiped on each pothead and the three single cables spliced and wiped on the three-conductor underground cable. This construction made it possible to allow more clearance between the junction points of the underground and overhead circuits. To protect the compound in the cable above ground from the sun's rays and at the same time allow ventilation, a wooden box painted white was built around the vertical run of cable. Next to the dead-end poles on a steel platform are oxide-film lightning arresters which are connected to the open-wire circuit by Johnson clamps. Attachment is facilitated by specially designed yokes on the insulators. The entire dead-end structure is surrounded by a barbed-wire fence.

The underground cable running from the overhead terminal to the substation is armored with steel tape and rated at 25,000 volts but tested for 62,500 volts. It was laid in an open trench in two lengths with a splicing box in the middle of the run. The cable was placed 3 ft. 6 in. (1.06 m.) below the ground level. At the substation end the underground cable was brought up to the open-wire circuits in the same manner.

The substation, which is in close proximity to the radio power house, is laid out for an ultimate installation of four banks of transformers, each bank rated at 1,000 kva. and connected in T to give 2,200 volts, two-phase, on the secondary. In the future there will be two sets of high-tension buses, each bus to be supplied from one transmission-line circuit and equipped with a high-tension oil circuit breaker, but at present there is only one high-tension bus and there are no high-tension oil circuit breakers. The metering is accomplished by means of an outdoor-type equipment in the line circuit.


COMPACT AND SAFE OUTDOOR SUBSTATION MADE POSSIBLE BY MECHANICALLY OPERATED DISCONNECTING SWITCHES

The high-tension substation structure is of a peculiar character, there being no overhead outgoing lines and no lightning arresters or choke coils, both high-tension and low-tension circuits leaving the station underground. As in most outdoor substations, the design of this station was primarily determined by the type and arrangement of the disconnecting switches. All disconnecting switches are mechanically operated from the ground, the switch bases being mounted in vertical planes with insulator axes horizontal, thus eliminating complicated, cumbersome and topheavy 45-deg. mountings. This arrangement may now be considered perfectly safe since sufficient test reports have been made available to prove that a pin insulator in the horizontal position has virtually the same flashover value as one in upright position or inclined 45 deg. The high-tension buses and connections are made of ½-in. (12.7-mm.) copper pipe, eliminating all loose and unsightly wiring and strings of strain insulators. The insulators used on the disconnecting switches, air-break switch and bus work are interchangeable and rated at 35,000 volts.

Compactness, simplicity and safety were the underlying requirements in the design of this station. Space was very valuable, both floor space and height, for the reason that the whole station had to be covered with wire mesh. Despite the compactness of the design, a maximum of safety was attained, there being no energized parts within reach from the ground. The necessity of swinging switch sticks was eliminated by the use of mechanisms on all disconnecting switches. The steel uprights consist of small I-beams, and all cross-members are single channels or angles, there being neither lattice poles, heavy trusses nor diagonal tie-rods.

The transformers are arranged in two rows, one transformer of each bank being on one side of the aisle and the other on the other side, with a track between for moving the apparatus to a repair house.

On account of the double-row arrangement of transformers, floodlighting could not be employed for properly illuminating the apparatus and the operating aisle, so bracket fixtures were provided instead. These were made of 1-in. (2.54-cm.) pipe and fittings and equipped with Benjamin waterproof globes, No. 1555, which are well adapted for properly distributing the lighting and for throwing sufficient light upward to illuminate the buses and insulators without giving excessive glare. A number of heavy receptacles were also provided for the purpose of attaching hand portables.

2,300-VOLT OUTDOOR STEEL BUS AND SWITCH STRUCTURE

Providing for the 2,300-volt switching equipment presented more difficulty than did the high-tension circuits because it was not considered desirable to house it within the radio power station and because the expense of erecting a separate building for it did not seem to be warranted. Although complete lines of outdoor apparatus are available for use on high-voltage circuits, no suitable outdoor apparatus, such as oil circuit breakers, current and potential transformers, etc., have as yet been developed for 2,300 volts. The only way in which such apparatus had been installed satisfactorily outdoors up to this time was to build separate oil-switch houses, each with eight waterproof bushings, provide separate waterproof boxes for current and potential transformers, and in addition erect an open structure for disconnecting switches and bus work. In this case everything would have to be covered with screening, an arrangement which would have been both unsightly and expensive. Fortunately, a new type of disconnecting switch, the LG-110, had just been made available by the General Electric Company, and this made it possible to place all the 2,300-volt apparatus and wiring in a small and simple steel housing. The expense of housing the complete switching equipment in this manner was not much more than would have been required for housing one oil circuit breaker with its eight bushings. Besides the construction employed eliminates the necessity of open structures for buswork.

The LG-110 disconnecting switch consists of one insulator per pole clamped to the bus. The clamp which carries the insulator is extended in the shape of a horn carrying the switch clips, which are thus made part of the bus. The blade and hinge are attached to the bottom of the insulator. The four blades of the four disconnecting switches of a two-phase circuit are tied together by a square steel shaft covered with insulating material. A grounded metal handle is attached to one end of the shaft to operate the four switches simultaneously. Auxiliary switches can be added on the shaft for operating signal lights or for interlocking.

The steel house for the 2,300-volt equipment was built in the style of a bus structure, the compartments merely containing the apparatus and wiring with no space for operators, the operation being performed from the outside. A steel door guards each circuit, and a steel barrier is provided between circuits, except along the top of each section, to provide a passageway for the bus. All the oil circuit breakers are solenoid-operated and are controlled from a panel in the radio power station. In each tripping circuit is a relay which makes the circuit independent of the bell-alarm relay. A small tumbler switch is installed in the closing control circuit for the purpose of disconnecting it when working on an oil circuit breaker. All the overload relays, tripping relays, operating relays and tumbler switches for each circuit are arranged on a single steel plate mounted on one side of each compartment. Illumination is provided in each compartment with door-switch control.

The structure consists of an angle-iron framework made of 2½-in. x 2½-in. x ¼-in. (6.35-cm. x 6.35-cm. x 6.35-mm.) angles and is covered with No. 24 gage galvanized corrugated iron. The barriers between circuits are No. 12 gage sheet steel, and the doors are made of 2½-in. x 2½-in. x ¼-in. angle frame and No. 12 sheet steel.

To the best of the writer's knowledge, this type of outdoor 2,300-volt bus structure is being used here for the first time. It seems to offer great possibilities for further development, even though it is not at all suitable for large-capacity installations, where each phase must be in a separate compartment.

A bank of induction feeder regulators is provided in the 2,300-volt bus between transformers and feeders. These regulators are situated within the inclosure of the outdoor substation and are supplied from the 2,300-volt switch house through an automatic oil circuit breaker by underground cables. By means of disconnecting switches the regulator can be disconnected and the service continued without regulation.

Red and green indicating lamps are provided on all high-tension apparatus, such as transformers, regulators and metering equipment, to indicate whether or not the particular piece of apparatus is energized from either side. These lamps are operated by auxiliary switches on the mechanisms of oil circuit breakers or disconnecting switches.

All control circuits from the radio power station are carried in one multiple-conductor cable containing nineteen No. 22 wires. This cable terminates at the substation in a box containing a slate panel with connecting lugs, from which smaller cables are distributed in iron conduit to the various circuits.

The whole distribution system is underground, the cables being carried in fiber conduits through a series of manholes, in which they are suitably supported, and protected by means of "brick lath" and cement. An interesting feature of the underground system is that all cables run straight through the manholes, there being no bends, offsets or loops, since all offsets are made beyond the manholes by means of fiber bends.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

The Automatic Station Represents Distinct Advance in Distribution

To the Editors of the ELECTRICAL WORLD:

The subject of automatic stations has been considered in your publication from time to time, but the new situation which has been created by this development has not, in my opinion, been sufficiently emphasized.

The automatic station represents a distinct advance in the art of electrical distribution. Installation of these stations on existing systems will effect economies which in some cases will be startling. In fact, it is the belief of those who have studied the situation that the automatic station is the greatest single advance in electrical distribution since the displacement of the series-arc system by the multiple incandescent system.

At first sight the automatic station may appear a little complicated and mysterious because it operates without an attendant. However, when it is considered that an automatic station is merely a simple combination of well-known devices which have been in use for many years, the feeling of mystery disappears. Moreover, when it is realized that these stations are installed and maintained by the usual type of electrician found on all power systems, the idea of complexity disappears.

Being electrically operated, the various devices which have been incorporated in an automatic switching equipment make the operation of a station very much safer than when an operator is depended upon to do the various tasks. There is not the possibility of a device hesitating a fraction of a second to think what it should do, as would be the case with an operator. Instead of that it is adjusted to operate under a certain set of conditions, and experience has demonstrated that it will virtually always operate in response to these conditions. Everybody recognizes that the overload coil on a circuit breaker gives protection which could not be given by an attendant. Its use has been widely extended by the application of discriminating relays, so that practically every large power system is today operating with automatic system protection. In this manner the entire development of the electrical art may be traced step by step until the culmination is found in the complete automatic station.

Among the principal features of automatic stations, one which has only been partly realized during the past few years has been the possibility by its economic location of remarkably improving distribution voltages as well as reducing power losses. The automatic station requires no attendant and may be made in single units; consequently it may be smaller in size and installed nearer the economic load centers of the system. It can be frequently located on relatively inexpensive sites and the buildings may be of the least expensive design. As a result it is relatively easy to maintain a more uniform distribution pressure than with manual equipments for the same initial investment.

A number of large lighting and power organizations have been making studies of the application of automatic stations to their systems. The results have been very illuminating. They showed that in general the cost of the automatic equipment could be balanced by the saving in power and operating expense during the first eighteen months after the stations were installed. Besides, a very much higher grade of service could be rendered and the saving in power and operating expense after the initial period would appreciably increase the net earnings.

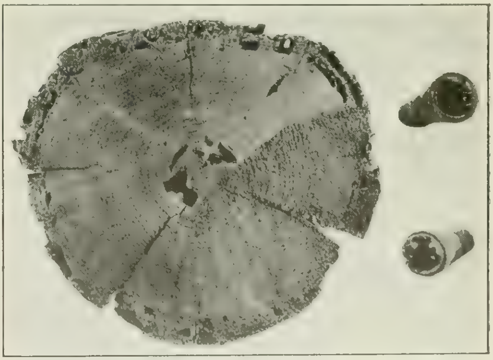
The result of many surveys indicates that practically all systems could advantageously be completely, but gradually, rehabilitated on the basis of automatic operation. This, together with an inexpensive supervisory control system, would effectively reduce operating expense and increase service efficiency.

General Electric Company, CHESTER LICHTENBERG,
Schenectady, N. Y. Engineering Department.

Termites Invade California and Destroy Poles, Cross-Arms and Pins

To the Editors of the ELECTRICAL WORLD:

Until quite recently this country has been unusually free from the ravages of termites, or white ants. But it has been discovered on the system of the Southern California Edison Company that not a few of the untreated cedar poles set along the coast north from San Diego, and even inland for 50 miles, have been attacked by these pests and partly or wholly destroyed. In some instances the destruction has extended to the cross-arms and even to the insulator pins. The ants work up from the ground or from below the ground surface and honeycomb the entire interior. The damage is not disclosed by a casual inspection, but when rapped with a metal bar the surface will give way and the ravages of the insects will be seen. Systematic inspection has indicated that creosoting will prevent penetration by termites, and as this has been a general practice for several years past the total damage will not be great.



METHOD BY WHICH WHITE ANTS ATTACK CEDAR POLES AND INSULATOR PINS

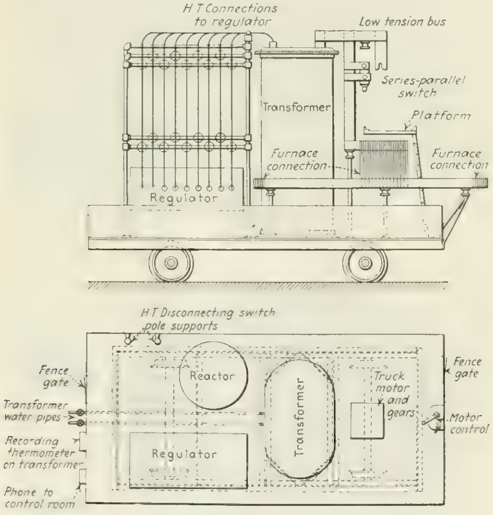
R. E. CUNNINGHAM,
Superintendent of Distribution.
Southern California Edison Company,
Los Angeles, Cal.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Furnace Transformer Mounted on Truck to Save Running Heavy Leads

IN ORDER to save running a large number of heavy connections to feed several electric furnaces, a certain plant has mounted the furnace transformer on a truck which can be placed close to any of the furnaces. By this arrangement only short secondary leads are required. The primary 13,200-volt leads are run to a point near each furnace, but these leads are comparatively small and inexpensive. This transformer equipment has been in service on an average of 92 per cent of the time during the last four years. Generally speaking the equipment is giving more satisfactory operation than stationary equipment would give. The expense attached for inspection, cleaning, maintenance and general repair has been about equal to that for a corresponding stationary layout exclusive of its busbar system. The maintenance of the latter system represents considerable expense which is absent with the present installation.



THIS ELECTRIC FURNACE EQUIPMENT IN SERVICE 92 PER CENT OF THE TIME DURING THE PAST FOUR YEARS

About four years ago it became necessary to increase the capacity of this plant by adding a 2,000-kva. single-phase transformer unit for service with electric furnaces. The policy previously followed when installing an equipment of this kind had been to erect the transformer and auxiliary apparatus in a convenient location and carry out a long heavy copper busbar for the low-tension connection to the furnaces. However, at this time, on account of the very high cost of copper and the long time required for delivery, other types of construction were discussed. The transformer was rated at 2,000 kva. and 13,200 volts primary and 50/200 volts secondary. It was intended to serve any one of ten or twelve electric furnaces. The furnaces were set in two rows with ends toward a center aisle. After considering all the costs in the matter, it was decided to build a four-wheel motor-driven truck to travel on tracks in the aisle between the furnaces. On this truck were mounted the transformer, switching reactor and regulator.

On the high-tension side a cable bus was placed on insulators and connected to disconnecting switches, which were placed near the tracks, where the transformer truck could stop and connection readily be made. The low-tension connections to the furnaces were also placed in convenient locations near the tracks. Water connections for cooling the transformer were made by means of flexible pipes similar to the air couplings used on trains. It was necessary to carry a control cable of more than twenty wires for the operation of the motor-driven regulator, signal equipment and safety devices. In all of these connections it was necessary so to design the equipment as to make it impossible to connect in any but the proper way and to facilitate connecting and disconnecting in as short a period of time as possible.

COMPACT TRUCK EQUIPMENT

The general layout of the truck is shown in the accompanying illustration of the floor plan. This truck is built of steel framework, with a hard-pine plank floor, and has a protecting fence made of asbestos lumber, placed on a wooden frame, with a gate in each end. This fence is equipped with safety switches which are connected to a no-voltage release on the main oil circuit breaker, so that should any person attempt to enter the inclosure after the transformer is placed in operation the high-tension voltage would be automatically cut off. The switchboard panel, with the main control for the transformer, is installed in a control room where all power control is centered. The main oil circuit breaker for the truck is automatic, with overload and undervoltage relays. From this 13,200-volt breaker a lead-covered feeder extends underground to the insulated cable bus. The bus is mounted on the building's steel frame, and the jaws of disconnecting switches are placed at the several stations where the truck stops to connect up for operation. The blades of the disconnecting switches are mounted upon treated poles carried on the truck so that the blades may be readily connected in the switch jaws when the truck stops at a position to feed a furnace. The switch blades have attached to them a short section of flexible cable that connects with the high-tension bus on the truck. They have also an interlocking device so that the truck motor circuit is open when the disconnecting switches are closed, preventing the motor from being started when the connections are made for operation.

The cable for the control of the regulator, which also carries the wires for the safety devices, temperature alarm and telephone, is brought from the switchboard panel in the control room along the steel frame of the building and at each operating station terminates on an alberene stone slab, mounted on a rigid steel box. The slab is provided with twenty-four low feeder-plug receptacles arranged in a triangle and connected to the main control cable. The plug carried on the truck connecting to this slab is made of a cast-aluminum shell with a sheet bakelite face which carries the twenty-four plugs arranged to fit in the twenty-four receptacles on the panel at each operating station. The plug has a flexible section of control cable attached to it and carries an interlock for the truck motor circuit to prevent operation of the truck with the plugs in operating position.

Rigid Bus Construction

The high-tension cable connections from the regulator and switching reactor to the transformer are standard-practice 13,200-volt construction, mounted on a pipe frame and braced so as to be held rigid against the movement of the truck. The conductors from the low-tension side of the transformer are built up of ⅜-in. x 6-in. copper and will safely carry approximately 40,000 amp. This is the highest current the transformer is called upon to deliver at the lowest operating voltages. The secondary bus extends from the transformer through the series paralleling switches to the point where the connections are made to the furnace buses at each operating station. The furnace connection is made by inserting a 1-ft. section of busbar between the truck bus and the furnace bus. This section is drilled for a through bolt, which makes a very rigid and tight connection when the bolt is drawn tight. The series paralleling switches are made of ⅜-in. x 7-in. busbar, arranged for two-pole double-throw through an arc of 90 deg. The top jaws are made to tie the proper ends of each pair of coils in series so as to connect in series the low-tension-transformer coils in pairs, while the lower jaws are arranged to connect the transformer coils to the main buses, all in parallel. The jaws of this switch are slotted to receive a through bolt carried by the switch blade, which is insulated by means of a bakelite tube and bakelite washers under the nut. When the switch is in place a positive contact is assured by drawing up this bolt.

Alfred L. Williams,
Consulting Engineer.
Niagara Falls, N. Y.

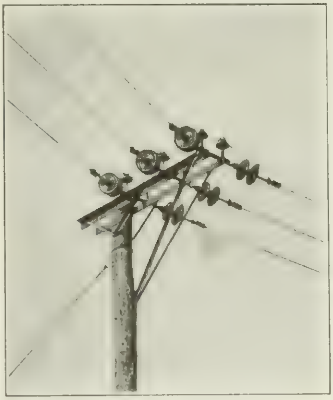
Safeguarding Repair and Construction Work on Electrical Circuits

A LARGE percentage of the accidents which occur to linemen and electricians are due to turning the power on before the men are off the line or to the men starting work on a supposedly dead line from which the power has not been cut off. Probably the most common source of trouble arises where the station operator receives orders from more than one person relative to a shutdown on the same circuit. The following set of rules governing shutdowns, which has been compiled from the general instructions of several comparatively small operating companies, has been found very serviceable on transmission systems which are not extensive enough to require a load dispatcher:

1. All power and lighting circuits are to be considered alive by all persons concerned unless such persons have definite knowledge to the contrary.
2. Power must not be cut off from any circuit until requested by the person in immediate charge of the work which necessitates the shutdown. The request shall be made either in person or by telephone by one person only, who shall give his name and indicate the line he wishes to work on. He must then wait until the station operator informs him that the power is off the line.
3. When the station operator receives an order to cut the power off a certain line, he must open the disconnecting switches between the bus and the oil circuit breaker, as well as the circuit breaker, and must place a danger tag on the latter. He must also attach a tag indicating the name of the party ordering the power off, and the time. After this has been done he shall advise the person desiring the shutdown that the power is off the line.
4. The person in charge of the work must see that the lines are shorted and grounded before work is commenced.
5. After the work has been completed, the person in charge of the work who made the request for the shutdown shall call the station operator, give his name, and shall plainly state that the work is completed, that the men are off the line, and shall order the power turned on. He shall then wait until the operator tells him the power is on the line and shall then test out the apparatus on this line to see that everything is in good working order before leaving the job.
6. The station operator shall record all power interruptions on his daily log sheet in full, the name of the person ordering the power off and on, the line involved and the time of shutting off and turning on the power.
7. When two or more jobs are being done on the same line at the same time and one man is in charge of each job, one man only may assume responsibility for ordering the power off and on, and the station operator shall not accept orders from more than one person relative to the same shutdown.
8. In case of emergency where life or property is endangered, any one may interrupt the power service by giving his name and the reason for cutting the power off, but where there is no urgent necessity arrangements must be made through the office of the superintendent long enough in advance to give all parties affected time enough to prepare for the shutdown.

A. L. Johnston,
Manager Electrical Department.
H. C. Felver, Engineering & Contracting,
Pottsville, Pa.

Simple Construction for 30-Deg. Turn



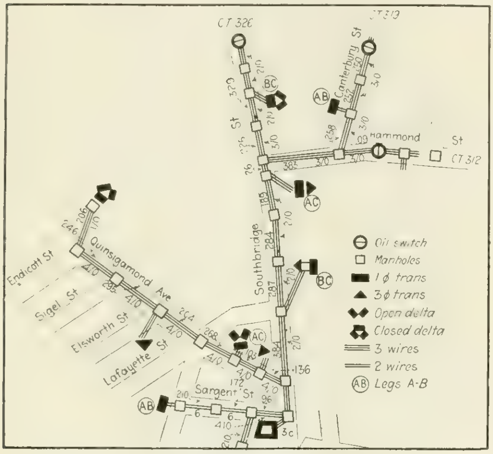
CONDUCTORS DEAD-ENDED AT OFFSET CROSSARM

A SIMPLE method of making a 30-deg. turn in a three-phase high-voltage line is shown in the illustration. Only one pole with a head guy bisecting the angle in the line is used. At the top is an offset crossarm made of angle irons braced at their outer ends. The circuits are dead-ended to this arm, short jumpers supported by pin-type insulators carrying the circuits over the arm. The construction is rigid and simple and so far has given no trouble. The turn is in a circuit of the Blackstone Valley (R. I.) Gas & Electric Company, feeding a large textile factory.

Boston, Mass. Field Editor Electrical World.

Loose-Leaf Prints of Circuits Help Distribution Force

By using appropriate symbols and keeping the original tracings up to date the distribution force of the Worcester (Mass.) Electric Light Company is supplied with excellent maps of individual circuits in the form of 8-in. x 10.5-in. blueprints of the loose-leaf type. On these easily can be shown the size of wire, number of phases, type of transformer connections installed and phase wires off which single-phase taps are taken, distance between manholes in feet and location of manholes and transformers, position of oil switches, etc. George M. Hardy is superintendent.



MAPS USED BY WORCESTER (MASS.) ELECTRIC LIGHT COMPANY FOR DISTRIBUTION SYSTEM

Boston, Mass. Field Editor Electrical World.

Finding Way to Start Standby Generators for Power-Factor Correction

No doubt numerous old generating stations now serving as substations could be used for improving power-factor and voltage regulation if the generators could be operated as synchronous condensers. However, considerable time and expense may be involved in starting up the units with the turbines; and besides, steam turbo-generators are apt to be more difficult to start inductively than the ordinary type because of the high speed and solid rotor construction. This was the condition at the Grant Street station of the Public Service Corporation of Quebec, and other means were therefore sought for bringing the machine up to synchronism.

The generator was uncoupled from the turbine and some experiments were made in starting with a motor belt connected to the generator. These experiments were not successful owing to the high synchronous speed of the generator (3,750 r.p.m.) and to the difficulty in transmitting the necessary power by a belt.

Later on the writer conducted some tests to determine the feasibility of inductive starting. The first unit tested was a Curtis turbo-generator rated at 750 kw., 3,780 r.p.m., three-phase, 63 cycles, two poles, 2,300 volts, 236 amp. per phase, with directly connected exciter. The tests were made with the turbine uncoupled from the generator.

As a preliminary test a potential of 220 volts, three-phase, was applied to the stator winding with the field circuit open. The induced voltage in the field circuit caused the slip rings to flash over. The field circuit was then closed with the resistance of the field rheostat in series and 220 volts was again applied to the stator. When the rotor received a start it slowly accelerated and came up to half speed. It was not possible to run it above half speed by opening the field circuit or by introducing a high resistance.

Next two 50-kw., 2,300/550-volt transformers were connected in open delta to furnish 550-volt starting current. When this voltage was applied the machine accelerated quietly and promptly, but again locked at half speed. Arrangements were made to install additional starting transformers that would give 1,100 volts as a second starting tap. It was hoped that this voltage would cause the machine to break out of the half-speed position and come up to synchronism. However, this test was not carried out for the reason that about this time the turbine of another unit stripped its blading and it was necessary to couple the 750-kw. generator to its turbine and hold it ready for emergency service.

Changes That Enabled Starting

Later on it was decided not to repair the damaged turbine, but to operate its generator as a synchronous condenser. (This generator was rated at 1,000 kw., two-phase, 2,000 volts, 60 cycles, four poles, 1,800 r.p.m. It had been reconnected for three-phase operation by connecting an 87 per cent tap on one phase to the middle of the other phase, thus forming a T connection.) Arrangements were made to apply 550 volts for starting, from the two 50-kw. transformers used in the previous test. The field circuit was closed through the resistance of the field rheostat. The initial current was over 600 amp., but this was not sufficient to start the machine. It was necessary to bolt on an extension shaft projecting out through the bearing housing, in order that a pipe wrench might be used to start the machine turning over. When this was done acceleration took place rather slowly, and synchronism was reached in from two to three minutes. A weak field was then applied and built up until the machine was taking a heavy leading current, when the starting switch was tripped out and the running switch thrown in. During this starting process the two 50-kw. transformers heated up considerably, and for this reason a third 50-kw. transformer was installed, forming a closed delta bank.

The machine proved to be quite stable when operating as a synchronous condenser. No trouble has been experienced with it in any way. When the synchronous condenser was put into service the induction regulator was put on hand control and the field of the synchronous condenser was controlled by a Tirrill regulator. The station attendant was instructed to set the induction regulator so that the synchronous condenser would be kept boosting at nearly full rating all of the time.

There were two buses in the station, the machine being connected to each bus by an oil switch. One of these was disconnected from the bus and connected as a starting switch to the 550-volt side of the transformers. Since the two hand-operated oil switches were mounted side by side on the generator panel, it was an easy matter to provide a mechanical interlocking device. The starting transformers were phased out with the bus so that there was no disturbance in passing from the starting to the running position. C. R. REID,

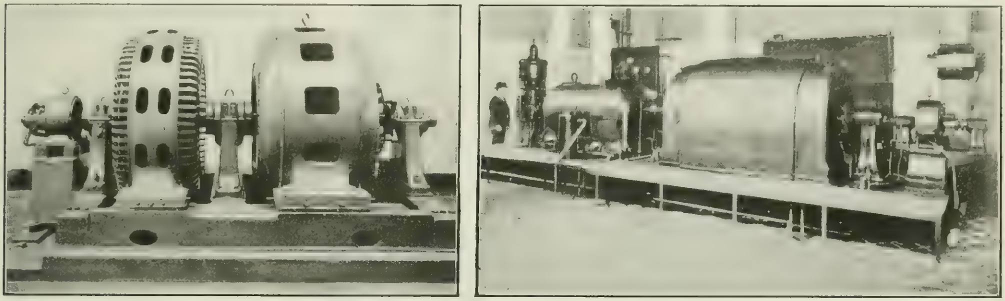
Power House Superintendent.

Shawinigan Water & Power Company,

Shawinigan Falls, Quebec.

Relative Merits of Three Methods of Obtaining Heat Balance

THREE methods of supplying electrical energy for station auxiliary drive for obtaining a satisfactory heat balance and the relative advantages of each were outlined in a paper by H. C. Albrecht, electrical engineer the Philadelphia Electric Company, before a recent meeting of the New York Section of the A. I. E. E. and the Metropolitan Section of the A. S. M. E. These methods involve supplying energy from (a) the main generating units or main bus, (b) the house turbo-generators, or (c) a combination of both.



TWO IMPORTANT PARTS OF COLFAX HEAT-BALANCE SYSTEM

When the house generator on the right runs at the same frequency as the main generators, the motor-generator on the left will carry no load and the house turbine will carry all of the electrical station auxiliaries. By reducing the speed of the house turbine the motor-generator, which is driven from the main bus, can be made to pick up some of the auxiliary load, and the exhaust steam from the house turbine will be thereby reduced. Since the exhaust from the fans and feed-pump turbines is always less than required in both the feed-water evaporators and barometric-condenser type heater, the speed control of the house turbine can always maintain the desired heat balance. The motor-generator set is fed from the main generator bus.

Some of the advantages of supplying energy from the main generating units or main bus through transformers are low investment costs, small space requirements and simplicity of operation as compared to supply from house turbo-generators. Great flexibility in obtaining heat balance is also possible by bleeding the main units, by use of steam drive or dual (steam-electric) drive for some of the large auxiliaries, or by combinations of these. With this scheme of energy supply, however, auxiliary equipment may be affected by disturbances on the main bus, due either to station or system troubles, and is subjected to more severe duty during short-circuit conditions than if isolated, although conditions may be modified somewhat by the installation of certain other equipment. Examples of this type of installation are the Chester and Delaware stations of the Philadelphia Electric Company and the Calumet station of the Commonwealth Edison Company.

The house turbo-generator method of supply has the advantage of complete isolation from the main generating system and of lessened duty on equipment during system disturbances, with consequent greater reliability of service. However, this method is more costly, requires more space than the transformer method and affords less flexibility in obtaining heat balance.

A combination of supply from the main units or main bus and of house turbo-generators has the merits of both methods and also gives the additional distinct advantage of two independent sources of supply. Great flexibility can be obtained in the adjustment for heat balance, but more space and greater investment are required than when supply is obtained through transformers from the main units or main bus. This method also permits the connection of certain essential auxiliaries to the house turbo-generators, thus giving the advantage of greater reliability and assurance of continuity of service. This type of installation is used in the Colfax station of the Duquesne Light Company and in the Hell Gate station at New York.

Any of the methods of supply outlined above may be arranged so that the supply will be from a common system for all of the station auxiliaries. This has the disadvantage that an interruption in the service may affect all of the auxiliaries supplied from the common bus. It may also be supplied from a segregated system arranged for operation of several selected groups of auxiliaries. These may be chosen to include a portion of the boiler auxiliaries, all of the auxiliaries of an individual main turbine, those of a pair of turbines, or only certain auxiliaries from two or more turbines. The latter practice is of advantage when important motor driven auxiliaries are provided in duplicate.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Flexible Hose Used for Transformer Oil Piping System

THE oil-circulating type transformers of the Southern California Edison Company's Long Beach steam station have been installed with flexible metallic hose connecting the transformer cases with the rigid piping. By this means any slight inaccuracies in the placing of the transformers may be easily corrected, and in the event that it is necessary to replace a damaged unit with a spare transformer the connections may be made quickly. Standard 4-in. flexible hose is used having fire-hose connections on the ends.

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

A Survey of Rural and Urban Dwellings in the United States

An Interesting Analysis Which Shows that the Number of Country Homes Exceeds Those in the Cities—Presenting a Large Problem for the Electrical Industry

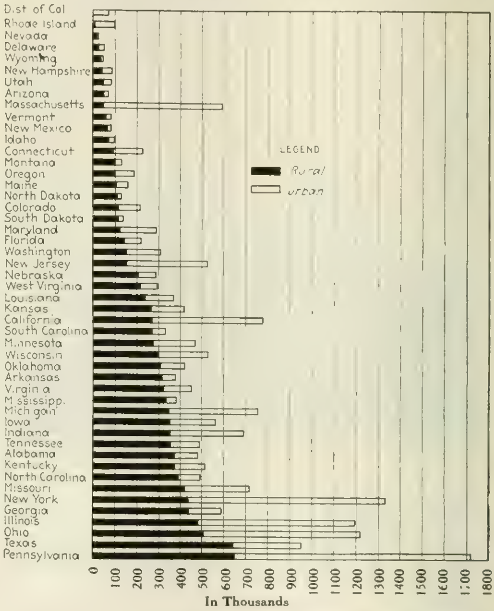
FOLLOWING the analysis of home ownership throughout the United States as compiled by the Bureau of Housing under the Department of Commerce, which was published in this section of the ELECTRICAL WORLD, March 25, this comparison of the number of rural and urban dwellings is pertinent. The accompanying chart and table show conditions which have considerable significance to the electrical industry.

Of the forty-eight states only twelve have fewer rural than urban dwellings. These are Rhode Island, New Hampshire, Connecticut, Maryland, New Jersey, California, Michigan, New York, Illinois, Ohio, Washington and Pennsylvania. Obviously the excess of urban over rural dwellings occurs in those states having one or more large cities and it is particularly interesting to note that in New York, even with its large metropolitan districts, 32.8 per cent, or nearly one-third, of the total dwellings are rural. In Illinois with 1,190,414 houses in all, 483,602 or 43.2 per cent are rural. In Pennsylvania there are 649,665 rural or 37.6 per cent.

The New England States with the exception of Vermont and Maine have a higher percentage of urban than rural dwellings. This, of course, is accounted for by the concentration of industrial plants and comparatively limited amount of agricultural activity in this section.

The Central, Southern and Middle Western agricultural states show a much higher ratio of rural to urban dwellings, ranging from 51.3 per cent rural in Indiana to 87.5 in North Dakota. The Southern states average a high percentage of rural dwellings. The Western and Rocky Mountain states also have a high percentage of rural houses.

The total for the entire country shows that 11,212,652 or 54.1 per cent of the dwellings are rural. In 1910 there were 10,551,603 rural dwellings in the United States, which was 57.6 per cent of the total 17,805,845 urban and rural dwellings at that time. These figures show that the percentage of rural dwellings has decreased from 57.6 to 54.1, which would seem to indicate a decided exodus to the city. It should be remembered, however, that the 1920 census was taken at a time when industrial activity in the cities was at its height and country people generally were moving into town. During the past two years this movement has been checked and now there is a trend in the other direction.



DISTRIBUTION OF RURAL AND URBAN DWELLINGS BY STATES

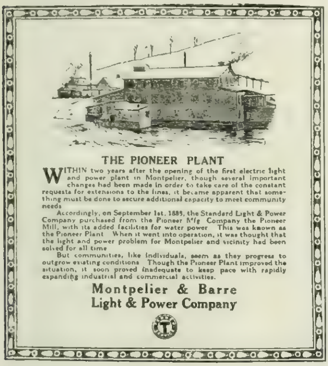
The fact that more than one-half of the country's dwellings are located in rural communities indicates the size of the problem which the electrical industry faces. So far this market has scarcely been scratched and the rural customers' demand upon the industry will probably equal if not surpass that of the urban customers.

NUMBER OF RURAL AND URBAN DWELLINGS BY STATES AS REPORTED BY BUREAU OF CENSUS FOR 1920

	Rural	Urban	Total
Dist. of Col.	..	72,175	72,175
Rhode Island	3,834	95,027	98,861
Nevada	17,368	3,341	20,709
Delaware	24,213	23,655	47,868
Wyoming	33,122	11,588	44,710
New Hampshire	40,728	51,456	92,184
Utah	46,325	43,262	89,587
Arizona	48,709	24,964	73,673
Massachusetts	49,156	547,896	597,052
Vermont	56,436	20,722	77,158
New Mexico	64,113	13,911	78,024
Idaho	69,913	25,386	95,299
Connecticut	93,204	135,201	228,405
Montana	94,535	36,135	130,670
Oregon	98,857	86,224	185,081
Maine	108,657	53,647	162,304
North Dakota	113,330	16,575	129,905
Colorado	115,199	95,904	211,103
South Dakota	115,312	21,200	136,512
Maryland	122,878	165,383	288,261
Florida	140,169	77,702	217,871
Washington	148,074	156,661	304,735
New Jersey	148,561	366,650	515,211
Nebraska	201,629	86,761	288,390
West Virginia	218,528	74,474	293,002
Louisiana	241,693	128,684	370,377
Kansas	269,739	146,326	416,065
California	270,133	508,728	778,861
South Carolina	273,191	57,309	330,500
Minnesota	277,918	191,734	469,652
Wisconsin	296,553	229,635	526,188
Oklahoma	307,240	111,317	418,557
Arkansas	311,713	63,603	375,316
Virginia	322,555	127,674	450,229
Mississippi	333,522	53,880	387,402
Michigan	339,777	416,154	755,931
Iowa	357,064	202,124	559,188
Indiana	357,485	338,981	696,466
Tennessee	358,904	129,488	488,392
Alabama	375,697	104,695	480,392
Kentucky	376,293	134,688	510,981
North Carolina	397,133	98,136	495,269
Missouri	422,201	295,055	717,256
New York	435,940	889,174	1,325,114
Georgia	436,368	150,141	586,509
Illinois	483,602	706,812	1,190,414
Ohio	501,808	714,734	1,216,542
Texas	643,608	303,021	946,629
Pennsylvania	649,665	1,076,559	1,726,224
Totals	11,212,652	9,484,552	20,697,204

A Public Policy Campaign Based on Local History

A COMPREHENSIVE public policy campaign designed to acquaint citizens with the fundamental needs of communities for utility service has been inaugurated by companies under the management of Charles H. Tenney & Company, Boston, Mass. The plan includes a series of newspaper advertisements run with weekly changes in the territory of the local company. With variations to meet differences in the local situations, the campaign for each company is planned to follow the same general line of development. Beginning with a short, interesting reference to the earliest history of the local community, the necessity for co-operation among the original pioneers and later settlers is shown. The first set was started by the Montpelier & Barre (Vt.) Light & Power Company before Thanksgiving, 1921. Insertions have been started in the territory of the Haverhill (Mass.) Electric Company, and shortly the Fitchburg (Mass.) Gas & Electric Light Company will begin a series of display advertisements in the local press. Enough material has been planned for these companies to cover virtually a year in presentation.



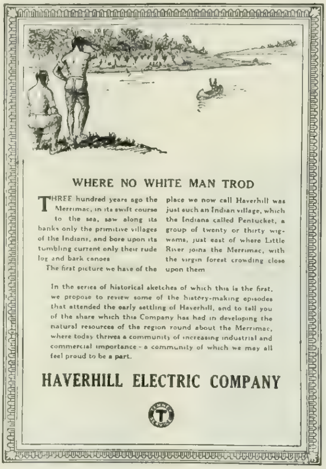
THE PIONEER PLANT

WITHIN two years after the opening of the first electric light and power plant in Montpelier, though several important changes had been made in order to take care of the constant requests for extensions to the lines, it became apparent that something must be done to secure additional capacity to meet community needs

Accordingly, on September 1st, 1885, the Standard Light & Power Company purchased from the Pioneer M'f'g Company the Pioneer Mill, with its added facilities for water power This was known as the Pioneer Plant When it went into operation, it was thought that the light and power problem for Montpelier and vicinity had been solved for all time

But communities, like individuals, seem as they progress to outgrow existing conditions Though the Pioneer Plant improved the situation, it soon proved inadequate to keep pace with rapidly expanding industrial and commercial activities.

Montpelier & Barre
Light & Power Company



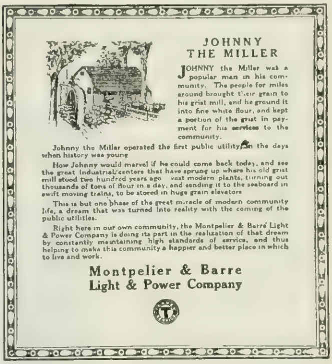
WHERE NO WHITE MAN TROD

THREE hundred years ago the Merrimac, in its swift course to the sea, saw along its banks only the primitive villages of the Indians, and bore upon its tumbling current only their rude log and bark canoes

The first picture we have of the place we now call Haverhill was just such an Indian village, which the Indians called Pentucket, a group of twenty or thirty wigwams, just east of where Little River joins the Merrimac, with the virgin forest crowding close upon them

In the series of historical sketches of which this is the first, we propose to review some of the history-making episodes that attended the early settling of Haverhill, and to tell you of the share which this Company has had in developing the natural resources of the region round about the Merrimac, where today thrives a community of increasing industrial and commercial importance - a community of which we may all feel proud to be a part.

HAVERHILL ELECTRIC COMPANY



JOHNNY THE MILLER

JOHNNY the Miller was a popular man in his community. The people for miles around brought their grain to his grist mill, and he ground it into fine white flour, and kept a portion of the grist in payment for his services to the community.

Johnny the Miller operated the first public utility in the days when history was young

How Johnny would marvel if he could come back today, and see the great industrial centers that have sprung up where his old grist mill stood two hundred years ago vast modern plants, turning out thousands of tons of flour in a day, and sending it to the seaboard in swift moving trains, to be stored in huge grain elevators

This is but one phase of the great miracle of modern community life, a dream that was turned into reality with the coming of the public utilities.

Right here in our own community, the Montpelier & Barre Light & Power Company is doing its part in the realization of that dream by constantly maintaining high standards of service, and thus helping to make this community a happier and better place in which to live and work.

Montpelier & Barre
Light & Power Company

HISTORICAL PUBLICITY FOR A UTILITY

An Interesting Anecdote of the Benefit of Customer Ownership

CONCRETE examples of the direct benefit of customer ownership to the central-station companies were cited recently by Samuel Insull, president of the Commonwealth Edison Company, in an address before the Chicago Chapter of the American Institute of Banking. He related some interesting anecdotes, the point of which can best be told in his own words. Mr. Insull said:

"What I am deliberately after is public ownership. Not municipal ownership, but public ownership that will result in a vast army of stockholders—and we have 500,000 of them in the State of Illinois today—to stand guard over their own property. I heard a story a few months ago of a case of a politician, I think it was in Minneapolis. He came home after the Legislature and was talking to his neighbor. He said: 'I think it is about time we went after this electric company. I think we ought to get the Legislature after them.' His neighbor said: 'Who do you mean? Our electric company?' He replied, 'What do you mean by "our electric company?" That company is controlled by a firm down here in Chicago, H. M. Byllesby & Company.' 'Oh, no,' said the neighbor, 'that company is owned around here. You are the only man in this block who is not a stockholder, and if you will go through your constituency, you will find there so many men and women who are stockholders that if you start to raise Cain with that institution they will raise Cain with you.'

"That is what we are after. There is nobody more alive to the fact that we are after it than the politician. That is what we are going to get, and when the junior securities of all these local public utilities are owned by the people themselves as individuals, you will hear less about municipal ownership, you will hear less about attacks upon utility interests, and you will find that the senior securities that the local utilities put out will be very desirable collateral whenever they come over your counters."

What Other Companies Are Doing

Chicago, Ill.—Customer-ownership sales of preferred stock at the operated properties of Standard Gas & Electric Company during February, 1922, resulted in 1,526 transactions having a total par value of $788,100.

Toledo, Ohio.—The Toledo Edison Company, as is its custom in all matters relating to the welfare of the city, took a prominent part in the recent "Talk Toledo" week. Frank R. Coates, president of the company, headed the church committee and secured co-operation from all churches, and a sermon on Toledo was given from every pulpit in the city. E. R. Kelsay headed the speakers' bureau, and every civic organization holding a meeting that week was furnished with a speaker. The company's display windows were also used to feature "Made-in-Toledo" products.

Hartford, Conn.—To help its customers learn from experience how much service the Hartford Electric Light Company is able to render under its new residential rate it is proposed at the end of this year to return to every customer whose bill is increased over what it would have been under the old rate the full amount of such increase as a reduction on the price of a flatiron or any other appliance purchased during the year.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

An Answer to the Question "Who Will Sell Electrical Appliances?"

By Fred Wardell
President Eureka Vacuum Cleaner Company, Detroit, Mich.

FRED WARDELL

Many electrical men are watching with considerable interest the inroads made by non-electrical dealers into the field of electrical merchandising and wondering how far the distribution of electrical goods is ultimately to be carried on through the channel of hardware, drug, automobile-supply and sporting-goods stores. They seem to feel that this is a menace, that the electrical business should be kept all within the hands of electrical men, and that the growing interest of non-electrical merchants in electrical goods will inevitably limit the opportunity of those now in the appliance business. I would say that, irrespective of the nature or class of dealers who make an attempt to sell electrical goods at retail, the mere fact that they make the attempt should be just reason to encourage their support. They will do their part in popularizing electrical merchandise, and their sales will help the electrical industry along just that much more.

The hardware store is even now a big factor in the sale of electrical merchandise. The hardware merchants should be encouraged. They are for the most part good merchants and are well financed. This is particularly true in small towns. The hardware store is well known and is in constant, intimate contact with every home, selling to all the households of the community other kinds of home supplies, including non-electric labor-saving devices and other conveniences.

Drug stores undoubtedly will become a big factor in the sale of small heating appliances, but as for vacuum cleaners and the larger appliances—never. Automobile-supply and sporting-goods stores, in my opinion, are not to be taken seriously.

The central-station company that adheres to an aggressive merchandising policy will always be the best single outlet for electrical goods. The reasons are obvious. The central-station companies represent our best dealers both in small towns and large, and particularly so in the smaller cities. In the minds of the people they are the established headquarters of electrical knowledge and service.

Next to the central station in the smaller cities, of 50,000 and less, is the contractor-dealer, while in cities of greater population the department store is the best outlet. The contractor-dealer will always be a big factor in the sale of electrical appliances, principally because of the number of contractors in business. As he is the man who wires the homes or installs the additional convenience outlets, he is in a most favorable position to suggest the appliance that the customer should buy.

Notwithstanding the favorable positions of the contractor-dealer, the hardware dealer and the central-station company, the old-established big dealers, the department stores, will eventually become—if they are not already—the popular leaders in the retail selling. They have the crowds, the finances, the advertising and the prestige and are therefore in a position, along with the central station, to dominate. As is quite evident, the department store is already taking the electrical merchandise business seriously—even to the extent of creating separate departments. As electrical goods become more popular, the department store will take even more interest in this business.

In the sale of the larger appliances, such as vacuum cleaners, washing machines and the like, the specialty stores in the larger cities are fast jumping into first place. Their combined sales are enormous, and with their highly organized and trained sales forces they are doing a first-class job of combing each block for prospective customers. But the electric specialty stores will never be a big factor in cities of less than 75,000.

In summing up the situation I would say that the contractor-dealer will be pushed to the background as an appliance merchant in cities of more than 75,000 population, while in the cities of less population he will have to split with the department and hardware stores and to recognize the central-station company as the big outlet. There is room enough for all, however, and every merchant who is willing to contribute his influence to the educating of the people in the knowledge of and desire for electrical appliances should be encouraged. For this is still our pioneering period, and the sooner we can build up the universal popularity the sooner we shall come into our own.

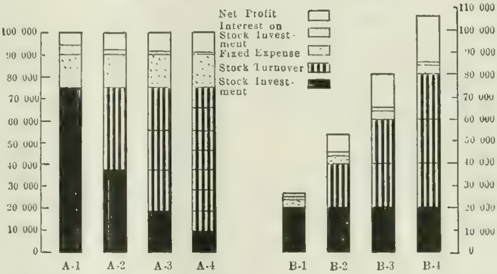
Research Must Be "Sold"

By C. E. Skinner
Assistant Director of Engineering
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

From a strictly utilitarian standpoint it is futile to carry on research unless its products can be made useful. The marketing of research products has been little discussed and is perhaps less understood. Industrial laboratories often find it necessary to conduct scientific investigations along lines presumably of no immediate commercial value but which are aimed to give more knowledge of the fundamental principles underlying the operation of the manufactured product.

In the end, however, research must be "sold," in the modern sense of the word. The problem is to get the results of the investigation incorporated into the product and into the hands of the ultimate user. Those who do research and obtain results which they are sure should be useful are often astonished at the indifference of others to the value of their work. Hence the need of a "selling" campaign, which consists in convincing all with whom the investigator has to do that his research is worth while and that the results will show a gain in quality or cost or performance over the formerly accepted methods. The better known the investigator, the less trouble in "making a sale," which is convincing those responsible for the financial operations of an organization that it is worth while to spend money on the investigator's scheme. The strategy of such a "selling" campaign must be as varied as the researches themselves and must be governed by the circumstances under which the investigation is made.

Probably the easiest "selling" campaign is where the results are specifically requested by an individual or group who need to attain certain ends and have no means themselves of accomplishing these. The hardest "sale" is doubtless where a new device or new principle is developed independent of the users and where a change is required in well-known methods or products to permit its use. Where the investigation can be carried on with the co-operative interest of designing engineers, and when feasible in the confidence of workmen and foremen having factory process work to do in the development of the product, much will be gained.



The Influence of Turnover

SERIES A represents sales amounting to $100,000, but the number of turnovers increases from one in A-1 to eight in A-4. Each increase in turnover reduces stock investment as well as interest, while the amount of profit increases. Series B shows uniform stock investments and cost of interest throughout, while the amount of profit increases with the number of turnovers.

If we develop a new device based on a newly discovered principle, the success or failure of the device may depend entirely upon conditions aside from its intrinsic merit. It must function in ways readily understood, and if too much "translation" is required to utilize it, as, for example, in the introduction of a new method of measuring the quality of a material, the research worker will have a hard time in getting the device accepted. A campaign of education is often necessary. Products of research sometimes fail because of obscure difficulties which are not due to the new product but to extraneous causes undiscovered until long after the apparent failures have given it a bad reputation.

Usually it is much harder to incorporate results of research into old processes than into new. In a large manufacturing plant the best approach is usually through new methods and processes which are necessary from time to time. Co-operation with the factory men in such cases yields good fruit. Many times wholehearted support can be secured by giving such men a sympathetic hearing and so far as possible credit for their suggestions, and complete success is sometimes insured by such a method where failure would surely result from an attempt to force its acceptance. The more intimate knowledge the investigator has of the problems of the engineer, the factory and the salesman, the more able he will be to shape his work to fit commercial requirements. Conversely, it is true that the engineer, the factory executive and the salesmen will be better in their own fields if they know and understand the problems of the research worker.

The Relation of Turnover to Profit

CLEAR as the importance of stock turnover is, jobbers and dealers, as well as manufacturers, through inattention frequently violate some of its most fundamental principles. The recent statement by the Domestic Distribution Department of the United States Chamber of Commerce pointing out some of the costs and wastes of slow turnover are therefore particularly interesting and worth a bit of study. There are seven distinct classifications under which losses may occur when merchandise is not turned over as rapidly as it might be. These are investment, interest, mark-down, salaries and wages, shelf and storage room, prestige and reputation and inefficiency. An examination of these elements shows their relation to each other, as follows:

Invested money is the source of profit, which in turn depends upon the amount of goods in stock and upon the length of time which these goods are carried. It is evident that to double the turnover comes to the same thing as doubling the amount of stock without increasing the investment. Or, vice versa, one-half as many turnovers results in doubling the amount of money invested for the same quantity of goods.

Interest must be paid upon all borrowed money and most merchants are borrowers. If the turnover is reduced from a period of six months to one of three months, the interest on a given loan is reduced in the same proportion.

Mark-downs are required when goods have proved unsalable at the original mark-up, or when too many were bought or when the articles become shopworn or out of date. Each of these conditions delays the turnover.

Salaries and wages must be included because every operation in every establishment costs something. When an unprofitable operation is performed it represents a loss.

Shelf or storage room is a definite part of the expense of doing business; and that portion which is devoted to slow-selling merchandise is wasted.

Prestige and reputation for the high character or timeliness of merchandise is sought by most stores. There is a distinct waste measurable in dollars and cents when the reputation of an establishment is lowered by unstylish or shopworn goods.

Inefficiency always results in waste. The buyer whose judgment often is wrong usually makes the mistakes from lack of knowledge as to the stock and the speed or slowness with which it is moving. Frequent mistakes cause uncertainty in the mind of the one who makes them and tend to worse errors as time goes on unless some measures are taken to make them improbable.

The accompanying chart presents a graphic picture of the influence of turnover both on the investment required and the resulting profit.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

The Proportioning of Steam-Turbine Blading.—H. M. MARTIN.—The author develops equations, curves, tables and other data necessary for the construction of the blades in steam turbines. The article is in five sections, published in successive weeks. In the first part a method is explained for determining, from the top valve and the condenser data and the steam rate required, the thermodynamic head under which a proposed turbine will operate. In the second a particular case illustrating this method is considered, and additional data that apply to turbines of all sizes operating under the same conditions and at the same steam rate are given. The method of fixing the blade height is described in the third article, and since this is in part empirical the author works out in this section the error involved in the method. It is shown that this error is in general insignificant save in cases necessitating the use of wing or semi-wing blades. In the fourth section a reaction turbine is proportioned with an output equal to 6,000 kw., and in the last installment impulse turbines are considered.—*Engineering (London)*, Jan. 6 to Feb. 3, 1922.

Split and Layer Windings for Small Armatures.—A. C. ROE.—The author outlines the repair-shop practice for handling split windings both chorded and diametrical, split-loop windings and layer windings. Reasons are given for the use of these windings, and their advantages in some cases over the straight-loop winding are explained. Many diagrams are given illustrating the various windings and showing the methods to pursue.—*Electrical Review and Industrial Engineer*, February, 1922.

Lamps and Lighting

Artificial Daylight.—J. S. DOW.—Discussion of the application of this form of lighting to textile and dyeing industries. The author considers the development of artificial daylight and how the advances that have been recently made, especially the invention of Chance's "daylight glass" and the Sheringham daylight, are likely to be used in these industries.—*Electrician (London)*, Feb. 24, 1922.

Artificial Lighting in Dentistry.—PERCY RUSSELL.—A discussion of lamps used by dentists for dental lighting to supplement daylight, for generating light within the mouth for viewing interior surfaces and for viewing tissues by light transmitted through them.—*Transactions of the I. E. S.*, January, 1922.

The Lighting of Large Dry Goods and Department Stores.—A. L. POWELL.—Without artificial lighting the modern large store would not be an economic possibility as space is too valuable in cities to design a building so that adequate daylight can penetrate a long distance from the street. Consequently the continuous use of lighting equipment is a necessity. Among the items that the author discusses are the desirable intensity of illumination, color of light and diffusion, arrangement and systems of lighting, choice of reflecting or diffusing equipment, the selection of fixtures and the spacing of outlets and hanging height.—*Bulletin L. D. 132 of Edison Lamp Works.*

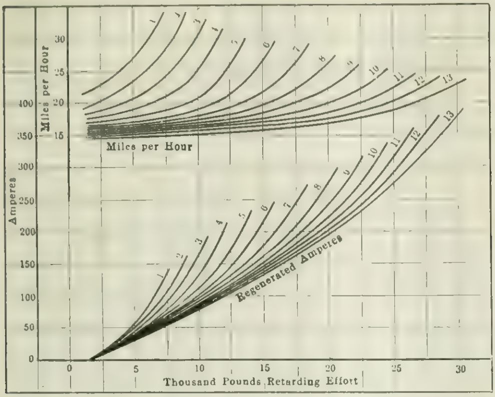
Generation, Transmission and Distribution

Utilization of Waste Heat in Generating Stations.—Abstract of two papers read before the (British) Institution of Electrical Engineers. The first, by C. I. Haden, suggests the combination of distribution in the form of steam or hot water with electrical generation so as to utilize the fuel resources to better advantage than at present. This could be effected by converting into heat stations generating stations which would otherwise be discarded. The second paper, by F. H. Whysall, deals with the practical and economic difficulties of any such scheme.—*Electrician (London)*, Jan. 27, 1922.

Hydro-Electric Plant at Seira, Spain.—J. REYVAL.—The paper contains a very detailed and profusely illustrated description of the largest Spanish power transmission system. The generating station is at Seira, on the river Esera, and utilizes a water head of 145 m. Four horizontal-shaft spiral-type turbines of 12,500 hp. each are directly connected to 9,000-kva., three-phase, 6,000-volt, 50-cycle generators, running at 500 r.p.m. Four 9,000-kva. forced-oil-cooled transformers step up the generator voltage to the transmission voltage of 120,000. At present only one three-phase line connects the station with the city of Barcelona, 175 miles distant, but it is planned to establish a second, independent line as soon as the fifth generator is installed. Along the line, which runs through a very rough and mountainous country, three 6,000-kva. substations are installed, and at its end, at the outskirts of Barcelona, a main substation with a present rating of 36,000 kva. is in operation. The transmission cables are of copper of 86 sq.mm. cross-section per phase and are suspended on ten-disk chains. All towers are of fabricated-steel construction. On top of the towers a galvanized-iron protective cable of 50 sq.mm. section is laid out. It is carefully grounded at every fourth tower. The entire electrical equipment was built by the Swiss Oerlikon works, and all guarantees are based upon the German V. D. E. rules.—*Revue Générale de l'Electricité*, Jan. 7, 1922.

Traction

Regeneration Characteristic Curves of Direct-Current Locomotives.—C. A. ATWELL.—Owing to the comparative newness of regenerative brakings on locomotives, the methods of representing the regeneration characteristics of the direct-current motor are not very familiar, nor are the methods standardized. On account of the large number of quantities that vary during regeneration it is desirable to plot as characteristic curves those quantities which will be of the most value to the one using them. After showing several ways in which these variables may be plotted in curve form, the author suggests the form shown in the accompanying illustration as being the most logical and useful. In this illustration the curves show speed and amperes regenerated in terms of retarding effort for each step of the controller.—*Electric Journal*, March, 1922.



LOCOMOTIVE REGENERATION CURVES FOR INTERMEDIATE-SPEED COMBINATIONS

Installations, Systems and Appliances

Flexibility of Electrical Service in a Large Textile Mill.—This article describes how a well-designed installation permits close control of production and facilitates changing of equipment. The plant referred to is the new weaving building and raw-stock dye house of the Riverside & Dan River Cotton Mills at Danville, Va., in which there are 5,040 motors of ½-hp. rating, each directly connected to a loom.—*Electrical Review and Industrial Engineer*, February, 1922.

The Textile Industry and Public Electricity Supply.—W. J. H. Wood.—The textile manufacturer wishes to be convinced that in adopting electric drive he will gain advantages which cannot be obtained in any other way. The author considers the particular cases of (1) an existing steam-driven mill changing over to the electric drive and (2) a new mill. In both cases the relative economies of private generation and public supply are compared. The heating problem, which is in many cases the determining factor, is shown to be capable of solution by electrical means.—*Electrician (London)*, Feb. 24, 1922.

Electrophysics and Magnetism

Natural Convective Cooling of Wires.—A. H. Davis.—An investigation of the apparent discrepancy between published data for the natural convective cooling of wires and the hydrodynamical theory of the phenomenon.—*Philosophical Magazine* (*London*), February, 1922.

High-Frequency Resistance of Inductance Coils.—Gregory Breit.—At high frequencies Ohm's law does not give complete information about the current flow in inductance coils because the current flow is modified by induction effects of magnetic as well as electrostatic nature. As a result the current density is not uniform over a given cross-section of wire, nor is it the same for different cross-sections of the wire. The effects of this non-uniformity and its measurement are the subject of the investigation described in the paper. —*Scientific Papers of the Bureau of Standards, No. 430.*

Electrochemistry and Batteries

Progress in the Use of Storage Batteries.—H. Beckmann.—The author reviews the vast field of storage-battery traction in an elaborate article. He describes the latest types of storage-battery-driven suburban motor trains with a special battery tender, deals with battery switching locomotives and mine locomotives which may have permanently installed or readily exchangeable batteries, mentions the great possibilities of the small one-man electric mule, gives a general outline of the rentability of electric passenger and freight automobiles, touches upon the use of storage batteries in submarines, in gasoline-driven cars as starter batteries and in miners' safety lamps, and finally mentions and describes the new design of small-output but high-voltage batteries for supplying the anode voltage for electron tubes in radio work. The fact that Germany has to import all of its gasoline but has an abundance of hydro-electric power will be a great impetus toward the more general electrification of its city trucks. The author believes that at least 40,000,000 marks a year could be saved by changing over one-half of the gas trucks in Berlin to storage-battery operation. This would not only be a great national benefit but would bring savings in operation and a welcome night load for central stations. — *Zeitschrift des Vereines Deutscher Ingenieure*, Jan. 28 and Feb. 4, 1922.

Telegraphy, Telephony and Signals

On the Grounding Reactor.—Sadatoshi Bekku.—With the increase in number of the high-voltage power-transmission systems the subject of inductive interference on telephone and telegraphic circuits has become one of the most important topics of study among transmission and communication engineers. Various methods of grounding and different types of grounding reactors are described. The effects of these in producing interference on communication circuits are given.—*Journal of Institute of Electrical Engineers of Japan*, February, 1922.

Low-Voltage Rectifier Design When Employing the Three-Electrode Vacuum Tube.—R. D. Duncan.—A discussion of the theory and design of the low-voltage rectifier for furnishing plate voltage required in the operation of relatively low-power radio telegraph and telephone transmitters of the thermionic type. Based upon the theory, equations are worked out from which the information required to carry through the design of the rectifier transformer may be obtained.—*Radio Review*, February, 1922.

Miscellaneous

International Joint Commission Recommendations.—The detailed plan for the construction of the St. Lawrence ship channel and power development that has been submitted to Congress, together with the recommendations of the commission, are dealt with and the recommendations are enumerated. A final report issued by the commission after a careful study of the situation from every possible angle states that the proposed deep waterway is practicable from both an engineering and an economic standpoint and that it would result in adding very materially to the prosperity of the United States and Canada.—*Canadian Engineer*, Jan. 24, 1922.

New Books

Reviews of the latest contributions to technical, industrial and commercial literature of particular interest to members of the electrical industry.

WITHIN THE ATOM. By John Mills. New York City: D. Van Nostrand Company. 206 pages, illustrated.

As many people are beginning to recognize, it will be through the more intimate knowledge of the electronic construction of matter and the discovery of methods of controlling these electrons that means will be evolved for releasing the world's greatest store of energy and for applying it to useful commercial purposes. In fact, signs point to the fact that electrical developments of the next decade are going to be so closely tied up with electron control that no one who expects to keep abreast of the times can afford to go along without studying what science has discovered so far. To those persons who do not want to delve into the more scientific works on the subject this recent book by Professor Mills may be highly recommended. It deals with an abstruse subject in a most entertaining and instructive manner. Being written in semi-popular form, it can almost be read like a novel, and still it embodies the exactness of a scientific discussion. No previous knowledge of the subject or more than a general knowledge of physics is required to understand it. The author has a happy faculty of presenting word pictures that stick in the mind without any effort on the part of the reader. Starting with the generally accepted conception of the divisibility of all matter into merely positive and negative electrical charges, the author builds up the present theory that all atoms have a positive nucleus surrounded by negative satellites, the only difference between atoms being the number and disposition of the charges. By this means he explains many chemical relations and actions such as the reason why certain elements act like each other, why multivalent elements act with different valences under different conditions, and the electronic phenomena which take place during the disintegration of elements like radium. Alpha, beta and gamma rays become more than Greek terms and radioactive and X-ray phenomena become more understandable. The interpretation of electrical and magnetic phenomena, light, etc., in terms of the electronic theory cannot help to stimulate some imaginative thinking regarding what may be accomplished when all physical manifestations are correlated as to fundamental cause and when electrons are brought under the control of human beings through this knowledge.

SWITCHING EQUIPMENT FOR POWER CONTROL. By Stephen Q. Hayes. New York: McGraw-Hill Book Company, Inc. 454 pages, illustrated.

Information on switchboards and switching equipment can be found in very condensed form in some electrical handbooks, and specific data on definite appliances can usually be obtained from manufacturers, but this book is the first to bring such information within the same covers. Following a description of the various pieces of switchboard and switching equipment, the author successively considers the main connections required in a power plant, switchboard panels of various sorts, construction of breaker and bus structures, and finally the general arrangement of that part of a power plant given over to switching equipment. The chief object of the book is to explain what may be expected of the equipment available, but it should also make it easy to specify equipment that can be easily obtained and will operate satisfactorily. A sequel might profitably be prepared on the factors to take into consideration in installing, operating and maintaining the equipment so that maximum reliability and economy will be attained with the least outlay. The work as it stands is, however, well worth possessing.

COSTRUZIONI ELETTROMECCANICHE. By Prof. Ettore Morelli. Turin: Unione Tipografica-Editrice Torinese. Two volumes; first volume 1,394 pages and tables; second volume 824 pages and tables.

The author, using the theoretical and practical knowledge acquired after many years of teaching in the Royal Polytechnic in Turin and his previous engineering practice in large electrical shops in Europe, has gathered in these two volumes on electromechanics much that will interest engineers, technical directors and designers engaged in manufacturing or in the selection of electrical generators and motors for various applications and uses. The book should also be of assistance to engineers interested in acceptance tests and performance characteristics of electrical apparatus employed in the construction and operation of power plants in public utilities or private industries.

In the first section the author deals with the design, calculation and construction of all the magnetic, electrical and mechanical parts of direct-current generators. This section, while it refers especially and specifically to one class of machinery, is in reality of general importance, as many calculations and processes of construction are common to the principal types of machines. The author gives attention not so much to the construction of the individual machine as to the industrial problem of the manufacture and production in series of a great number of similar machines. On the basis of the broad premises of the section on direct-current generators, the author in the following sections applies similar studies to the other classes of electrical machinery, namely, alternators, transformers, direct-current and alternating-current motors, converters, cascade motor-generator sets, and so forth.

In the last section the author, after having studied the electrical machines *per se*, analyzes the problem of coupling them with machinery. After two chapters on the electrical and mechanical accessories most generally used in practice, Professor Morelli studies first the coupling of different-type generators to hydraulic and thermal prime movers and subsequently the coupling of electrical motors to individual-drive operating machinery as applied to agriculture, mines, transportation, metallurgical industries, paper mills, signals and remote controls, etc. The subject is treated in a clear way that will appeal to technical men. The exposition rests on the basis of modern theory as used in calculating machines and derived from the study of extensive data and designs of machines actually constructed.

DIE SAUGSTRAHL TURBINE. By Dr. Hans Baudisch. 48 pages, 37 illustrations, 16 examples. Leipzig and Vienna: Franz Deuticke.

The booklet covers the theory and the design of the "draft-tube" water turbine, sometimes also called Kaplan turbine.

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

No Lower-Freight-Rate Decision for Week or More

THE decision of the Interstate Commerce Commission in the matter of a general reduction in freight rates, it now appears, will not be forthcoming before April 15. At present the case is being studied by the commissioners individually. If they should find themselves in substantial accord, the decision probably could be handed down as early as April 15, but should there be important differences between them, it obviously will extend the time required for the consideration of the case.

Effort Being Made to Reopen Open-Price Association Case

A REHEARING upon the open-price association practice in trade or a modification of the decree in the hardwood-lumber case to permit of the collection and dissemination of reports on production, sales and stock has been requested of the United States Supreme Court in a petition filed by the American Column & Lumber Company, the defendant in the recent suit in which the court decided the practice to be in violation of the anti-trust law. The lumber interests base their request on an alleged misinterpretation of certain phases of the case and make general denial of the conclusions of the court that the purpose of the practice employed by the lumber interests was to curtail production or enhance prices.

German Patent Convention Not to Be Revived

THE President is understood to be satisfied that it would be unwise to revive the patent convention of 1919 with Germany. The Senate recently authorized the President to revive this patent convention, but it is believed that this action was taken without a thorough understanding on the part of most members that it would exempt German patents taken out in this country from any working clause that might be enacted.

The whole matter of a patent working clause is to be threshed out at once. Senator Stanley of Kentucky has introduced a bill which has been approved by the War Department, and public hearings on the bill have been called for April 5. The salient feature of the Stanley bill is that any patent issued to any person under the provisions of the act shall contain a proviso to the effect that if such patent is not worked so as to result in actual production in the United States of the article patented in reasonable quantities within a reasonable time from the date of its issue, which in no case shall be less than two years or more than five years, the United States reserves the right to issue a license for its manufacture in the United States, and to use and sell the subject matter thereof subject to the conditions provided.

In all probability the definition of a reasonable time will be altered so as to leave it to the discretion of the administrative officer.

Fifteen Billion Dollars of Tax-Exempt Securities Outstanding

TAX-EXEMPT securities to the extent of $15,000,000,000 have been marketed in this country, according to an estimate made by the Secretary of Agriculture in a public speech in Washington April 1. Secretary Wallace was explaining why the Federal Land Bank bonds are tax free.

Bill to Limit Federal Court Jurisdiction Over Commission Rulings Opposed

ALTHOUGH it would seem from the attitude of members of the judiciary committee of the House of Representatives that there is little chance for Representative Bacharach's bill to limit the jurisdiction of federal courts in matters pertaining to state public utility orders, it seems likely that the bill will be vigorously advocated. It is believed that it will make little legislative progress, however, if the opposition to the proposal continues active. A further hearing on the bill will be held April 25. In explaining the object of the legislation, Mr. Bacharach said:

"This bill seeks to amend the judicial code of the United States so as to compel utility corporations dissatisfied with the findings of the state utility commissioners to carry their cases through the courts of the state and then on to the Supreme Court of the United States if necessary. The enactment into law of this bill would not deprive utility companies of any of their just rights, for they have every protection afforded them in the high type of men who compose the membership of the higher courts of the various states."

To enact such a bill as that proposed by Mr. Bacharach would be highly injurious to the public welfare, in the opinion of Everett T. Wheeler, of the jurisprudence and law reform committee of the American Bar Association, who said:

"We often hear criticisms upon the writ of injunction from those who feel its effects, but in my judgment, derived from fifty years' experience at the bar, it is just as beneficial and important for the public welfare as the writ of habeas corpus. It prevents parties from taking the law into their own hands and provides for a continuance of existing conditions until a competent court has adjudicated the rights of the parties."

One of the most able of those who spoke for the bill was Clyde M. Reed, chairman of the Kansas Public Utilities Commission, who said:

"It is not in the interest of public policy for the government to interfere where a body has been created under the state law, for such a body has the benefit of the state laws and the state judicial bodies. If a constitutional question is involved, it can appeal to the Supreme Court of the United States.

"We have had in Kansas during the last eight or ten years a very large volume of litigation over these questions, invoking the state courts and federal courts, and many of these cases have come direct to the Supreme Court of the United States. Usually the state power has been upheld, but there has been a very considerable interference in the meantime by the lower federal courts."

Paul V. Keyser of Des Moines, representing the Investment Bankers' Association of America, said that if the suggested legislation be adopted it will affect very materially the value of securities already issued and outstanding. In addition, it would have a direct and immediate effect upon the credit of the utilities in respect to all additional capital requirements.

William Chamberlain of Cedar Rapids, Iowa, representing utility companies in Iowa, Illinois, Indiana, Michigan and Tennessee, said in part:

"I think that it would be a serious thing to the finances and to the development of the utilities in the entire Middle West to have a law passed which would say to the Eastern investors, after the protection which they have long enjoyed, which the traditions of this government have promised the citizens, and which the constitution has given to the citizens of one state for their investments in another state, that these investors have ceased to enjoy the protection of the federal courts. I think that the result of it would be that in the financing of the utilities in the West you would practically drive away from us many millions of dollars which would otherwise be available for that development."

To Increase Service in Southern Indiana

THE Southern Indiana Gas & Electric Company of Indianapolis has made arrangements to spend between $400,000 and $500,000 this year for improvements, Frank J. Haas, vice-president and general manager, announced recently. The first expenditure will be for equipment to increase the capacity of the electric light plant. Some of the improvements on the program are the installation of a 7,500-kw. turbine, two 500-hp. boilers, new coal and conveying apparatus and a large addition to the Division Street power plant.

Carolina Power & Light Contracts for 20,000 Kw. of Energy

INSTEAD of building at this time a hydro-electric plant on the Pee Dee River, the Carolina Power & Light Company has purchased 20,000 kw. continuous power from the Pallassee Power Company, the plant of the Aluminum Company of America at Badin, N. C. The Aluminum Company has not been running in North Carolina at anywhere near full load for three years, so that there is considerable surplus power available.

The Pallassee Power Company's plant is just above the Carolina Power & Light Company's Swiss Island site, on the Yadkin River.

The Carolina Power & Light Company is going to build 65 miles of double-circuit steel-tower 110,000-volt line to carry this purchased energy. In addition, the company is planning construction of more transmission-line mileage and a number of substations. Expenditures for additions to the Carolina Power & Light Company's system, including that of its subsidiaries, the Yadkin River Power Company and the Palmetto Power & Light Company, are expected to run in the next year or two up to $4,000,000.

Tampa to Put Light and Power Wires Underground

TO remove danger of interruptions of service from high water in the cable house or from fires in the lower downtown district, the Tampa (Fla.) Electric Company is planning to start at once to put the electric light and power wires and cables leading from its east cable house underground, at an expense of approximately $300,000. This is part of the improvements and extensions program for 1922, when $800,000 is to be spent on the electric and street-railway system.

To finance this expenditure stockholders have been asked to meet May 2 to ratify the action of the board increasing the capital stock from $2,879,800 to $3,454,800. The property is under Stone & Webster management.

Ohio Adopts New Overhead Rules

ANNOUNCEMENT is just made by the Public Utilities Commission of Ohio of its adoption on March 6 of a set of rules governing overhead electric lines in situations where such lines cross or more or less parallel the line of a railroad, interurban or other public utility. The rules are divided into nine sections, the first of which consists of "General Rules and Definitions" applicable to all situations within the scope of the entire set of rules. The second, third, fourth and fifth sections are complete detailed specifications covering specific situations. Each of these sections is self-contained and free of cross-reference to other sections. The seventh section consists of a set of general principles or rules governing inductive interference, the eighth being reserved for rules governing lines crossing under railroad tracks. The ninth contains a brief set of rules applicable to the status of construction in existence prior to the adoption of these rules. In addition to the rules proper there are a number of elaborate appendices which contain valuable informational data, carefully prepared to assist in the practical application of the rules in the several sections. The work was prepared through the co-operative endeavor of a general committee, representative of the railroads and public utilities interested, whose report to the commission was the basis of the final rules adopted.

A feature of primary importance which appears throughout these rules is the insistence upon co-operative solution of problems between the parties interested, advance planning and proper notification, so that the public might be served by all with the least total cost consistent with safety and good service.

In the section outlining the "General Scope and Application," there is emphasized the necessity for co-operation and advance planning. The general principles by which both supply and signal companies should be guided in the location of lines on public highways are outlined. This portion of the rules represents an entirely new treatment of the subject and recognizes the rights of both interests concerning occupancy of the highway for their respective services, without drawing any definite restrictive limitations on either class of utility.

Danville Municipal Plant Expands

CONTRACTS totaling $81,098,80 for the installation of additional generating equipment in the Danville (Va.) municipal electric light plant have been authorized by the Council. The General Electric Company will supply a 3,000-kw. turbine at the cost of $42,885 and a motor-generator for $3,816. The Babcock & Wilcox Company will be awarded the contract for boilers for $18,500, and the C. H. Wheeler Company the condensers for $10,000.

Niagara Falls Power to Install Three 70,000 Hp. Units

AUTHORITY to allow an amendment of plans on the part of the Niagara Falls Power Company which will permit the installation of three hydro-electric units of 70,000 hp. capacity each and of one forebay, to replace five proposed units of 37,500 hp. capacity each and two forebays, was granted by the Federal Power Commission at its meeting on March 27.

Michigan Utilities Planning Spring Expansion Programs

WITH the coming of spring considerable expansion and construction is being planned by Michigan electric light and power companies, according to reports from the Michigan Committee on Public Utility Information. Plans to serve the northwestern Michigan towns of Marion, Lake City, McBain, Evart, Tustin, Leroy and Avondale are progressing through the development of a water-power project in Winterfield township, Clare County, to be known as the Winterfield Light & Power Company. Most of the financing has been completed in the communities to receive service. John Perry of Tustin is president of the company, and W. L. Kinney is general manager.

Lake Huron and Saginaw Bay summer resort districts expect to obtain electric power this summer from the Central Power Company of Bad Axe. Its lines now reach to Kinde. The city of Caseville is considering underwriting the construction of an extension to serve itself from Kinde also.

Pontiac is planning to extend its street lighting. City Manager Brower has told the Council that the lights in the business district are too close together and that they could be "staggered" by removing about thirty-five of them, which he would place on other streets.

Reports from Ludington state that the new power plant of the Stearns Lighting & Power Company, to cost $250,000, is going up rapidly.

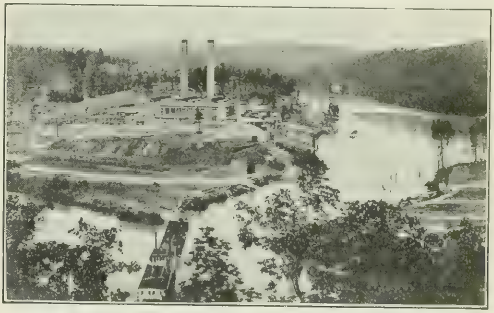
Installation of the hundred-thousand-dollar addition to the Citizens' Light & Power Company's plant of Adrian is well under way. The capacity of the plant will be doubled when the 2,000-kw.-installation is complete. Alpena officials are negotiating with the Alpena Power Company for service to operate the municipal waterworks and to light the streets.

Deadlock in Congress Over Muscle Shoals

HENRY FORD'S offer for Muscle Shoals has "blown up," as the result of the visit of inspection made by members of the Senate committee on agriculture and the House committee on military affairs to the government's one-hundred-and-six-million-dollar war-time nitrate projects in Alabama and the hydro-electric projects on the Tennessee River in connection with the partly completed Wilson Dam and other proposed dams.

This information is furnished to the ELECTRICAL WORLD by a special correspondent who has been traveling with the Senators and Representatives who went to Alabama and Tennessee to inspect the projects in connection with Mr. Ford's offer to purchase for $5,000,000; the Alabama Power Company's offer to lease and complete the Wilson Dam at its own expense; the Engstrum offer to construct on a cost-plus basis for the government, and the last offer, made by Charles L. Parsons, to produce chemicals with the first 100,000 secondary horsepower, in case that became available under any plan worked out by Congress.

Chairman Kahn of the House military affairs committee had a conference on Wednesday with President Harding at the White House in order, if possible, to decide upon a policy in regard to the development of Muscle Shoals. Mr. Kahn said, after his conference with the President, that he would not press the idea he had previously suggested for a Muscle Shoals commission consisting of the Secretaries of War, Agriculture and the Treasury. Mr. Kahn's view of the President's position was also that no legislation could possibly come out of the House military affairs committee satisfactory to the President which would involve handing the whole problem to him. In other words, the President thought that the House military affairs committee ought to do its own work rather than to bring its problems down Pennsylvania Avenue.



GORGAS STEAM DEVELOPMENT ON WARRIOR RIVER

Right-hand portion belongs to the Alabama Power Company and left-hand part to the government.

It is understood that the President expects the House military affairs committee and the Senate committee on agriculture to require the presence personally of Henry Ford so that he may state to the people of the country just exactly what his intentions are in regard to Muscle Shoals, concerning which there is much doubt and fog in the minds of the legislators charged with the problem of the Muscle Shoals development.

Senator Norris, chairman of the Senate committee, in an interview granted the correspondent of the ELECTRICAL WORLD, stated that there is not sufficient time at the present session of Congress for the Senate to dispose of the great mass of other unfinished business and at the same time pass on the merits of the Ford offer or that of the Alabama Power Company or any other offer. In these circumstances, in view of the fact that three years' time will be necessary in any case to complete the Wilson Dam before Mr. Ford or any other agency can obtain cheap water power with which to manufacture fertilizer or anything else useful in peace time and at peace-time costs, Senator Norris brought to the attention of his colleagues on the trip, receiving their support, a plan to have the government appropriate $7,500,000 to continue the work of building the Wilson Dam for a year, installing at the power house there the four units already on the ground and nearly all paid for by the government, which are planned to produce 120,000 kw. By the time that work is done, Senator Norris said, Congress would reach a decision on what to do with the nitrate and steam-power plants and how to administer the power from the Wilson Dam when it is ready.

On the other hand, members of the House committee on military affairs express their unalterable opposition to appropriating another dollar to go into the investment until it is decided in advance what is to become of the projects. The House has four times refused to appropriate money to continue work at Muscle Shoals.

This means a deadlock in Congress at this session, and members of the Senate and House committees are dubious whether anything will be done before the next session in December.

IMPOSSIBLE TO SEPARATE GORGAS PLANTS

Senators and members of the house in the inspection party were almost unanimously agreed that it is impossible to separate the plants of the Alabama Power Company and the government at the Gorgas development of the power company on the Warrior River. "You cannot unscramble these eggs," as Senator Norris expressed it, and when Chairman Kahn of the House military affairs committee was informed of this statement by Chairman Norris he added: "You can not only not unscramble the eggs in connection with the Gorgas plant, but it is impossible for any committee of Congress to resolve the legal difficulties in the way in connection with Nitrate Plant No. 2, which the Air Nitrates Corporation has an option to purchase just as the Alabama Power Company has an option to purchase the government's interest in its Gorgas plant."

Senator William B. McKinley of Illinois, himself a public utility man, has recently been appointed to the Senate committee on agriculture, in place of Senator Kenyon of Iowa. He was a member of the inspection party, and the Senators and Representatives had the benefit of his advice and information. Commenting for the ELECTRICAL WORLD on one feature of Mr. Ford's offer for the various plants and water-power rights at Muscle Shoals, Senator McKinley made this statement:

"In my opinion the steam plant at Sheffield, which was designed to furnish power for Nitrate Plant No. 2, now under lease as a stand-by plant to the Alabama Power Company, is worth $6,000,000 as a going concern today; the government's interest in the Gorgas plant is worth $3,000,000 of anybody's money as a going concern today; the transmission line of 88 miles from Gorgas to the nitrate plant is worth $1,000,000 of anybody's money. Here is property in these three items alone worth $10,000,000, and Mr. Ford is offering but $5,000,000 for everything that cost the government $106,000,000, to say nothing of the water-power rights in perpetuity.

"While ten or twelve years ago I should have frowned on the idea of the government going into this and completing these or any part of these projects," Senator McKinley said, "the state of the art has advanced so rapidly in recent years, it being now possible to send energy so many miles farther than ever before—possibly over a radius soon of 600 miles from Muscle Shoals—benefiting so many communities and giving cheap power to so many industries, that I think I should be willing to vote for Senator Norris' plan to have the government appropriate to complete the Wilson Dam, and possibly Dam No. 2, and at least install the four units on the ground to generate the 120,000 kw., while in the meantime we work on the many problems involved in the future of the Muscle Shoals development."

Senator McKinley stated that if Mr. Ford would make a fair offer he would not be against turning over the Muscle Shoals projects to him. He does not think that Mr. Ford has made a fair offer, and that point of view was expressed by many Senators and Representatives who were impressed with the great scope of the projects.

Would Investigate Radio Manufacturing Control

A RESOLUTION has been introduced into the House of Representatives calling on the Attorney-General to investigate and report charges that the General Electric Company, the Westinghouse Electric & Manufacturing Company; the American Telephone & Telegraph Company and the United Fruit Company have combined with the Radio Corporation of America for control of the manufacture and sale of radio equipment and regional rights emanating out of various patents.

The Radio Corporation of America is cited in the resolution for limiting supplies by various methods to hundreds of thousands of amateur users of wireless apparatus and for causing for the benefit of itself and its agencies not only unreasonably high prices for radio equipment but also a scarcity of parts. Although the demand for radio tubes cannot be accommodated even at extortionate prices, it is stated, both the Navy and the War Department have on hand more than 300,000 receiving tubes and large quantities of transmitting tubes, headsets, receiving sets, etc., as war surplus material, which the government is anxious to sell at half the wholesale price of the Radio Corporation but cannot sell or even give away because of an agreement with the American Telephone & Telegraph Company or other agencies promoting the monopoly. The cross-licensing of patent rights and the combination of the various interests, centering in the Radio Corporation of America, is held to be a conspiracy in restraint of trade.

Electric Rates at Washington Reduced

THE Public Utilities Commission of the District of Columbia has directed a reduction of 5 per cent in the rate of the Potomac Electric Power Company for electricity to Washington consumers. The reduction became effective April 1, but the consumers will not receive immediate benefit as court proceedings are pending regarding the valuation of the company. Previous to the final decision in this matter the old rate of 10 cents per kilowatt-hour will be collected and the difference between it and the lower rate since established will be impounded.

New York Edison Holds Second Annual Electric Vehicle Show

ENTHUSIASM and optimism marked the opening on Monday of this week of the second annual electric vehicle show conducted under the auspices of the New York Edison Company in its main showroom. As was the case last year, the show is to last two weeks, the first week having been devoted to road trucks and pleasure vehicles and the second to be devoted to industrial trucks and trailers. Accessories have been on exhibit this week and will be next. Evidence of the growing interest in secondary transportation by electrically propelled vehicles was given by the attendance at luncheon on Tuesday at the Hotel Astor, which brought out between four and five hundred people.

Arthur Williams, general commercial manager of the New York Edison Company, presided. He paid tribute not only to the electric vehicle industry but to Charles R. Skinner, manager of the company's vehicle bureau, to whose efforts the success of the show was attributed. The speakers at the luncheon were E. M. Cowie, vice-president of the American Electric Railway Express Company, the largest operators of electric trucks in the United States; F. H. Hotchkiss, who read a paper by Gerson Marks, assistant to the general manager of the New York, New Haven & Hartford Railroad, and J. E. Dann, president of the Pilgrim Laundry of Brooklyn. All the speakers bore testimony to the efficiency and economy of operation of the electric vehicle and foresaw a bright future for this means of secondary transportation.

"The electric vehicle," said Mr. Cowie, "is very dependable and its costs are reasonable. Replacement costs are less than for the gas truck; of far greater importance, however, is its smaller record of accidents and personal injuries in congested traffic than for any other kind of transportation. The 'electric' has all the speed consistent with safety and traffic regulations, while its upkeep is but 50 per cent that of the gas car. Gradually the electric truck is pushing the gas truck out into the long suburban hauls, while reserving the city transportation for itself."

Trucks and trailers for railroad freight terminal hauling were shown by Mr. Marks to be more economical in man-hours and more efficient in tons of material moved by from 50 to 100 per cent than manual trucking. He gave a number of operating figures.

Mr. Dann, who uses thirty-four electric trucks in laundry delivery service, gave as the monthly operating and maintenance expense, excluding depreciation, $20.39 per truck.

The exhibits at the first week of the show included a number of new cars and also the oldest "electric" in existence. The list of electrical exhibitors is as follows:

Pleasure cars: Detroit Car Company, Rauch & Lang, Inc.

Road trucks: Commercial Truck Company, Lansden Company, Inc.; O. B. Electric Vehicle, Inc.; Steinmetz Electric Motor Car Corporation, Walker Vehicle Company, Walter Motor Car Company.

Taxi cabs: Electrocar Corporation.

Storage batteries: Edison Storage Battery Company, Electric Storage Battery Company, General Lead Battery Company, K. W. Battery Company, Philadelphia Storage Battery Company.

Accessories: A. & J. M. Anderson Manufacturing Company, Allen-Bradley Company, Auto Electric Device Corporation, Corte Engineering Company, Cutler-Hammer Manufacturing Company, Electric Products Company, General Electric Company, Westinghouse Electric & Manufacturing Company, Sangamo Electric Company, Service Recorder Company.

General Electric Wins Another Injunction in Lamp-Patent Suits

THE Continental Lamp Works, Inc., 532 West Twenty-second Street, and the United Lamp Manufacturers Corporation, 44 West Eighteenth Street, New York, have been enjoined from manufacturing vacuum tungsten and gas-filled tungsten lamps, covered by the Langmuir and the Just and Hannaman patents, pending settlement of litigation, by the United States Circuit Court of Appeals on a petition filed by the General Electric Company. The Continental Lamp Works, Inc., were organized in February, 1920, and, it is alleged, have been manufacturing without license from the General Electric Company lamps of the gas-filled tungsten type, covered by the Langmuir patent, the property of the General Electric Company. The

SECOND ANNUAL ELECTRIC VEHICLE LUNCHEON ATTENDED BY MORE THAN FOUR HUNDRED PEOPLE

United Lamp Manufacturers Corporation was organized in July, 1921, and is said to be a consolidation of companies not licensed to use the patent in suit. It sells vacuum tungsten and vacuum carbon lamps.

As a defence the appellees adduced the act of the General Electric Company in selling to them lamp bases such as are used on lamps of the Langmuir type and thus impliedly granting a license to use the patent in question. The appellant showed that the contract of sale provided unmistakably that the sale of these bases conferred no license under any patents of the General Electric Company. The court below had sustained the contention of an implied license and had refused an injunction. However, the appellate division found the bases to have been a standard article of manufacture for a number of years before the Langmuir patent was granted. The General Electric Company stated that it had sold the bases only because of a desire to avoid certain unfair trade practices complained of by the government in 1911. In conclusion, the court stated there was nothing in the language or conduct of the appellant to justify the appellees in using the patented lamp with these bases and granted the injunction pending settlement of the suit.

Philadelphia Electric Reduces Rates

ANNOUNCEMENT was made last week by Joseph B. McCall, president of the Philadelphia Electric Company, of a reduction in rates, effective May 1, which will mean a saving to consumers of more than $1,000,000 annually. Residence and retail lighting rates will be cut from 9 cents-hour to 8 cents per kilowatt-hour maximum; retail power service from 8½ cents to 7½ cents per kilowatt-hour, maximum, and wholesale light and power service from 9 cents to 8 cents per kilowatt-hour for the first 500 kw.-hr. and from 7½ to 7 cents per kilowatt-hour for the next 1,000 kw.-hr. per month. The other schedules, which involve large users of power for industries, utility, railroad and other purposes are reduced by 1 mill per kilowatt-hour.

Mr. McCall, in discussing the reduction in rates and explaining its meaning, said:

> This reduction, at the rate of more than a million dollars per annum, to our customers in this territory is approximately 5 per cent of the total bills written, the percentage varying with different schedules and depending upon the class of service. Putting it another way, this reduction really means an amount equivalent to 20 per cent of the net income of the Philadelphia Electric Company system.
>
> Customers who are obtaining service under schedules of our tariff in which the coal clause is incorporated are now receiving and will receive, in addition to the 1 mill reduction, the benefits of lower prices for coal.
>
> We are making the reduction because of our expectation of increased business during the rest of the year, the first three months of the year indicating that such an expectation is reasonable. In making this reduction we feel that this is the time to introduce the element of lower costs in production, in the belief that it may serve as a real stimulus for the industrial revival which should be hopefully anticipated by every one.
>
> We have always shared our prosperity with the community which we serve, and we have always reduced our rates where such a reduction was possible without prejudicing the character of service we aim to furnish or our ability to finance additions to and extensions of our plants made continually necessary to meet the demands of such an industrial territory as Philadelphia and Delaware Counties. Making this reduction at the present time is a source of great gratification to us.

North American Company Acquires Interest in Cleveland Electric

NEGOTIATIONS have been concluded by the North American Edison Company, a new subsidiary of the North American Company, for the purchase by the former of the $7,763,500 common stock of the Cleveland Electric Illuminating Company, about 75 per cent of which was held by the Central States Electric Corporation.

In exchange for its holdings in Cleveland Electric Illuminating the Central States Electric is to receive $3,000,000, par value, or 60,000 shares of North American 6 per cent preferred stock and cash sufficient to pay off its $5,963,500 ten-year 5 per cent notes due June 1, 1922, besides a substantial cash balance available for purchase of new securities. It is understood that additional stock of the Cleveland Electric Illuminating Company will be acquired by the Central States Electric Corporation.

The North American Edison Company will have a capital of 200,000 shares, no par value, all owned by the North American Company. The new company will also take over all the outstanding common stock of the Union Electric Light & Power Company of St. Louis, which has heretofore been owned by the North American Company.

The new company has just sold an issue of $14,000,000 thirty-year secured sinking fund 6 per cent bonds, the proceeds of which will furnish the necessary cash financing in acquiring Central States holdings in Cleveland Electric as well as to pay off its notes.

S. E. D. Publication Schedule

A DEFINITE publication schedule of business-building aids and educational material for public distribution which the Society for Electrical Development has undertaken to produce and distribute during the next few weeks has just been announced. These booklets and monographs, which are being prepared by the staff of the Society, are in addition to "Do It Electrically," the monthly publication of the society. The announced schedule is as follows:

April 17.—"Editorial Suggestion Service," promoting good will for public utilities; distributed to newspapers and central stations.

April 20.—"Building Housewiring Business," a monograph giving details of how to obtain housewiring business.

April 20.—Sales helps for use in obtaining housewiring business, "ad" cuts, slides, letters, window displays, etc.

April 20.—"Why Is an Outlet?" a pamphlet for distribution to the public, promoting the idea of convenience outlets; first issued by the S. E. D. in 1918, revised and improved for 1922 use.

April 27.—"Partial Payment Plans," a monograph giving details of plans of time-payment financing.

May 2.—"Customers Versus Population," for Canada, showing percentage of wired homes in Canada.

May 5.—"Adequate Wiring Folder," a small folder for public distribution.

May 10.—"Appliance Selling Suggestions," a monograph of procedure, with details of successful campaigns.

May 15—"Editorial Suggestion Service to Newspapers and Central Stations."

June 5.—"Home Electrical Plans," a monograph on how to organize and conduct an "electrical home."

June 5.—Booklet for distribution to visitors at electrical homes.

June 15.—"Useful Information for Architects," revision of previous society publication.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Another Municipal Plant Gives Up.—The taxpayers of the village of Clifton Springs, N. Y., have voted to sell the municipal electric light plant to the Empire Gas & Electric Company for $15,000.

Cost of Electrification in Norway.—Short stretches of two Norwegian railway lines are to be electrified, according to reports to the Department of Commerce. Electrification planned on the Ostensjo line will cost $125,000 per kilometer, it is estimated, and work on the Sognsvand line $122,000.

New Orleans Company to Have New Power House.—Receiver O'Keefe of the New Orleans Railway & Light Company has, it is announced, effected arrangements with the security holders of the company for an extension of $1,100,000 in receiver's certificates, which will fall due April 1, 1922, and for the issuance of an additional $1,000,000 of certificates for a new power house and other improvements, including the installation of a 20,000-kw. generator and a new electrical distribution system.

Lafayette (Ind.) Plant Sold to Indiana Northern.—The Indiana Public Service Commission has authorized the Indiana Northern Gas & Electric Company to acquire the steam-electric generating plant of the Lafayette Service Company at Lafayette. The Indiana Gas & Electric Company bid in the plant at a chancery sale for $120,000. The commission in authorizing the acquisition of the property said it would not recognize the purchase price as a rate-making base, the property being probably worth more than what was paid for it.

Continental Electric Moves to Omaha.—The executive offices of the Continental Gas & Electric Corporation, formerly at Cleveland, Ohio, will be moved in the near future to Omaha, Neb. This company now operates electric light, gas, steam-heat and ice plants in more than 100 towns within a radius of 100 miles of Omaha. It has let a contract to the Henningson Engineering Company of Omaha for the construction of 150 miles of new transmission lines in Nebraska. This company now has 430 miles of transmission line, serving sixty-five towns, which are connected with the Nebraska Power Company's system. According to Vice-President Harvey, electrical service is given to 32,500 people and, although the company is only ten years old, there are 1,100 stockholders in Mr. Harvey's own territory.

France Plans High Dam.—A 340-ft. dam is one of the features of the scheme of hydro-electric development of central France backed by capitalists of that region and likely to receive government approval, according to a correspondent of the New York *Times*. The project comprises in all the construction of four dams, of which the one referred to would be the highest, and four electrical plants, at the estimated cost of 400,000,000 francs. The great dam would form a reservoir covering 404 acres, including the sites of eight towns. The plant at the base would be equipped to generate 150,000 hp.

Keeping in Touch with Air Expresses by Radio.—A device has been installed in the air-traffic control tower at the London air station consisting of an extension line from the wireless station so arranged that the wireless operator can "plug" the air-traffic controller through on the wireless telephone and thus reach an air express flying between London and the coast. As soon as machines are in the air the controller is able to get into communication with them on the wireless extension. He can also guide the planes down to earth even if the whole district is shrouded in mist or fog. The photo shows the controller speaking by wireless telephone from the lofty control tower to an approaching airplane.

—From Wide World Photos

Utility Company to Distribute Hydro-Electric Energy at Halifax, N. S.—The Nova Scotia Tramway & Power Company has entered into a contract with the Nova Scotia Water Power Commission whereby the public utility company is to have entire charge of the distribution of the hydro-electric power developed at St. Margaret's Bay. The contract is for a period of thirty years. The distribution of this power has long been a subject of contention, and there was strong support for a plan whereby the Halifax City Council would undertake the distribution. The contract provides that up to 18,000,000 kw.-hr. annually is to be delivered at the tramway's power station in Halifax at cost. The tramway company in turn must sell power to the city government at actual cost. Power for private use is to be sold at rates approved by the Public Utilities Board. The distribution of this new power for private use in Halifax and vicinity will begin in May.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

National Electric Credit Association.—This association will meet at Detroit on Thursday and Friday, May 18 and 19.

Canadian Electrical Association.—The thirty-second annual convention of this association will be held in Ottawa, Ontario, on June 15 to 17, at the Chateau Laurier.

International Association of Municipal Electricians.—Preliminary arrangements for a four-day convention this summer of the International Association of Municipal Electricians at New Bedford, Mass., are being made under the direction of William P. Briggs, New Bedford, chairman committee on arrangements. Meetings are scheduled for Aug. 22 to Aug. 25.

Safety Switch Congresses.—The success of the first safety switch congress, held in Pittsburgh on Jan. 21 last, has stimulated interest in the other displays to be held in the various sections of the Association of Iron and Steel Electrical Engineers. On April 8 there will be a safety switch congress at the Hotel Statler, Cleveland, from 1 p.m. to 8 p.m., followed by a technical session, and on April 22 a similar meeting will be held in the Atlantic Hotel, Chicago.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Cleveland, April 10; Pittsburgh, April 15 and 22; Philadelphia, April 18.
A. I. E. E. Spring Convention—Chicago, April 19-21.
Tri-State Water and Light Association—Spartanburg, S. C., April 19-21.
American Physical Society—Washington, April 22.
American Electrochemical Society—Baltimore, April 27-29.
Missouri Association of Public Utilities—Columbia, Mo., May 4-6.
A. S. M. E. Spring Meeting—Atlanta, May 8-11.
Florida Engineering Society—Daytona, Fla., May 15-16.
N. E. L. A. Annual Convention—Atlantic City, May 15-19.
National Electric Credit Association—Detroit, May 18-19.
Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.
N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15.
Electric Power Club—Hot Springs, Va., June 5-7.
Canadian Electrical Association—Ottawa, Ont., June 15-17.
Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.
American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.
A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.
American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.
Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Service Must Not Be Abandoned.—The Oklahoma Corporation Commission has refused to permit the abandonment of service to sixteen customers of a gas company, this service being rendered at a heavy loss. The commission found the service mains to be in leaky condition and ordered repairs to be made, which it held would reduce the loss to a reasonable amount.

Equalizing Cost of Service.—An equal distribution of the cost of maintaining line service is sought through an order of the Oklahoma Corporation Commission, which affects electric rates in ten towns and adjacent oil fields served by the Oklahoma Gas & Electric Company. The order does not increase rates in these towns as a whole, but readjusts them so as to make the rates uniform in all the places served, the commission finding that some communities were not bearing their just share of the cost of maintaining service.

Companies Must Present Complete Case.—Officers of a public utility seeking increased rates should, the Nebraska State Railway Commission has announced, state definitely their conclusions as to the company's needs or as to the rate schedule which they regard as necessary for the future, together with supporting data. "It is not the commission's task to assume management of the internal affairs of the company," the announcement says, "determine questions of policy and reach conclusions as to rate schedules which are necessary. This is the company's responsibility, and while the commission is entirely willing to confer upon problems of the moment, it refuses to have delegated to it duties which are so obtrusively and manifestly the company's."

Ratio of Capital Expenditure to Revenue in Service Extension.—The Idaho Public Utilities Commission, which purposes to frame a comprehensive rule governing service extensions when its valuation of the Idaho Power Company for rate making shall be completed, has in the meantime ordered that the company shall be required to make an immediate capital expenditure for each new customer in an amount not exceeding twice the estimated annual revenue from such customer. Under the existing rule the company has been required to spend only the amount of the estimated annual revenue, any further expenditure requisite to service having to be advanced by the customer. "An extension rule," the commission observes, "not only requires the utility to make extensions in all proper cases, but is also a necessary means of protection for those who already have the service. Unreasonable and excessive investment for the benefit of new customers, if permitted, would adversely affect the rates of the old customers."

Abandonment of Unprofitable Territory Without Commission's Consent Forbidden.—The Public Service Commission of Pennsylvania has refused to allow the United Natural Gas Company to cease to supply a certain part of its territory. The company pleaded that this power had been lodged in natural-gas companies for thirty-six years. The commission holds that natural-gas companies are in the same relationship to it as all other public utilities and that its consent is a prerequisite to any curtailment or enlargement of territory. More than 600 consumers, the commission pointed out, who had equipped their premises for the use of natural gas on the implied assurance that they could depend upon its continued supply would be deprived of service were the proposed abandonment to be authorized.

Dilemma Presented by Rural Rates in Overbuilt Territory.—In an order reducing the rates of the Molalla Electric Company the Oregon Public Service Commission said: "It seldom becomes the duty of a commission to consider a problem where the conditions are more unfavorable for the establishment of rates to yield an adequate return than in the present instance. The evidence in this case shows that the company's system is largely overbuilt in the rural communities and embraces large areas of sparsely settled territory. The burden resulting from such improvident capital investment must fall upon the company and not upon the consumers generally. The commission realizes that the rural rates now effective do not provide an adequate return. However, a rate must not exceed the value of the service."

Confiscatory Rates Not Justifiable Because of Post-War Readjustments.—Declaring that public utilities cannot be required to accept confiscatory rates during the post-war price-readjustment period, the Utah Public Utilities Commission, in fixing rates for the Telluride Power Company, said also that it would be unfair to future customers of the utility to make rates too low to permit of the renewal and replacement of property, since this would mean that the present class of customers would escape a just obligation and that the burden of continuing the plant would be thrust upon future consumers. A public utility, moreover, should be allowed a return sufficient to enable it to compete for money for investment in extensions; but an electric company must forego a full return upon new property constructed in sparsely settled districts, although consumers in these districts cannot expect that service can be rendered them at a rate comparable with rates effective in centers of population.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Supreme Court of United States Upholds Pennsylvania Commission.—A contest waged by the borough of Edgewood, Pittsburgh, Pa., against the Public Service Commission of Pennsylvania and involving the power of the commission to annul a contract made by the borough has been decided by the United States Supreme Court in favor of the commission.

Commissions Bound by Definitions in Statutes Creating Them.—Contending that to every word, phrase, clause and sentence in a statute must be given a meaning, if it is possible to do so, and that it is competent for a legislative body to adopt restrictive definitions if it chooses to do so, the Supreme Court of Montana has found (State ex rel. Thacher vs. Boyle) that an irrigation company is not a public utility subject to the jurisdiction of the Public Service Commission of that state in the meaning of the law creating the commission. (204 Pac. 378.)*

Powers of Commission and of Municipalities in Ohio.—Reversing an order of the Public Utilities Commission of Ohio fixing telephone rates in the city of Columbus, in a suit brought by that city against the commission, the Ohio Supreme Court found that, although the commission, in approving a telephone merger, could require as a condition a reduction in rates, it could not bind a city not a party to the consolidation proceedings to an increase over the maximum fixed by contract between the city and one of the companies, the Ohio Public Utilities Commission not being authorized to change a contract rate. (133 N. E. 800.)

Party Participating in Inquiry Cannot Complain of Lack of Notice.—The Public Service Commission of West Virginia is not, the Supreme Court of Appeals of that state has determined, in Baltimore & Ohio Railroad Company vs. Commission, confined to the immediate scope of the pleading, and where the party whose interests were affected was before the commission, participated in the inquiry and made full defense, it is not entitled to complain of lack of notice or departure from the pleadings. An enforced discharge by a railroad company of its duty to provide reasonably adequate facilities for serving the public does not, the court further held, violate the Fourteenth Amendment merely because it is attended with some expense. (110 S. E. 475.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Edward B. Craft has been appointed chief engineer of the Western Electric Company. A prominent figure among the younger generation of America's electrical engineers and a leader in the development of the telephone and telegraph systems of the United States, Mr. Craft in his new capacity will direct the efforts of more than 2,820 engineers. Mr. Craft joined the Western Electric Company twenty years ago as a development engineer, and more than sixty patents on telephone apparatus have been granted to him. In 1917 he became assistant chief engineer in charge of development and design, playing an important part in the design of the so-called mechanical switching telephone-exchange system. In 1917 he was commissioned captain in the Signal Officers' Reserve Corps and was assigned to the consulting engineering division of the Signal Corps, being soon afterward promoted to the rank of major. In the summer of 1918 he was sent abroad on behalf of the Bureau of Steam Engineering of the navy to carry on consulting engineering work in connection with radio communication. Mr. Craft's new appointment is the result of a reorganization of the administrative department of the Western Electric Company. Dr. F. B. Jewett, vice-president of the company, who preceded Mr. Craft as chief engineer, is now in charge of the telephone department, which includes the engineering, telephone sales and manufacturing departments.

E. B. CRAFT

F. M. Mason, chief engineer of the Central Maine Power Company, was elected president of the Maine Association of Engineers at its annual meeting, recently held in Augusta. Mr. Mason is a graduate of Rensselaer Polytechnic Institute and for the past fifteen years has been connected with some of the largest power developments in the State of Maine. One of his most recent engineering accomplishments was the completion of the North Channel Dam at Skowhegan, which is considered one of the finest dams in New England. Mr. Mason is a member of nearly all the national engineering societies.

F. D. Emory has been promoted to superintendent of operation and maintenance of the British Columbia & Alberta Power Company, Ltd., and assumed his duties on Feb. 1. Mr. Emory comes to his new position after some thirteen years of experience in the operation of various public utilities in Canada. He began in 1909, when he became connected with the Winnipeg (Man.) Electric Railway Company in the construction and operation of its hydro-electric plant at Lac du Bonnet. After a year of such work he entered the Bliss Electrical School in Washington, D. C., and was graduated in 1911. Following six months of construction work on the Pacific Coast, he spent about two years with the engineering department of the Canadian Westinghouse Company. In 1913 he was appointed assistant superintendent of the Northern Ontario Light & Power Company and was later assistant manager of the Winnipeg offices of the Fenanto Electrical Company of Canada. He was city electrician and engineer of Kaslo, British Columbia, from 1915 to 1918, after which he entered the employ of the Electricity and Gas Inspection Services of the Dominion of Canada in the Nelson district as district inspector.

Lyle A. Whitsit, formerly of the engineering staff of the Superpower Survey as principal assistant in the division of power and transmission, has recently been appointed to a position with the Adirondack Power & Light Corporation of Amsterdam, N. Y. He will make various studies relative to load and operating conditions and proposed extensions of generating and transmission equipment. Mr. Whitsit is a graduate of Michigan University and after graduation spent four years in structural steel work and design. He then entered the employ of the Aluminum Company of America as resident electrical engineer on the Massena (N. Y.) power development. Subsequently he served in an administrative capacity as district engineer of the United States Forest Service on water-power development, and still later as captain of engineers on the War Industries Board. This work consisted of a study of the economic and operating advantages of the interconnection of electric power systems in western Pennsylvania and eastern Ohio and in the Southeastern States. After the war Mr. Whitsit was sent to Japan by the Aluminum Company of America to make power studies. His work on the interconnection of power systems was continued in the Superpower Survey.

Herman Russell, general manager of the Rochester Gas & Electric Corporation, was elected a vice-president of the company at a meeting of the board of directors held on Feb. 14. Mr. Russell comes to his new position after some twenty years' experience in the operation of public utilities, and his latest advancement is the logical recognition of managerial ability of a high order. He was born in Manistee, Mich., in 1878, and was graduated from the University of Michigan in 1898, taking a post-graduate course in chemistry and gas engineering, for which he received a master's degree in 1900. After leaving college Mr. Russell immediately entered public utility work in the employ of the Detroit Gas Company, and in 1902 he was promoted to become assistant superintendent of that company. This position formed a stepping stone to that of superintendent of the gas-manufacturing department of the San Francisco Gas & Electric Company, a position which he filled from 1903 to 1904. The Gas & Electric Company of Cincinnati appointed him assistant superintendent of gas manufacture in 1904, after which he became connected with the Rochester Railway & Light Company as assistant superintendent of gas works, and in 1906 he was made superintendent of gas manufacture for that company. With the increasing growth of the company and the consequent need for expansion in the management, Mr. Russell was again promoted and became assistant general manager in 1914, from which position he was advanced to that of general manager of the company in February, 1919.

HERMAN RUSSELL

J. D. A. Cross, until recently manager of the appliance sales department of the Edison Electric Appliance Company, is now vice-president in charge of sales of the Rutenber Electric Company, Marion, Ind. Mr. Cross has been connected with the General Electric Company and its subsidiaries for the past twenty-six years, starting in Schenectady in a clerical position. Later he was transferred to Chicago and covered the territory of Indiana, Illinois and Iowa as general supply salesman until 1907. At that time he was made heating-device specialist for the entire Chicago district. In 1916 he was put in charge of the heating-device sales department of the General Electric Company, with headquarters at Pittsfield, Mass., and when the Edison Electric Appliance Company was formed on Jan. 1, 1918, was made manager of the appliance sales department of that company.

J. D. A. CROSS

W. A. Bersch, comptroller of the S. F. Bowser Company, Inc., Fort Wayne, Ind., has recently been elected a member of the board of directors of that company.

Reginald M. Campbell, formerly with the Habirshaw Electric Cable Company, has become a member of the sales organization of the American Copper Products Corporation, New York, and will have his headquarters at the New York office of the company.

Horace F. Kite has been appointed by the Incandescent Supply Company to manage its St. Louis jobbing house, now being opened. Mr. Kite, originally from Norristown, Pa., has devoted virtually all of his business life to sales work. At first he was city salesman for the New York office of the American Brass & Copper Company, and later he was manager of its Chicago office. In November, 1921, he resigned to become connected with the Incandescent company, and he received the new appointment about a month ago. In this capacity he will direct the sales of the company in the entire Southwest territory.

H. J. Grosvenor has been appointed secretary-treasurer of S. F. Bowser & Company, Inc., Fort Wayne, Ind. Mr. Grosvenor has been with the company twenty-one years, starting as bookkeeper.

Noel Cunningham, formerly connected with the Coal Washing Equipment Company, has become associated with the Hardinge Company, New York City, and will take charge of the new department created by the acquisition by the Hardinge Company of the manufacturing and sales rights of the James coal-washing equipment.

T. K. Quinn, formerly manager of the credit department of the National Lamp Works of the General Electric Company, has been appointed manager of the miniature-lamp sales department, succeeding P. F. Bauder, who resigned that position on account of ill health but is still with the company. Mr. Quinn will continue to supervise the activities of the credit department. He joined the National Lamp Works organization in 1911 with the Cleveland Miniature Lamp Factory. Two years later he entered the large lamp sales department and in 1915 joined the credit department. He became manager of this department in 1917.

Victor M. Arana has recently been made chief engineer of the Empresa de Trabajos Electricos, a newly organized commercial, manufacturing and contracting firm, Casilla del Correo 64, Lima, Peru. Mr. Arana was graduated in electrical engineering at the University of Notre Dame, in 1904. After spending nearly two years as draftsman for the Buffalo Forge Company, the Babcock & Wilcox Company and also as instructor in electrical engineering at the University of Maine, he sailed for Peru, where he has been established ever since. In 1911 he was appointed head of the electrical department in the National School of Arts and Crafts and subsequently chief engineer and commissioner of public services for that country. After spending about eight years in the above positions, where he organized and directed these institutions on modern lines with American standards, he decided to open a consulting and contracting office in Lima. In the last three years he has exerted a powerful influence in behalf of the American importers, helping to counteract the long-established hold of German electrical interests. The new electrical organization to which Mr. Arana will devote his main energy is a general importing, manufacturing and contracting firm. He will also give much of his time to association and editorial activities. He has held the position of main editor of the bulletin of the Sociedad de Ingenieros, the representative engineering publication of Peru. Mr. Arana, who in 1912 became an associate of the American Institute of Electrical Engineers and in 1919 was transferred to the grade of member, is now actively organizing an American electrical club

Charles H. Talmage, who has been field secretary to the Rocky Mountain Electrical Co-operative League for the past six months, has resigned that position to return to the Western Electric Company as manager of the Omaha branch. His successor has not yet been appointed. Mr. Talmage has been in the electrical field more than twenty-three years. He was born on an Iowa farm in 1875, and his first electrical association was in 1898, when he joined the Advance Electric Company of Indianapolis as treasurer. In 1901 he resigned to become associated with the Western Electric Company as traveling salesman, covering the Illinois territory and later taking a desk in the Chicago office. In 1904 he was transferred to the Kansas City office of the Western Electric Company, where he acted as sales manager until 1917, when he was promoted to be manager of the company's Salt Lake City office. In the summer of 1921, after having completed twenty years of service with the Western Electric Company, he accepted the position he has just resigned.

C. H. TALMAGE

D. G. Milligan, formerly treasurer of S. F. Bowser & Company, Inc., Fort Wayne, Ind., has been appointed director of foreign sales.

P. S. Richter, superintendent of several departments of the Yale & Towne Manufacturing Company, Stamford, Conn., will also have charge of the industrial electric truck department and the door closer and hoist departments, which were consolidated recently.

J. R. L. Glover, who has been connected with the Bridgeport Brass Company for the past six years, has been appointed sales engineer on brass and copper pipe and piping. Mr. Glover entered the employ of the company as a laborer shortly after being graduated from Yale University. He served in the United States Air Service in France during the war and when peace was declared re-entered the employ of the Bridgeport company in the sales department. Until recently he promoted sales of the company's trolley wire.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Considerable Improvement Noted in Basic Industries

CONDITIONS in basic industries have, with a few exceptions, shown enough improvement since the first of March to warrant moderate optimism. Production of pig iron, steel ingot and structural steel gained during the month after a very mediocre start. Just at the end of the month Carnegie steel started operations on a basis of close to 100 per cent. Steel quotations were pushed up toward the end of the month, and, what is more important, producers have been successful in maintaining the new levels. Buyers have been forced to protect their lower price options, and the result is a large gain in unfilled orders. Much more steel is going to automobile manufacturers, who were very active in March, and the railroads are still active in the market. The advance in building was consistent all over the country.

There were favorable developments in agriculture, winter wheat being good and a larger acreage of cotton being planned for the coming season. Agricultural machinery is experiencing better demand. The movement of commodities to market was better, an increase in car loadings being noticeable in many parts of the country. Lead and zinc mining has improved, and though copper prices have weakened, the statistical position is still good and the porphyry group of mines has reopened. There has been little change in finance with the exception of a slight thawing out of "frozen" credits in the South and West. Lumber production jumps week by week.

Manufacturing has about held its own, though jobbing and retailing have dropped slightly. This is explained by the usual "between-season" slackness. Two conditions have acted to offset all this improvement. They are the coal strike and the strike of textile operatives. Neither is considered as seriously detrimental yet, but both act as a drag on the business bandwagon. All in all, however, the period since March 1 may be regarded as one of distinct improvement.

Control Equipment Manufacturers Report Better Market

BETTER industrial conditions are seen in reports from several large manufacturers of control apparatus, and an even greater increase in activity is forecast for the next six months on the basis of orders now in hand and inquiries being received. Six months ago sales were very quiet, and it was almost an accepted fact that most industrial plants were much overequipped for any business which would develop within the next year or so. Nevertheless, an improvement in sales was noted late last fall, and since the first of the year bookings have increased at a very satisfactory rate.

One large manufacturer estimates the increase in orders over six months ago as approximately 40 per cent, and while others are more conservative in their reports, all agree that the slowest period has been passed. There have been many requests lately for engineering suggestions on new equipment, and many of these undoubtedly will be translated into terms of orders before the end of the summer. Inquiries for quotations also are being received in satisfactory volume.

Much hope is pinned on the improvement in the metal manufacturing and producing industries, which gained considerable momentum during March. Steel-ingot production, pig-iron production, structural-steel contracts and the unfilled orders of the United States Steel Corporation have all gained, and prices of many steel products were advanced on April 1. Exports of steel increased during that month, and all this activity means that more electrical equipment will be put to work in the mills.

Deliveries of control equipment have got back to normal since most of the producers are working at only part capacity. Shipments of special-type equipment are being based on the time necessary for manufacture. Prices have not been cutting quite so important a figure in this industry as in many branches of the electrical trade and are now estimated at from 10 per cent to 15 per cent below the peak. It is stated by the manufacturers that there is nothing in their manufacturing costs which would justify any reductions at the present time.

Collections Generally Good with Sectional Improvement Shown

COLLECTIONS and credits in the past month and a half have shown no violent change, though some sections are seeing things more rosily than others. The characteristic of the situation now is the desire to catch up, whereas six months ago it was a desire to put off payment as long as possible. This change in the frame of mind of retailers and jobbers is encouraging, even though for the present it does not actually reduce the average time of collections. Several manufacturers and jobbers in the metropolitan district of New York report many of their overdue accounts being reduced bit by bit and are more confident than they were on the first of the year. This is not to say that credits are being watched any the less closely.

A better tone in collections is apparent in New England. The outstanding accounts of representative jobbers are being settled in their favor in from sixty to seventy days. In some cases back accounts in excess of the monthly statements sent out are coming in, showing a gratifying "taking up of slack" in handling these obligations. Central-station outputs are better than last year in not a few cases; general manufacturing and building are looking better despite textile strikes, and banking conditions are more favorable. Retail trade is off somewhat, but money is moving more easily and the electrical industry is sharing in the improving financial situation.

Collections taken as a whole are reported slow in the Southeastern States, and considerable effort is required to collect outstanding accounts within the allotted period. Some firms report they are filling only a percentage of the orders received, rather than extending further credit to those who have demonstrated that they are unable to make satisfactory payments on outstanding accounts. It might generally be said that collections in the rural districts are slower than in the cities, owing to the fact that the rural population is using such funds as are available for the purchase of farm implements, fertilizer and other necessities for agricultural purposes. This condition will, undoubtedly, continue until some of this year's crops are available for the market.

In the Middle West conditions show few changes and the average is between sixty and sixty-five days. More dealers than formerly are discounting their bills, but the percentage that takes advantage of every minute of time that will be granted is still large. In the Southwest jobbers report credit conditions virtually unchanged. Collections are on a basis of about sixty days. Money is tight in the small country banks because of the agricultural conditions, and this has some effect on the money conditions of the city banks. The latter, however, are lending now more liberally and money rates are substantially lower than eighteen months ago. However, the increased sales to dealers for replenishing stocks and for meeting the increased demand tend to make collections somewhat slower.

Collections on the Pacific Coast were not quite so good as for the preceding three months, though they are not considered bad. The average days outstanding for the month of March were between forty-five and fifty. The situation seems to be improving and accounts are getting on a better footing. The credit situation is easing up and will continue to do so from present indications.

Southwest Wiring Material Orders Still Small, but Demand Increases

A REPRESENTATIVE manufacturer of wiring material whose trade takes in much of the territory in the West and Southwest reports that though building of residences and commercial structures has been going ahead steadily sales of electrical materials are still on a hand-to-mouth basis. Almost all orders are small and seem to include barely enough for one or two small jobs, but there are many of these orders and the volume at the factory is not to be despised. There is one advantage in this small-order large-volume business as far as the manufacturer is concerned, and that is a smaller total discount given on all the business done.

Demand is increasing week by week, says this manufacturer, and has already passed the mark of a year ago. There is a more noticeable confidence in the Southwest, resulting from a better oil market, higher-priced cotton and wool and gradual stabilization of live-stock prices, and construction of residences should be greater this spring than ever before in the territory southwest of the Mississippi River. The demand should reach its peak at the factory, said this manufacturer, in July and August and should continue well into fall.

Of wiring materials in general jobbers have fair stocks, while contractors have been ordering cautiously. Manufacturers have good supplies and are prepared to ship in quantity so that there is little danger of a shortage. Producers are finding it easy to obtain raw material, and, taken all in all, this branch of the industry is in a comfortable position to wait for the opening up of building in the Southwest.

German Electrical Exports Not Alarming

EXPORTS from Germany during 1920 and part of 1921 were not large enough to cause much alarm to American manufacturers, according to figures just obtained by the Chamber of Commerce of the United States. A table giving those figures applying to electrical manufacturers is printed here. The table indicates that not a single German electrical product was shipped to the United States. It is believed in electrical circles here that the figures supplied by Germany are somewhat inconclusive on this point and that moderate quantities of German-made electrical goods have entered this country since the war.

The figures for 1920 show a decrease from 1913 of about 70 per cent in dynamos, motors and transformers, approximately 55 per cent in electric cables, 35 per cent in electrical apparatus for lighting, power and electrolysis, over 50 per cent in lamps and 75 per cent in copper manufactures. South America, it will be seen, proved a fairly good customer for lamps, dynamos, motors and transformers, but sales were made in the main to the countries which lie close to Germany.

PRINCIPAL ELECTRICAL EXPORTS FROM GERMANY BY TONS*
FOR 1913, 1920 AND MAY-AUGUST, 1921.

Commodities	1913	1920	May, 1921	June, 1921	July, 1921	Aug., 1921	Exported in 1920 Chiefly to
Electric dynamos, motors, transformers	41,889	12,352	839	1,278	910	944	Neth., Aus., S. Amer., Sw., Sp.†
Electric cables	47,591	22,422	1,506	1,690	7,494	4,250	Neth., Nor., Den.
Electrical apparatus for lighting, power and electrolysis	24,874	15,205	1,066	840	1,180	1,157	Neth., Nor., Switz, Den., Sw.
Electric incandescent lamps	2,349	1,217	87	74	59	94	S. Amer., Nor., Sw., Den. Neth., Fin.
Manufactures of copper	84,755	21,581	2,250	2,454	3,560	3,406	Neth., Switz., S. E. Asia.

* Quantities are expressed in metric tons (2,204.6 lb.)

† Abbreviations: Aus., Austria; Den., Denmark; Fin., Finland; Neth., Netherlands; Nor., Norway; S. Amer., South America; Sp., Spain; Sw., Sweden; Switz., Switzerland; S. E. Asia, Southeast Asia.

According to a recent report to the United States Department of Commerce, German exports of electrical goods among other commodities showed an increase in December, 1921, over the previous month.

Metal Market Situation

THE copper market remains inactive with a small amount of domestic inquiry to be found, while buying is negligible. Foreign buying also has been small for the past week. As a result of the stagnation in the market a weakening tendency remains noticeable, and the metal is reported to be obtainable in moderate lots at 12¾ cents per pound for April shipment. The larger producers are still quoting 12¾ to 13 cents for prompt delivery and apparently are willing to sit back until the slack is taken up.

The opening of the porphyry group of mines is apparently one reason for the dearth of buying, consumers waiting to see how the added production will affect the market. The companies include Utah Copper, Ray Consolidated, Nevada Consolidated and Chino Copper. These companies have been closed down for more than a year. Officials of the finance committee of the companies in discussing the action said it was justified in view of the fact that the companies' selling agents have disposed of all supplies on hand for delivery over the next three months.

That this production will soften the market is doubtful, for production at present is well below demand and stocks for both export and domestic consumption are not very large. Consumption is increasing here, brass manufacturers and wire drawers reporting good orders and inquiries, and foreign consumption is holding its own. Probably the underlying reason for lack of buying now is that domestic consumers have hardly been able to cut deeply into the commitments made during the last three months of 1921.

NEW YORK METAL MARKET PRICES

	March 28, 1922	April 4, 1922
Copper:	£ s. d	£ s d.
London, standard spot	57 12 6	57 2 6
	Cents per Pound	Cents per Pound
Prime Lake	12.87½	12.75
Electrolytic	12.62½	12.75
Casting	12.37½	12.50
Wire, base	13.87½–14.12½	13.87½–14.12½
Lead, Am. S. & R. price	4.70	4.90
Antimony	4.40	4.50
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	4.97½	5.05
Tin, straits	29.25	29.37½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	March 28, 1922	April 4, 1922
Heavy copper and wire	10.75 –11.12½	11.00 –11.37½
Brass, heavy	5.00 – 5.50	5.00 – 5.37½
Brass, light	4.75 – 5.00	4.75 – 4.87½
Lead, heavy	3.75 – 3.87½	3.75 – 3.87½
Zinc, old scrap	2.37½– 2.60	2.25 – 2.50

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in general showed improvement last week, though there does not seem to be much confidence in its ability to continue the pace. Prices remained on their former levels all week with a few minor suggestions, and demand for a number of items was unusually strong. New England central-station companies are buying more line material and jobbers also enjoyed better sales on tableware appliances. The textile strike seems to be unabated there. The Federal Reserve Bank report for Atlanta and the remainder of the sixth district notes business progress and announces a cut of one-half of 1 per cent in its rediscount rate. There is a fair movement there of wire and high-tension transformers. The coal strike has brought St. Louis jobbers a temporary increase in orders for electrical equipment for the Illinois mines, but sales to other customers increased also.

There has been a marked improvement in Chicago jobbing business and a constantly increasing demand for wiring materials. The general trend around Portland and Seattle is toward normal, and the lumber market is improving so rapidly as to necessitate bigger operations soon. San Francisco retailing has slowed up slightly. The opening of more copper mines has made the Intermountain country optimistic.

NEW YORK

Some improvement in the electrical trade was noted this week. Continued favorable weather has given further impetus to building activity, and this is being reflected in an increased demand for wiring supplies. Jobbers state that orders are coming through for larger quantities; but no exceptionally large purchases are being made. Generally there is a very optimistic sentiment throughout the trade, and a steady increase in business is looked for.

No important price changes were reported this week, although there has been some stiffening in quotations on certain items which have been the medium of special inducements to obtain business on a competitive price basis. The new prices on lamps do not seem to have stimulated sales, but this could hardly be expected at this season of the year. Stocks are good as a rule and ample to meet the present conservative buying.

Little apprehension is felt in this section regarding the adverse effect which the coal strike might have on the electrical trade as its possible influence on local conditions has already been discounted.

Rigid Conduit.—Only a fair demand for this material is reported and moderate stocks are carried. The following quotations show no change since last week. For ½-in. black pipe in 2,500-ft. lots, $44.50; ¾-in., $58.10, and 1-in., $82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities was quoted at $50, $64.50 and $92.20 per 1,000 ft.

Rubber-Covered Wire.—No change in price or conditions in the wire market was reported this week. A moderate demand for No. 14 is apparent. This size is selling around $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—A good steady demand for armored conductor is reported by all jobbers. No change in price has been announced by the manufacturers, but quotations have stiffened during the past week. No. 14, two-wire, single-strip, ranges from $43 to $45 per 1,000 ft.

Loom.—Only a moderate demand is reported. In 1,000-ft. lots the 7/32-in. size sells for $14.50 per 1,000 ft. and the ¼-in. size is quoted at $16.20 per 1,000 ft.

Lamp Cord.—Fair sales are reported, with jobbers' stocks in good condition. No. 18, cotton, twisted, is quoted at from $11.65 to $12.75 per 1,000 ft. No. 18, cotton, twisted, parallel, is quoted at $14.50 to $15.45 per 1,000 ft.

Appliances.—Flatirons and toasters are the best sellers of the heating devices, and jobbers report satisfactory activity. Intensive selling effort is producing good results on vacuum cleaners, while washers continue rather sluggish.

Metal Molding.—A slight drop in this material was recorded this week. The three-wire size now sells for $50 per 1,000 ft. in that quantity, as against a price of $52.50 to $55 formerly. "Wiremold" is quoted at $38 per 1,000 ft. in 1,000-ft. lots.

Radio.—There is no let-up in the demand for radio apparatus of all kinds. Jobbers are unable to build up stocks, and they have many unfilled orders on their books. Prices on some coils, tubes and complete sets have been advanced from 3 to 5 per cent.

CHICAGO

A marked general improvement in the electrical business has been noted during the past week. Although every day of the week was rainy, jobbers reported a better movement of wiring materials. The variance in the price of flexible armored conductor and rigid conduit still exists, but these materials are also moving well. The call for bare wire, especially No. 14, is continuing, owing to radio use. Better interest in household lighting fixtures has been shown this past week than during any week of March, and jobbers feel that with the spring residential building a better fixture business can be expected.

Wire.—An improved market for No. 14 rubber-covered wire was noticed during the week. The price is still around $6.25 to $6.35 per 1,000 ft. in 5,000-ft. lots and stocks are ample. The call for No. 14 bare wire is sustained by the demand for copper to be used in building radio sets. Sales of weatherproof wire have been steady but individually small. Prices of these two commodities have not changed.

Conduit.—Jobbers state that the call for conduit has increased, but prices still vary, and the ½-in. black pipe in 5,000-ft. lots sells for $41, the ¾-in. for $52 and the 1-in. for $73 per 1,000 ft. Galvanized pipe in the same sizes and quantities is quoted at $46.50, $57.70 and $81 per 1,000 ft.

Flexible Armored Conductor.—The demand for this material is continuing and stocks are not excessive. The double-wire, single-strip, sells for $42.50 per 1,000 ft. in 5,000-ft. lots and the double-strip for $45 in the same quantities.

High-Tension Equipment.—An increase in business on outdoor and indoor switching and control equipment has been reported for the week by one manufacturer. Another company states that it has received orders for a 7,500-kva., 33,000-volt and a 600-kva., 22,000-volt outdoor substation, the former for an Indiana utility and the latter for a company in the Northwest. One company tells of a good business in outdoor equipment and is quoting on installations for companies in the Northwest and the Southeast.

Lamps.—A price reduction of about 10 per cent on nearly all types went into effect on April 1. While all lines are moving well, the mill-type seems to lead, possibly because of replacement of the old carbon type by the railroad and industrial companies. The gas-filled bulb is also selling well. For home and theater lighting there seems to be a pronounced demand for the new golden-glow lamp.

Dry Cells.—The demand for dry cells is steady because of radio requirements. The standard cell is quoted at $30.55 per barrel in barrel lots.

Fixtures.—While March business in fixtures has been sluggish, dealers feel that improvement has begun since the past week has seen better activity in the standard household fixture. Inquiries are also increasing.

BOSTON

Business holds up remarkably well considering the extent of curtailment in the textile field resulting from strikes. Building activities are increasing rapidly, and for the week ended March 28 the total of New England contracts was $6,546,800, compared with $2,770,600 for the same week last year. Jobbers are still buying from hand to mouth in most lines. Prices are lower on lamps, without much change in other lines. Central-station buying of line material is increasing somewhat. So far the coal strike has had no apparent effect on business in this district, ample stocks for two to four months' consumption being noted in many localities. Central-station earnings are running well ahead of last year's in not a few companies. Stocks are being maintained in some quarters on the basis of thirty days' requirements. Appliance sales are improving somewhat in the tableware lines.

Motors.—The demand for small motors is increasing slowly and inquiries are much more active. No difficulty is reported in obtaining deliveries. One distributer found last month's business better than February's and ahead of the same month last year.

Wire.—Light demand features the market, No. 14 rubber-covered selling at $6.25 per 1,000 ft. in 5,000-ft. to 25,000-ft. lots. Weatherproof base is 16 cents, with moderate sales. Very close competition is apparent.

Lamps.—Prices were reduced on an average about 10 per cent April 1 on various sizes and types of lamps, with the exception of the 75-watt type C, which continues steady. Lamp sales are holding up remarkably well.

Pole-Line Material.—Line hardware is moving a little more actively and small-lot sales of cross-arms are reported. In less-than 100 lots 3 ft. long-leaf yellow-pine arms sell at 40 cents each and 5½-ft. arms at 80 cents.

Fans.—Buying for stock for early seasonal distribution is under way in some establishments, but as yet little interest in fans is apparent in retail buyers' orders.

Porcelain.—There is little activity in either "Nail-it" knobs or tubes. The former are selling at $15.50 per 1,000 in barrel lots. Increased building construction will probably be reflected by a better demand in the near future.

Radio Equipment.—The demand for wireless telephone apparatus grows greater from day to day. Deliveries are long and it is almost impossible for jobbers to accumulate stocks amounting to anything. One jobber reported $25,000 in unfilled radio equipment orders on hand last week after barely a month's work as a distributer. On 3,000-ohm receivers one manufacturer recently quoted six months' delivery.

Appliances.—Flatirons are moving well, and washing machines are in somewhat better demand. Interest is apparent in a new combination grill and toaster which is coming into the market in small quantities. Vacuum cleaners are a little more active, and toasters and percolators are moving in response to vigorous sales efforts.

ATLANTA

The Sixth Federal Reserve Bank in its last report states that there has been "more apparent progress" in business during the past few weeks than for some time past, and the report as a whole can be summarized as distinctly optimistic. Electrical jobbers, however, say that their business is rather quiet, inclement weather continuing to hold up construction and purchases of wiring material. Just as soon as weather conditions will permit, however, construction should get under way and employment increase rapidly. In fact, employment in Chattanooga, New Orleans and Birmingham is on the increase, while Atlanta has shown but little variation since last month. Savannah is also reported as showing employment on the increase, though it appears that a decrease will be temporarily effected by the curtailment in the operation of textile plants throughout the section, this curtailment now being daily expected. The Sixth Federal Reserve Bank announces a reduction in the rediscount rate from 5 to 4½ per cent, which should stimulate expansion. Announcement has been made of an available appropriation of $400,000 for the additions and improvements to the infantry training camp at Fort Benning, Ga., and activity is noted among municipalities in the building of schools and other improvements.

Flexible Non-Metallic Conduit.—Building of small homes is stimulating the demand for this line, and the movement is the best reported in several weeks in both the $\frac{7}{32}$-in. and ½-in. size. Local stocks of both sizes are in satisfactory shape, with shipments good. A price reduction of 10 per cent was announced last week.

Distributing Transformers.—Anticipated activities have not developed, owing in a great measure to inability to complete home and commercial building projects which have been held up by weather conditions. As soon as this work gets under way, this line should respond accordingly.

Armored Conductor.—Considerable activity is reported in armored conductor, the No. 14, two-wire, single-strip variety leading in popularity. Wiring of old houses is consuming its share. Stocks are in good shape with shipments satisfactory. A price reduction of 10 per cent became effective ten days ago.

Lightning Arresters.—This line, which should be moving excellently at this time, continues somewhat sluggish, there having been no thunderstorms of moment this spring. There should be a brisker demand upon the advent of hot weather and the lightning season. Jobbers have accumulated fairly good stocks in anticipation of a good movement.

Sewing Machines.—Except in isolated instances, sewing machines continue dormant, a jobber here and there being able to move his stock by vigorous sales campaigns.

Flashlamps and Batteries.—The sales of batteries and cases are reported as only fair, the volume being considerably reduced from that of the same period a year ago. Flashlamps also continue sluggish with little likelihood of a pick up for some months.

Wire.—The low base prices are causing a very satisfactory movement of both weatherproof and rubber-covered varieties in all of the popular sizes, while occasionally a large order for the heavier sizes is recorded. The base at the present time is 15 cents with stocks in good condition.

High-Tension Transformers.—A fair activity is to be noted, particularly in the sizes from 75 kva. to 200 kva. in 11,000, 19,000 and 38,000-volt types. A few of the smaller sizes are in stock with shipments on the larger sizes up to 1,000 kva. at about forty-five days.

ST. LOUIS

To what extent the coal strike is going to affect the electrical interests in this territory can only be conjectured. One jobber reports that sales to the mines have been somewhat heavier than usual the past few weeks, equipment being installed to care for the property while there is an enforced shortage of labor. However, from now until the strike is concluded there will probably be very little selling to the mining companies, and this will materially reduce the volume of St. Louis sales. As far as the shortage of coal is concerned the St. Louis utilities are considered to be in good position.

Business of the jobbers was universally better last week than has been customary, and all of the lines were apparently benefited by the improved demand. Central-station companies are better buyers of poles, cross-arms, transformers, meters and lightning arresters, the latter being especially in demand. Wiring supplies are selling in gradually increasing amounts as building progresses. Construction work is being materially advanced by the reductions being made in wage scales. Last week the hoisting engineers voluntarily voted a 10 per cent reduction. The carpenters have indicated willingness to accept a reduction of the same amount, but have refused to accept a 20 per cent reduction, and construction work may be hampered until a definite agreement is reached. Work to cost about $8,000,000 and to start soon has been announced.

Wire.—Substantial improvement in the sale of rubber-covered and weatherproof wire is reported, but bare is still moving slowly. The usual price for No. 14 rubber-covered is $6.25 per 1,000 ft. in 5,000-ft. lots. The base price on weatherproof is 15.85 cents per pound, and that on bare is 15.5 cents per pound, both of these representing reductions of ½ cent per pound.

Poles.—While the total movement is still small compared with normal times, it is much heavier than has been experienced for several months. Buying is principally for distribution work of the central stations, as the transmission jobs have not yet materialized. Inquiries for the latter, however, are quite active. The following are representative quotations for Northern white-cedar poles with 7-in. tops, in car-load lots, f.o.b. St. Louis: 30-ft., $8.90; 35-ft., $14.60; 40-ft., $18.30; 45-ft., $21.75.

Lightning Arresters.—The compression type of arrester, for 2,300-volt and 4,000-volt lines, is selling exceptionally well in the central-station companies in preparation for coming thunderstorms. The aluminum and oxide-film arresters are moving very slowly because of the lack of the higher voltage transmission construction.

Pliers.—The demand for the past year has been very quiet. The contemplated extension work may afford some stimulus, but no material increase in sales is expected before next fall. Prices have not changed for several months, and the Klein side-cutting plier is now priced at $2.80 for the 6-in. size and at $3.75 for the 8-in. size.

Rigid Conduit.—The ½-in. black experienced much better demand last week and is expected to sell in satisfactory amounts for the rest of the year. Stocks of about thirty days are being carried in all kinds. Prices per 100 ft. in 100-ft. lots are: ½-in. black, $4.35; ½-in. galvanized, $4.95; ¾-in. black, $5.50; ¾-in. galvanized, $6.30.

SAN FRANCISCO

Warmer weather throughout the state and just enough rain promise excellent crop conditions. Many conventions are scheduled for this year, and municipal appeals to renovate and renew in preparation for the expected crowds of visitors are reflected in the many small jobs given to contractors.

The San Francisco Chamber of Commerce is beginning to organize a series of sales trips for executive members of firms affiliated with it. These trips are made to territories which have not been thoroughly solicited or which lie in the debatable "No Man's Land" between cities. The convenience outlet and range campaigns are also stimulating California business.

Lamps.—The reduction in price, effective April 1, has produced no appreciable increase in sales. Lamp business, in fact, has maintained an excellent level all through the spring months. Intensive canvassing of agents and scientific display of publicity matter are features of this business.

Radio Apparatus.—The future of this business cannot be predicted, but that it will reach large dimensions seems assured. There are constant shortages of indispensable material such as head sets. Each daily paper is now maintaining a radio section, and department stores are devoting a large amount of advertising to it. It is evident that the country dealers have been rather slow in installing radio departments, for a large proportion of local shipments are made to interior addresses.

Tape.—Commercial grades of tape in 8-oz. rolls and in 200-roll lots are now being quoted pretty generally at about 40 cents per pound for the friction, and 36 cents per pound for the rubber with a 5 per cent higher price in fifty-roll lots. Local stocks are good.

Appliances.—Except in the case of a few companies who are waging vigorous door-to-door campaigns, household-device business is in an uncertain state, most dealers agreeing that it needs new methods of handling. Few, however, can suggest any practical solution, and as a matter of fact the buying public is more unreceptive even than last year. Soliciting salesmen have concentrated upon the lower-priced articles, such as vacuum cleaners. Los Angeles dealers in general are doing better in these lines than those around the bay cities.

SALT LAKE CITY—DENVER

With the exception of the Utah coal fields, production has been brought practically to a standstill in the intermountain region. The Utah mines operate on a non-union basis, and only a negligible number of miners have laid down their tools in sympathy with the strikers. The effect will be a widened market for the Utah product and possibly an increased production. In territories affected by the tie-up there is no serious concern about the outcome.

The most significant event in months was the unheralded resumption of copper production in Utah and Nevada. Thousands of men who have been idle for many months have been called back into service. It is the general belief, substantiated by reliable forecasts, that there will be a gradual increase in production until normal capacity has been reached. This has had a decidedly good effect on business. It is declared to be the beginning of the end of hard times in the mountain country. Building and construction look extremely promising. In some of the larger Colorado cities records have been broken for the number of building permits issued for a given period of time.

Gradual improvement in the money market is noted. The live stock industry and agriculture are being well taken care of by financing corporations, including the War Finance Corporation. There is a tendency to recession in money rates. Collections are somewhat better.

Appliances.—Very little electrical merchandise is moving, except such appliances as vacuum sweepers, flatirons and washers. Jobbers are generally prepared to handle orders without recourse to factory consignments. Prices are tending downward.

Mining Equipment.—The purchasing departments of copper companies are showing signs of interest in the market. Such electrical equipment as they use will be in decidedly better demand.

PORTLAND—SEATTLE

The general trend of business seems to be one of slow but gradual improvement. The curve dips now and then but again recovers and proceeds upward. February and the first part of March indicated a slump from which business recovered later. One knitting mill in Portland reports greater business booked so far this year than for the entire year 1921. Portland's building permits for the month of March were the greatest in the history of the city. Bank clearings and shipping both showed healthy increases. Residence construction throughout the Northwest continues active, creating a good demand for wiring supplies. Lumber production for the week ended March 25 was only 10 per cent below production, while new business was 16 per cent above production and shipments were 13 per cent below new business. At this rate it is very evident that it will soon be necessary for lumber operations to increase.

Electrical jobbers report business about the same or in some cases a trifle improved. There is a very active demand for schedule material and also for No. 14 wire. In the case of the wire the activity may perhaps be due to a feeling that wire has about reached the bottom of the market. Dealers and contractors of Portland report business to be about the same. Contracting business is active in small lines but still uncertain on larger contracts. Fixture business is very active owing to the increase in residence building, while store business is slow.

Rigid Conduit.—The ½-in. galvanized conduit is quoted at from $6.12 to $6.80; ½-in. black from $5.62 to $6.25; ¾-in. galvanized from $7.97 to $8.85, and ¾-in. black from $7.24 to $8.05 per 100 ft. in less than car-load lots. Demand is steady, prices are firm and stocks are ample.

Flexible Armored Conductor.—No. 14 single-strip armored conductor is quoted at from $54.33 to $59.25 per 1,000 ft. in coil lots of 250 ft. No. 14 double-strip in similar lots is quoted at from $56.33 to $61.70 per 1,000 ft. Demand is moderate.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Hurley Company Plans Pacific Coast Factory

A $1,250,000 factory branch of the Hurley Machine Company, Chicago, is being planned for construction on the Pacific Coast, according to E. N. Hurley, president of the company, who is visiting the Coast to inspect various available sites. As planned, the proposed plant would cover 100,000 sq. ft. and employ about 400 workers. The company manufactures electric washing machines, irons and other appliances.

Hartford Electrical Supply Company Expands

The Hartford (Conn.) Electrical Supply Company has purchased a three-story building at 234 Pearl Street, Hartford, giving about four times the floor area occupied by this house at its former quarters on Haynes Street and has transferred its entire activities to the new address. The company has added a fixture department, representing L. Plaut & Company, New York, and is now taking agencies for various specialties in radio-telephonic apparatus. Dwight Pease, at present Pittsburg representative of the Hart & Hegeman Manufacturing Company, Hartford, will join the Hartford Electrical Supply Company May 1 as vice-president. He will take immediate charge of business in the city of Hartford.

States Company Enjoys Brisk Meter Demand

Brisk business in meter-testing apparatus is reported by the States Company, Hartford, Conn., the first two weeks in March representing the best fortnight's sales in the company's history. C. P. Upson, sales manager, informed a representative of the ELECTRICAL WORLD last week that the company is quoting deliveries of from four to six weeks on phantom-load sets, and that there is an increasing demand for test tables from many parts of the United States. A recent order for ten phantom-load sets was received from Australia and another from Hawaii for a good quantity. The company has entered the field of manufacture of amplifying and continuous-wave transformers for radio service. Business in general is at least 50 per cent better with this concern than during 1921, and the demand for test tables is better than at any time since 1917. The company has recently appointed the following new distributers: Intermountain Sales Company, Denver, Col.; Industrial Power Equipment Company, Kansas City, Mo., and the George C. Rough Sales Corporation, Montreal, Que.

Robbins & Myers Company Enlarges Sales Staff

A number of additions have been made to the sales staff of the Robbins & Myers Company, fan and motor manufacturer, Springfield, Ohio, according to a statement to the ELECTRICAL WORLD. N. R. Norman, formerly of the New York office of the Western Electric Company, has joined the New York branch of the Robbins & Myers Company, while J. E. Timmons, formerly with Frank Toomey, Inc., Philadelphia, has joined the Philadelphia branch. A. I. Benedict has become connected with the Chicago branch, while E. A. Barbeau is now with the general sales office in Springfield. Mr. Benedict was formerly with the Miller-Seldon Electric Company, Detroit, and Mr. Barbeau was with the General Electric Company and Domestic Electric Company. J. J. Martin, formerly of the Philadelphia branch, has been made manager of the Buffalo office.

Woodward Governors on 200,000-Hp. Waterwheels in 1921

During 1921, according to a statement made by R. J. Kelley, general manager Woodward Governor Company, Rockford, Ill., the company furnished governors for waterwheels totaling a rating of about 200,000 hp. These waterwheels ranged in capacity from about 1,500 hp. to 20 hp. under heads from 500 ft. to 6 ft. About 150,000 hp. were vertical-shaft units and 50,000 hp. were horizontal-shaft installations. The distribution of the installations was approximately as follows: 60,000 hp. in the Eastern States, 25,000 hp. in the Central States, 35,000 hp. in the Western States, 10,000 hp. in the Southern States and 70,000 hp. in Canada, Europe and Japan.

Organizes to Manufacture Radio Apparatus

Forbes-Babcock, Inc., 4,113 West Irving Park Boulevard, Chicago, has recently been incorporated to manufacture radio-telephone receiving sets. Plans are being made at the present to obtain factory space, and equipment will be installed as soon as this is accomplished. Allen C. Forbes is president of the company, Samuel Rubinkan is vice-president and Robert S. Babcock is secretary-treasurer.

Manufacturer of U. S. Motors Reports Increasing Business

The U. S. Electrical Manufacturing Company, Los Angeles, motor manufacturer, reports that its business for 1922 to date shows a satisfactory increase over the corresponding period of last year. Business booked for the month of February shows orders equal to 200 per cent of those for February, 1921, making the month of February, 1922, the largest month's business in the history of the company. This company began the production of motors on the Pacific Coast thirteen years ago and has specialized in this line of manufacture during the entire time.

In order to take care of the rapidly increasing growth of its business, the company is planning the construction of a new factory and expects to occupy it the latter part of the present year. The new plant will take care of the largely increased demand and be of the most modern construction. H. G. Steel, president, and C. E. Johnson, vice-president, intend to spend thirty days on an Eastern trip, studying the various types of factory construction. They expect to leave for the East during the month of May.

First Quarter Reported Good by Black & Decker

The Black & Decker Manufacturing Company, Baltimore, has just declared a dividend for the first quarter of this year at the rate of 8 per cent on the preferred stock. The sales of the company have been increasing by leaps and bounds this year, and the actual sales recorded for the last week in March were the highest for more than two years. Sales two weeks before that were more than any week for twenty-two months. The company set its sales quota for this year a half million dollars higher than its actual sales last year and for the first quarter of this year officials report that this quota has been reached.

International Western Electric Reports Good Year

Despite the world-wide business depression during 1921, the International Western Electric Company, Inc., reports that year as the best in its history. The total sales of the company and of its foreign associated companies amounted to $41,000,000 at the current rates of exchange, or about $49,000,000 if figured with exchange at par. The profits also were larger than in any previous year of the company's history.

The business of the company is divided into two general classes—apparatus manufactured and sold abroad by its foreign associated companies in which the company owns a controlling or part interest and apparatus exported from this country. For the first time since the war the plants of the associated companies in England and Belgium were operated at full capacity. The export business from this country compared quite favorably with that of 1920. This was due, however, to a very considerable extent, to orders which were on hand at the first of last year. The input of orders last year was smaller than in 1920, and the company's executives express themselves as seeing little prospect of improvement during the current year, although the rise in exchange rates will help the situation somewhat. Prospects for the foreign associated companies for the current year, however, are good. The demand for telephone equipment all over the world continues to increase, and while competition is always keen, the manufacturing facilities of these foreign associated companies and the technical assistance furnished them by the Western Electric Company has enabled them to improve their position year by year.

General Electric Allowed to Issue Non-Voting Stock

The New York State Legislature before adjournment passed the Walton bill (Senate Print No. 1,100) amending the act incorporating the General Electric Company by providing that the said corporation, notwithstanding any other provision of law, may issue one or more classes of preferred stock, having a par value of not less than $10 and not more than $100 per share. This stock will not entitle the holder to vote at any meeting of stockholders or election of the company or to participate otherwise in any action taken by the corporation or stockholders except as expressly authorized at its issue by the incorporation. If so authorized, the vote is to be on the basis of one vote for each $100 of par value of the stock. The provision in the charter that each share of stock, whether preferred or common, shall entitle the holder thereof to one vote has been changed to read "each share of common stock shall entitle the holder thereof to one vote." The bill is in the hands of the Governor as a thirty-day bill.

Anchor Lite Company to Expand Activities

It is the announced intention of the Anchor Lite Appliance Company, 420 Wood Street, Cleveland, manufacturer and distributer of electric lighting fixtures and supplies, to enlarge the activities of the jobbing end of the business. A radio department has been added and several lines of equipment are being carried. The electrical supply department is to be in charge of H. W. Goldstein. A. S. Goldstein will have charge of the department handling lighting fixtures, glassware, portable lamps and household electrical specialties.

A. S. Goldstein, president of the company, has purchased the stock held by S. J. Goldberg and M. Kimball and now controls the entire stock originally issued.

Street-Lighting Activity Reported at Conference

A conference of lighting specialists was held recently at the plant of the George Cutter Company, South Bend, Ind., under the direction of L. A. S. Wood, general manager of the illuminating section. The George Cutter Company, now owned by the Westinghouse Electric & Manufacturing Company, specializes in street-lighting fixtures and equipment of all kinds, and the conference was for the purpose of training salesmen for this particular kind of work. Mr. Wood, who has been closely identified with the lighting industry in this country and abroad, states that there never has been a period in which so much interest has been shown by the public in improved lighting, and that street lighting is probably the most active branch of the electrical industry at the present time.

In order to promote the publicity campaign, which is coupled with popular advertising in leading journals, the Westinghouse company has trained a staff of lighting specialists who will be permanently stationed at each of the offices of the company to make reports on improvements in street lighting and to assist in the promotion of ornamental lighting systems.

The conference covered a period of three days. Prominent speakers who delivered addresses were W. T. Blackwell, L. A. S. Wood, Gates Harpel, H. H. Ashinger, Earl Pillsbury and J. H. Waxman. J. H. Lynch of Boston was the principal speaker on the second day. The subject of his address was "How I Am Going to Create a Demand for Our Ornamental Street-Lighting Systems." Other speakers on the program were C. J. Stahl, who was heard on "Selling the Salesman;" Warren Ripple, vice-president of the company, and L. A. S. Wood. The principal address at the closing session was delivered by P. Y. Danley, St. Louis, on the subject of "My Experience as a Lighting Specialist." F. A. Clarke gave some instruction and advice on "The Order and Follow-Up System." J. R. Townsend was heard on "Projectors and Our Development Program," and the meeting was closed with a general discussion on arc lamps led by L. A. S. Wood.

Credits Helped by Jobber Salesmen

At a meeting of salesmen employed by Seattle jobbers held recently under the auspices of the Northwest Electrical Service League the salesmen heard how they and local organizations could help to improve conditions among their retail customers and cut down credit losses. The talk in question was delivered by M. R. Chatfield of the Electrical League of Vancouver, B. C. The Vancouver organization and the jobber salesmen members, said Mr. Chatfield, have been preaching low stocks and a quick turnover, and it has been found that dealers are not only discounting their bills and establishing better credit but are actually able to do more business.

Prof. W. D. Moriarity of the University of Washington talked to the salesmen on window trimming, while Mr. Davis of the National Association of Electrical Contractors and Dealers talked on store display.

The National Radio Electric Corporation, Wilmington, Del., has filed notice of increase in capital stock from $300,000 to $1,200,000.

The Champion Electric Manufacturing Company has filed notice of change in name to the Champion Appliance Manufacturing Company, Inc., New York.

The Federal Sign System (Electric), 651 West Forty-third Street, New York City, has filed notice of change in name to the Federal Electric Company.

The Uehling Instrument Company, manufacturer of CO_2 recorders and other fuel-economy equipment, has moved its main office from 71 Broadway, New York, to its factory at 473 Getty Avenue, Paterson, N. J.

The H. Lee Reynolds Company, Pittsburgh, manufacturers' representative for industrial electrical equipment, announces the removal of its offices from the First National Bank Building to the Henry W. Oliver Building, where it has much larger quarters.

The McKenney & Waterbury Company, Inc., Boston, has been appointed New England distributer for the Sunny Suds Appliance Company, Detroit, manufacturer of washing machines. The company will distribute the radio apparatus manufactured by the Connecticut Telephone & Electric Company, Meriden, Conn. Kendall Redfield has been appointed manager of the radio department of the McKenney & Waterbury organization.

The Wetmore-Savage Company, Boston, has opened a branch of its main electrical supply jobbing establishment at 46 Hampden Street, Springfield, Mass., to expedite the handling of its Connecticut Valley and western New England business. A full line of electrical supplies and automobile accessories will be carried. J. Edward Hall, formerly western Massachusetts representative, has been appointed manager, and Byron H. Spinney, formerly Connecticut representative, has been made sales manager of the Springfield branch.

The Weston Electrical Instrument Company, Newark, N. J., has appointed the Shiefer Electric Company, Inc., with offices at Rochester, N. Y., as sales representative for upper New York State and Erie, Pa. L. D. Joralemon, Otis Building, Philadelphia, has been appointed representative for Pennsylvania, Delaware, Maryland and the District of Columbia, and the Warren C. Graham Company, Carondolet Building, New Orleans, will represent the Weston company in Louisville, Mississippi and lower Alabama.

Foreign Trade Notes

DEMAND FOR SMALL LIGHTING PLANTS IN SOUTHERN ARABIA.—Farm-lighting plants, according to *Commerce Reports*, can be sold in southern Arabia to a limited extent. Aden, with a population of 50,000, including many Europeans and wealthy Parsee, Indian and Arabian merchants, has no central-station service. The heat makes electric fans most desirable, and the possibility of using individual lighting plants to operate them is a good selling factor.

INCREASING DEMAND FOR ELECTRICAL MACHINERY IN BRITISH MALAYA.—According to the *Electrician*, there is an increasing demand for electrical machinery in the British portion of the Malay Peninsula. During 1920 imports were valued at £241,923, against £60,525 in 1917, and exports increased to £51,002, against £18,795 in 1917. Though classified as exports, the electrical goods sent out of the Straits Settlements do not to any great extent leave the Peninsula, but find their way to the federated and unfederated Malay States, in 1917 to the value of £14,823; in 1918, £10,317; in 1919, £22,818, and in 1920, £32,497. Of the machinery imported in 1920, the United Kingdom supplied £123,122, against £50,430 in 1919; the United States £46,985 in 1920 and £74,593 in 1919. In the Federated Malay States the supervision of electrical machinery is intrusted to the Senior Warden of Mines, and according to A. R. Mynott's report, the number and capacity of installations of generating plants in 1918, 1919 and 1920 were as follows: 106 plants, total capacity 9,360 kw.; 109, 9,544 kw., and 110, 10,376 kw., respectively. In addition to these there were forty-five self-contained low-voltage lighting plants in private houses and plants of about 900 kw. in course of construction at the close of the year.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agency firm in Spain (No. 1,220) wishes to purchase electric motors and electrical material and also to secure an agency for their sale.

A firm in Italy (No. 1,267) desires an agency for the sale of electric insulating material.

ESTABLISHING AGENCIES IN EUROPE.—The president of an American manufacturing company is planning to go to Europe in July for the purpose of establishing agency connections in various European markets. He wishes to represent three other electrical manufacturers who desire to make similar connections in Europe. Particulars may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

AGENCY WANTED FOR HEATING AND COOKING APPARATUS.—Manufacturers interested in obtaining a representative in New Zealand to handle electrical heating and cooking apparatus can be put in touch with a well-established firm at Wellington which desires to obtain an agency for this line of goods. Particulars may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

New Apparatus and Publications

PULL SOCKETS.—Bulletin No. 17-10 issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes the "Hubbell" pull sockets for candle fixtures.

TRADE DIRECTORY.—An electrical trades directory and handbook for the British Isles for 1922 has been brought out by Benn Brothers, Ltd., 8 Bouverie Street, London, E. C. 4, under the name of "The Blue Book."

USED EQUIPMENT.—A catalog of used equipment for power, ice, refrigerating, chemical and pulp and paper plants has been issued by the Technical Products Company, Inc., 300 Madison Avenue, New York.

SWITCHBOX TEMPLATE.—The Sea-Lu Company, 10 Highgate Street, Lawrence, Mass., has recently placed on the market the "Sea-Lu" switch-box template.

STREET LIGHTING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a four-leaf circular on street lighting in which it calls attention to the organization of the illuminating engineering bureau of the Westinghouse company for the purpose of handling street-lighting problems.

RADIO GROUND SWITCHES.—Bulletin No. 26 issued by the Barkelew Electric Manufacturing Company, Middletown, Ohio, describes the "Barkelew" radio ground switches.

AMPLIFYING TRANSFORMER.—The Coto-Coil Company, 87 Willard Avenue, Providence, R. I., is distributing bulletin 4, covering its type 5,000 radio-frequency amplifying transformer.

CLOCK.—The Sterling Clock Company, 220 East Forty-second Street, New York City, has placed an electric mantel clock on the market.

SAFETY SWITCH.—A new safety switch for electric ranges has been placed on the market by the Electrical Manufacturing Company, 4,149 East Seventy-ninth Street, Cleveland.

HOT PLATE.—A new hot plate designed to fit any gas stove and which can be used as an electric toaster, heater or warmer for hospitals, chemical laboratories, etc., has been developed by the Acme Electric & Manufacturing Company, 1444 Hamilton Avenue, Cleveland.

THERMOSTATS.—A line of electrically operated thermostats for heat regulation in residences, offices and public buildings is manufactured by the Gold Car Heating & Lighting Company, 220 Thirty-sixth Street, Brooklyn, N. Y.

CLOTHES WASHER.—An oscillating clothes washer, known as the "One Minute" cabinet washer, has been put out by the One Minute Manufacturing Company, Newton, Iowa.

IRON.—The Electro Weld Company, 70 Munroe Street, Lynn, Mass., has placed on the market the "Reverso" electric iron with an automatic current shut-off.

WATER HEATER.—The S. U. E. Company, 89 Beach Street, Boston, has placed on the market a new electric water heater for use on faucets.

LUMINOUS PENDANT.—The Eagle Manufacturing Company, 430 Kent Avenue, Brooklyn, N. Y., has placed on the market the "Radium-Lite" luminous pendant.

HOIST.—A small, self-contained portable hoist electrically driven is being marketed by the Treadwell Engineering Company, Easton, Pa.

CONSTRUCTION SUPPLIES.—The Fletcher Manufacturing Company, Dayton, Ohio, is distributing catalog No. 568, listing its electrical construction supplies for central stations.

OVERLOAD RELAY.—Brown & Pengilly, 607 East Fourth Street, Los Angeles, have brought out a new type of overload relay for particular application to induction motors. These relays are made for voltages up to 2,500 volts and currents from 5 amp. to 600 amp.

LOAD-TESTING SET.—Brown & Pengilly, 607 East Fourth Street, Los Angeles, are manufacturing an improved type of load-testing set, consisting of an ammeter and a split-core current transformer, for use on alternating-current circuits.

New Companies

THE WHEATLEP FALLS POWER COMPANY, Remington, Va., has been incorporated with a capital stock of $100,000 to distribute electricity in Culpeper and Fauquier Counties. A. L. Hord is president and S. W. Cole is secretary.

THE UNIVERSAL ELECTRIC COMPANY, 243 Washington Street, Jersey City, N. J., has been incorporated by Edward A. Markham, 626 Bergen Avenue, Jersey City; Frank H. Gates, 4 Wakeman Avenue, Newark, and Henry E. Forcsutt, Edgewater Avenue, Ridgfield. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical fixtures.

THE SIGNAL ENGINEERING & MANUFACTURING COMPANY, Worcester, Mass., has been incorporated with a capital stock of $100,000 to manufacture electrical and mechanical apparatus. The incorporators are John F. Moran, Jersey City N. J.; John E. Wjeelock, Fitzwilliam, N. H., and Albert E. Fay, Worcester, Mass.

THE FEDERAL RADIO LABORATORIES, INC., Elmira, N. Y., have recently been incorporated for the manufacture of small radio parts. The directors are C. E. Johnson, 403 West First Street; H. S. Thayer, 150 Lake Street, and J. K. Whiteker, 370 Fulton Street, Elmira, N. Y.

Record of Electrical Patents

Notes on United States Patents

(Issued March 14, 1922)

1,409,898. Automobile Signal; Emil E. Olson, Denver, Col. App. filed May 20, 1921. Rear light for right, left or stop signal.

1,409,895. Electric Storage Battery; William Knoblock, Philadelphia, Pa. App. filed May 2, 1918. Grids made in tubular form.

(Issued March 21, 1922)

15,313 (reissue). Arc-Welding System and Method of Operating the Same; Harry D. Morton, Detroit, Mich. App. filed Dec. 2, 1918. Automatic feed.

1,409,913. Message-Register System; Frederick Avery, New York, N. Y. App. filed June 4, 1920. To register calls on party line telephones.

1,409,927. Busbar Support; Christen Christensen, Chicago, Ill. App. filed March 20, 1920. Busbars held by supports on two sides.

1,409,948. Combined Resistance Element and Regulator; William A. Harvey, Scranton, Pa. App. filed March 1, 1921. Placed in shower lighting fixture to regulate brilliancy of lamps.

1,410,003. Repeater Apparatus; Charles S. Demarest, Brooklyn, N. Y. App. filed Oct. 2, 1919. For both automatic and manually operated telephone panels.

1,410,035. Support for Insulating Bases; Joseph C. Regan, New Britain, Conn. App. filed March 19, 1919. Holds switch base away from panel.

1,410,053. Electrically Heated Burnishing Machine; Frank E. Boothroyd, Beverly, Mass. App. filed May 2, 1921. Burnishes the sole edges of boots and shoes.

1,410,062. Rectifier for Alternating Currents; Gilles Holst and Ekko Costerhuis, Eindhoven, Netherlands. App. filed May 10, 1920. Electrodes of tubes can be used as cathodes or anodes.

1,410,065. Incubator; Simeon A. Keller, Knoxville, Tenn. App. filed March 12, 1921. Two automatic electric elements for heating.

1,410,176. Electric Igniter for Cigars; Manious Garl, Akron, Ohio. App. filed Nov. 16, 1920. On dashboard of automobiles.

1,410,215. Electromagnetic Transmission; Alfons H. Neuland, Bergenfield, N. J. App. field May 27, 1918. Electromagnetic power transmission for automobiles.

1,410,251. Magneto Plug; Howard J. Hoegg, Weatherly, Pa. App. filed Nov. 3, 1921. For Ford automobiles.

1,410,262. Switch for Electric Flatirons; Charles W. Mabey, Indianapolis, Ind. App. filed March 24, 1919. Circuit completed when operator grasps handle.

1,410,276. Motor Vehicle; Leigh J. Stephenson, Chicago, Ill. App. filed June 10, 1918. Rear wheels driven by engine, front wheels by two motors supplied by storage battery and generator.

1,410,292. Indicator for Garages, Etc.; John A. Granstrom, Boston, Mass. App. filed April 27, 1921. Registers number of machines passing in and out.

1,410,304. Electric Induction Furnace; Albert Hiorth, Asker, Norway. App. filed Feb. 9, 1921. Performs smelting under vacuum or under any desired pressure.

1,410,335. Electric Flashlight; Engelbert Ludescher, Chicago, Ill. App. filed April 12, 1920. Switch placed between bulb and battery.

1,410,392. Signal; Albert L. Eliel, Los Angeles, Cal. App. filed Jan. 15, 1919. Indicates direction automobile is turning.

1,410,395. Electromagnetic Brake; Bernhard E. Fernow, Jr., Milwaukee, Wis. App. filed Dec. 16, 1918. Electromagnet placed next to one shoe.

1,410,400. Electric Heater; Nicola Furfaro, Seattle, Wash. App. filed April 6, 1921. Removable secondary reflector to reflect heat sideways.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME.—Corson Brothers & Company contemplate the construction of a hydro-electric power plant at Six Mile Falls, near Bangor. A site has been acquired and plans are being prepared.

PERHAM, ME. — Application has been made to the Public Utilities Commission by Charles O. Austin for permission to generate and distribute electricity in Perham.

HARDWICK, VT.—The Council is considering the installation of a new street-lighting system.

BOSTON, MASS.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 26, for the construction and equipment of an electric substation and distributing system at the naval drydock, South Boston. (Specification 4550.)

EAST BRAINTREE, MASS.—Extensions are contemplated to the municipal electric light plant, including the installation of an additional 600-hp. boiler and 2,000-kw. turbine. F. B. Lawrence is manager.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, for extensions and improvements to its plant at the foot of Cannon Street, to cost about $1,750,000. The work will include an addition to power station, 60 ft. x 150 ft., and the installation of a 20,000-kw. turbine and two 1,600-hp. boilers.

NEW BEDFORD, MASS. — The Union Street Railway Company has started work on the installation of new equipment in its power house on the water front, consisting of a 2,500-kw. turbo-generator unit, a 2,500-kw. converter and a condenser. The Harry M. Hope Company, Boston, is engineer.

NORTHAMPTON, MASS.—An appropriation of $14,000 has been made for the installation of a new fire-alarm system.

WAKEFIELD, MASS. — At an election held recently the proposal to sell the municipal electric light plant to the Malden & Melrose Gas & Electric Company was defeated.

PUTNAM, CONN.—The Eastern Connecticut Power Company, Norwich, Conn., has acquired the property of the Putnam Light & Power Company and will connect the system with its lines. Extensions and improvements will be made to the power plant at Mechanicsville, and in the transmission and distributing systems.

VERSAILLES, CONN.—The Inland Paper Board Company will build a one-story power house at its plant, 50 ft. x 62 ft.

Middle Atlantic States

ALBANY, N. Y. — The Municipal Gas Company is taking bids for the erection of a one-story addition to its Riverside electric power plant, 50 ft. x 170 ft. Thomas E. Murray, 50 Duane Street, New York, is engineer.

BUFFALO, N. Y.—The Buffalo General Electric Company contemplates extensive improvements to its system this year, involving an expenditure of about $2,000,000. Roscoe McMillan is statistician.

CLIFTON SPRINGS, N. Y.—At an election held recently the proposal to sell the municipal electric light plant to the Empire Gas & Electric Company, Geneva, was carried.

NEW YORK, N. Y.—The Department of Plant and Structures, Municipal Building, will call for bids at once for the construction of two, and possibly three, electrically operated ferry boats for Staten Island service, to be equipped with generators, etc. Grover A. Whalen is commissioner.

NEW YORK, N. Y. The Alaska Development & Mineral Company, a subsidiary of the Kennecott Copper Company, 120 Broadway, contemplates the construction of a hydro-electric power plant on the Tyee and Anan Creeks, Alaska. Permission was granted by Federal Power Commission.

TROY, N. Y. — The Eastern Malleable Iron Company has awarded a contract to the Fred T. Ley Company, Springfield, Mass., for the erection of a one-story power plant, 50 ft. x 190 ft.

WOODVILLE, N. Y.—Steps have been taken to organize the Woodville Light & Power Company to distribute electricity in Woodville and vicinity. Energy will be purchased from the Northern New York Utilities, Inc., Watertown. The company will require material and equipment for high-tension and distribution lines, switchboard and meters. The total cost, including 4 miles of transmission line, will exceed $10,000. The incorporators will be D. H. Liard, Edward Eastman, G. E. Converse.

DOVER, N. J.—An ornamental lighting system will be installed on Blackwell Street, comprising about seventy-four lamps, each of 250 cp., replacing the arc-light system now in use. The Business Men's Association is interested in the project.

NEWARK, N. J.—A power house will be erected by the National Oil & Supply Company at its plant at Frelinghuysen Avenue and Bigelow Street, to cost about $17,000.

NEWARK, N. J. — The Public Service Electric Company has plans under way for extensions and improvements to its system, to cost about $10,000,000, during the next three years. Of this amount about $5,000,000 will be used during the present year, to include the installation of new equipment at the Essex power station, at the Burlington power plant and at plants at Trenton and Camden. Line extension work will cost in excess of $1,000,000. An addition will be built to the testing laboratory at the Marion power plant and apparatus installed for testing pulverized fuel.

HANOVER, N. J. — The Hanover and Montville Township Committees are negotiating with the Morris & Somerset Electric Company, Morristown, for the installation and operation of a street-lighting system on the Pinebrook-Parsippany Road.

WILDWOOD, N. J.—The Wildwood Electric & Traction Company has made a proposition to the Council for the sale of its local electric power plant and traction system for $650,000. If taken over by the city, the plant will be extended and improved.

CHESTER, PA.—The board of directors of St. James Mercy Hospital plans to erect a power house at the institution in connection with the construction of a new main building.

DOYLESTOWN, PA.—The Bucks County Electric Company contemplates the erection of a new power plant in the vicinity of Doylestown, to be tied in with its present station at Yardley. The transmission system will be extended to New Hope, Stockton and surrounding district. Negotiations are under way for a new lighting contract, with improved system, at Doylestown.

LEBANON, PA.—The A. S. Kreider Shoe Company, Eighth and Water Streets, will build a power house in connection with its new factory at Fifth and Canal Streets, to cost about $100,000. Plans are being prepared by John H. Wickersham, Breneman Building, Tamaqua, Pa.

MOSCOW, PA. — The Moscow Electric Company, recently organized, has contracted with the Scranton (Pa.) Electric Company for electricity. A local distributing system will be installed.

PENBROOK, PA. — The Council has authorized the installation of a street-lighting system in Progress and Hainton Streets.

PHILADELPHIA, PA.—The Philadelphia Electric Company has increased its capital from $41,000,000 to $45,000,000, part of the proceeds to be used for extensions to its system.

PHILADELPHIA, PA.—A power house will be erected by the Cambria Silk Hosiery Company, Cambria and A Streets, at its new mill on Louden Street, to cost about $75,000. Louis Weber is president.

PHILADELPHIA, PA.—A power house will be erected by the Hensel-Colladay Company, Twelfth and Wood Streets, at its plant at Hunting Park Avenue and Twenty-first Street, to cost about $75,000. William H. Hensel is president.

PITTSBURGH, PA.—The Clarion River Power Company has issued $20,000,000 in capital stock, a large portion of the proceeds to be used in connection with a power development and hydro-electric generating plant on the Clarion River.

TREICHLER, PA. — The Pennsylvania Power & Light Company Allentown, will extend its transmission line here and install a local distributing system.

ST. MICHAELS, MD.—The St. Michaels Utilities Commission is moving its substation from the city limits into the center of the town, making it necessary to erect 4,000 ft. of 6,600-volt, three-phase transmission line. E. W. Milliken is manager.

ELKINS, W. VA.—The West Virginia & Maryland Power Company, a subsidiary of the West Penn Railways Company, has acquired the property of the Elkins Power Company. Extensions and improvements will be made to the local plant.

KINGWOOD, W. VA.—The West Penn Power Company has acquired the local municipal electric plant. Extensions and improvements will be made to the system.

PIEDMONT, W. VA. — The Board of Works will build a new electrically operated pumping plant at municipal waterworks.

FAIRFAX, VA.—The Fairfax & Loudon Light & Power Company, recently organized with a capital of $100,000, is having plans prepared for the construction of a transmission line, local substation and distributing system, to cost about $70,000. A. S. Harrison is vice-president.

FRANKLIN, VA.—The Municipal Light and Water Department contemplates the installation of a 300-hp. Keeler water-tube boiler and the erection of local distribution lines. W. A. Faulkner is superintendent.

HARRISONBURG, VA.—The Council has authorized plans for the construction of a new auxiliary steam-driven electric power plant, to supplement the hydro-electric generating station, to cost about $60,000.

LYNCHBURG, VA. — The Lynchburg Traction & Light Company has plans under way for the construction of a one-story addition to its steam-driven electric plant on Blackwater Creek. J. W. Hancock is general manager.

WARRENTON, VA. — The Warrenton Electric Light & Power Company expects to erect transmission lines to serve territory 12 miles distant and to install electrical service in two towns. James O'Connell is president.

North Central States

DETROIT, MICH.—The Detroit Edison Company is preparing plans for an addition to its generating plant in the Ann Arbor district. Gardner S. Williams, Ann Arbor, is engineer.

FLUSHING, MICH.—The Hart Milling & Power Company contemplates alterations in its power house and the installation of additional switchboard equipment, and possibly new steam equipment and also new hydro-electric equipment. The company is also planning to extend its service to nearby towns and to erect electric lines to rural districts. C. O. Hart is engineer.

NADEAU, MICH. — Nadeau Brothers, owner of the local electric light plant, contemplate the purchase of electricity from a transmission line to be erected this summer. If the project goes through, the plant in Nadeau will be closed down.

DOVER, OHIO.—Bids will be opened on April 14 for the installation of an ornamental street-lighting system consisting of eighty lamps. The rebuilding of about 11 miles of lines of the municipal electric lighting system is under consideration. Homer Keppler is superintendent of the municipal electric plant.

KENMORE, OHIO.—A power house will be erected by the Palmer Match Company, Second National Bank Building, Akron, in connection with its new local plant, to cost about $250,000. Charles H. Palmer is president.

MANSFIELD, OHIO — The Western Power Company will build a new transmission line in Crawford County in the vicinity of Bucyrus. The R. M. Mead Company, Shelby, Ohio, is engineer.

NORTHFIELD, OHIO. — The Board of Public Affairs contemplates the erection of 1 mile of primary service lines to serve from twenty to thirty consumers. O. Patterson is clerk of board.

PRAIRIE DEPOT, OHIO.—D. M. Scott, owner of the local electric light plant, contemplates erecting an electric transmission line, 5 miles long, to a neighboring town, and will also furnish electricity for lighting rural districts.

TIPPECANOE, OHIO. — Bonds to the amount of $60,000 have been authorized for enlarging the municipal electric light plant and waterworks system.

INDIANAPOLIS, IND.—The Council is considering the installation of an electric lighting system on Minnesota Street from Belmont Avenue to Harding Street.

INDIANAPOLIS, IND. — The Indiana Hydro-Electric Power Company, affiliated with the Interstate Public Service Company, Indianapolis, has awarded a contract to the Mansfield Engineering Company for the construction of a dam and power-house foundation on the Tippecanoe River, near Monticello, to cost $500,000, exclusive of power plant and machinery. The plant will be the first of a series of hydro electric stations in this section and will cost about $1,000,000. Harry Reid of the Interstate company is vice-president and general manager.

NAPPANEE, IND.—The Nappanee Utilities Company expects to install a 150-hp. boiler in June. A. J. Ogden is manager.

CHICAGO, ILL. — The Commonwealth Edison Company contemplates extensions and improvements to its system in the Chicago district, to cost about $11,000,000, during the present year.

RACINE, WIS.—The Wisconsin Public Service Company has appropriated $2,000,000 for extensions to its system during the present year.

ALEXANDRIA, MINN. — Specifications are being prepared for the installation of new equipment at the municipal power plant, to cost $30,000, for which bonds have been voted.

JORDAN, MINN.—The Jordan Electric Light & Heating Company is planning to rebuild its lines and may purchase a second-hand 100-kw. to 150-kw., 220-volt direct current generating set, directly connected. S. L. Sly is manager.

LUVERNE, MINN.—Extensions and improvements are contemplated to the municipal electric light plant, including the installation of a water-tube boiler, heater and water weigher and surface condenser of about 400 hp. capacity. N. A. Lee is manager.

CEDAR RAPIDS, IOWA.—The Board of Public Improvements will soon call for bids for ornamental lamps, conduits, rewiring, etc., for the Second Avenue bridge. L. J. Zika is superintendent.

HUMBOLDT, IOWA. — The Northern Iowa Gas & Electric Company has increased its capital from $1,000,000 to $3,000,000, part of the proceeds to be used for extensions and improvements to its system.

MANSON, IOWA.—The Manson Light, Heat & Power Company contemplates the installation of new engines. Frank W. Mack is manager.

OTTUMWA, IOWA.—The Ottumwa Railway & Light Company contemplates extensions and improvements to its system, including the installation of a 3,000-kw. turbine and auxiliaries. G. E. Fahrney is general manager.

CALIFORNIA, MO.—The California Electric Light & Power Company contemplates the erection of 24 miles of electric transmission line. F. T. Porter is president.

CARROLLTON, MO.—The Water, Light & Transit Company is planning to install a 1,500-kw. generating unit and a 500-hp. boiler. H. A. Spradling is manager.

EOLINE, MO.—The Moffet Coal Company, St. Louis, contemplates the installation of electric and other machinery at its properties at Eoline, recently acquired. W. O. Lewis is assistant general manager.

KANSAS CITY, MO.—The Council has passed an ordinance providing for the installation of a street-lighting system in Santa Fe Place and neighboring streets.

NOVINGER, MO.—The erection of 20 miles of 13,000-volt, single-phase transmission line is under consideration by the Merchants' Light & Power Company. J. F. Duncan is manager.

ST. LOUIS, MO.—The North American Edison Company, a subsidiary of the North American Company, has disposed of a bond issue of $14,000,000, part of the proceeds to be used for extensions and improvements. The Union Electric Light & Power Company, a subsidiary, will erect a new power plant at Cahokia, Ill., to cost about $8,000,000. Edwin Gruhl is president.

WOOD LAKE, NEB. — A new street-lighting system will be installed in the business district, to cost about $10,000. Prince & Nixon, Peters Trust Building, Omaha, are consulting engineers.

BUNKER HILL, KAN.—Work will soon begin on the erection of a municipal electric lighting plant, to cost about $25,000. The Weber Electric Power Company, Ellsworth, is engineer.

ELLSWORTH, KAN.—The Weber Electric Power Company has completed its new 2,000-kw. station and is erecting 70 miles of high-tension transmission lines to reach seven more towns. The company will also install another turbine during 1922. Benjamin H. Bearnes is vice-president.

GREAT BEND, KAN.—The Great Bend Water & Light Company is planning to install a 500-hp. oil engine. E. A. Wright is manager.

McCRACKEN, KAN. — Extensions and improvements are contemplated to the municipal electric light plant, including the construction of a new power station and the installation of two additional oil engines having a total capacity of 250 hp. with generators. L. L. Ryan is city manager.

NICKERSON, KAN.—Plans are under consideration to rebuild part of the municipal electric distribution system. Later a line may be erected to supply electricity to the farming district. B. O. Beck is city engineer.

Southern States

ASHBORO, N. C. — The Council has authorized the installation of new equipment in the municipal electric plant.

CONCORD, N. C.—The Midway Lighting & Improvement Company is planning to erect a transmission line through Midway and surrounding territory to furnish electrical service. Electricity will be secured from the substation of the Southern Power Company in Kannapolis. C. C. Stonestreet is president of the Midway company.

DURHAM, N. C.—The Durham Public Service Company will make extensions and improvements in the street-lighting system to cost about $25,000, the cost to be paid by the city.

GREENWOOD, S. C.—The Greenwood Water & Light Company will make extensions and improvements in the street-lighting system, to cost about $20,000.

COLUMBUS, GA.—The Columbus Electric Company plans a merger with the Columbus Gas Light Company and the Columbus Railroad Company, under the name of the Columbus Electric & Power Company, to be capitalized at $10,095,700. Extensions and improvements are contemplated in the electric system.

PABLO BEACH, FLA.—Bonds to the amount of $38,000 have been voted for the erection of an electric transmission line from South Jacksonville to Pablo Beach. C. U. Smith is clerk.

PENSACOLA, FLA.—The Chamber of Commerce contemplates the installation of an electric lighting system at Camp Saufey.

QUINCY, FLA.—The Council contemplates the construction of a new municipal hydro-electric plant, to cost about $80,000. A number of extensions and improvements will be made in the street-lighting system. J. P. Smith is city clerk.

MEMPHIS, TENN.—A number of electric traveling cranes will be installed at the new barge line terminals, to be constructed jointly by the city and the federal government, estimated to cost $500,000.

BIRMINGHAM, ALA. — The Alabama Power Company will build a transmission line from Selma to Marion, to cost about $75,000.

GADSDEN, ALA. — The Gadsden Clay Products Company will build a one-story, steam-operated power plant at its works. Gordon Hood is secretary.

LUMBERTON, MISS. — The board of trustees of the Edward Hines Yellow Pine properties has acquired the local municipal lighting plant. Extensions and improvements will be made. F. W. Pettibone is general manager.

DE QUEEN, ARK.—The De Queen Light & Power Company has been granted permission by the State Railroad Commission to construct and operate a local power plant.

CONVENT, LA.—The board of directors of Jefferson College is planning to rebuild the power plant at the institution, recently destroyed by fire.

HAMMOND, LA.—The Council is considering the installation of a street-lighting system in the business section and in other principal streets.

JEFFERSON, LA.—The Citizens' Light & Power Company has been granted a twenty-five year light and power franchise in Jefferson Parish. A distributing system will be installed.

RAYNE, LA.—Improvements are contemplated to the municipal electric light plant, including the installation of an engine of about 200 hp., with generator and switchboard. E. J. Bertrand is superintendent.

MUSKOGEE, OKLA.—The Muskogee Refining Company South Cherokee Street, will install electric power equipment in connection with the enlargement of its oil refinery, to cost $250,000.

RED ROCK, OKLA.—At a special election citizens have approved bonds for the construction of a transmission line to Ponca City, Okla., for light and power service at Red Rock.

DALLAS, TEX.—The Dallas Power & Light Company has submitted plans to the City Commissioners providing for the construction of an addition to its main central station, to increase the capacity about 15,000 kw., to cost about $1,500,000. C. E. Calder is president.

HOUSTON, TEX.—The Houston Electric Company contemplates an expenditure of $1,200,000 during the next twenty-four months for extensions and improvements to its system. William E. Wood is manager.

Pacific and Mountain States

ABERDEEN, WASH.—Plans are under consideration by the officials of the Gray's Harbor Railway & Light Company for the installation of a hydro-electric plant to develop 5,000 hp. for use in the Gray's Harbor district. E. N. Sanderson, 60 Broadway, New York City, is president.

CHEHALIS, WASH.—The North Coast Power Company contemplates the erection of new power lines, etc., to cost about $6,000.

SEATTLE, WASH.—The Board of Public Works has authorized bids to be asked for 5,000 poles, cable and wire for transmission and telephone service for the municipal power plant, to cost about $45,000.

SEATTLE, WASH.—The Council is considering a project recommended by J. D. Ross, superintendent of lighting, for a connection between the local municipal power plant and that of the city of Tacoma, for interchange of service. The cost is estimated at $150,000.

SPOKANE, WASH.—The Hedlund Box & Lumber Company, 803 North Stone Street, plans the construction of a power plant in connection with a new lumber mill, to cost about $80,000. D. C. Hedlund is president.

CORVALLIS, ORE.—The Mountain States Power Company is planning to erect a new office building and substation on Second Street, to cost about $15,000, this spring.

FAIRFIELD, CAL.—The Board of Trustees contemplates the installation of an ornamental street-lighting system on Texas Street between Washington and Taylor Streets. J. H. Prather is city clerk.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 19 for the installation of an electric distributing system at the local naval base. (Specification 1610.)

SAN FRANCISCO, CAL. — The Great Western Power Company, 14 Sansom Street, has purchased the property of the Universal Electric & Gas Company. Plans are being made for extensions to the system.

SANTA MONICA, CAL.—The Council has approved plans for an ornamental street-lighting system in Palisades Park.

YOUNTVILLE, CAL.—The State Department of Buildings, Sacramento, will build a power house at the Yountville Veterans' Home, to cost $40,000. George B. McDougall, Sacramento, is state architect.

GLENDIVE, MONT.—Alvin C. Leighton, Miles City, Mont., is organizing a local company to construct and operate a hydro-electric plant on the Yellowstone River, near the Buffalo Rapids, to cost about $150,000.

ARRIBA, COL.—The Council will build a transmission line for city service about 10 miles long. W. B. Rollins & Company, 209 Railway Exchange Building, Kansas City, Mo., are engineers.

BUENA VISTA, COL.—The Buena Vista Electric Light & Power Company contemplates the erection of a 2,300-volt transmission line from its plant through the town, about 2 miles long, the installation of meters and farm line extensions. Charles S. Shryock is owner.

ALBUQUERQUE, N. M.—The Albuquerque Gas & Electric Company will make extensions in its electric system, to cost about $200,000. Arthur Prager is manager.

Canada

LONDON, ONT. — Application will be made by the City Council to the Provincial Legislature for authority to appropriate $140,000 for the construction of a dam across the Thames River at Springbank Park.

WINDSOR, ONT. — The Avon Power Company is contemplating a hydro-electric development at Avon Falls, near Windsor.

YORK TOWNSHIP, ONT.—Plans have been approved by the Township Council for the installation of electric lamps on Willard and Frater Avenues and Westmount Drive by the Hydro-Electric Power Commission.

MONTREAL, QUE.—The Montreal Public Service Corporation, now being consolidated with the Canadian Light & Power Company to be capitalized at $100,000,000, is arranging an appropriation of $40,000,000 to be used during the next twenty-four months for a hydro-electric power plant and system at Carillon, on the Ottawa River.

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The Curse of Secrecy

WHY does the old idea of secrecy linger so long with —not all—but many central-station managers? We have utility commissions today, which is obvious recognition of the fact that the public has a right to say how the light and power service shall be run. We are eagerly selling securities to customers, because we want the people to know more about utilities and take an understanding interest in them. It is no longer possible to make a private business out of a central station. And yet some utility executives still perch on the lid, hugging their elbows, trying to hide the details of this work that their communities are paying them to do.

THERE was a time when no employee of a utility was allowed to tell anything to press or people. Everybody was muzzled but the manager, and he would not talk. The affairs of the company were nobody's business. All questioners were looked on with suspicion. "Pussyfoot" was the word. The slogan of the company was "Silence!" But, thank Heaven, times have changed.

Not long ago a newspaper reporter in Pueblo, Col., got the idea of taking a job as a meter reader for the Arkansas Valley Railway, Light & Power Company to get an inside picture of the public utility and its service to the people. He told the manager and was welcomed in. He read meters for weeks and all the time wrote human-interest stories of what the utility meant to the community. It was literally worth millions to the company and almost as much to the town. It won thousands of friends.

THERE is nothing to hide about the utility business. Many stockholders own it. The people regulate it. The people have a natural interest and they want to know about it. So, why not tell the world continually the whole appealing, creditable story of the present practices and progress of this great, growing industry? Why not talk freely to the press? Why not make it easy for any citizen to get the facts? Why not disarm the politician by giving the people knowledge and appreciation of the facts as they occur before any pirate can build up false accusations?

In theory the industry believes all this. In many cities it is well in practice. But across the land this curse of secrecy dies hard. And so we still find central-station executives who refuse to talk, men who neglect to give a free and full account of this, their stewardship, to the communities for which they work. Why, even when contributing experience to their own industry, they suppress their company and community names as though they were afraid. Yet there is far more safety in honest frankness than in the biggest gag that ever blocked the mouth of man.

Waldo Calvin Bryant

Pioneer electrical manufacturer and inventor, who has championed "quality production" for over three decades

WHETHER justly or not, American industry is sometimes criticised for undue emphasis upon "quantity production." As the demand for a commodity increases, the temptation to sacrifice quality to securing minimum cost is often very alluring. Had the electrical manufacturer succumbed to that lure progress would have been materially curtailed. Quality products, especially in the wiring-device field, mean not only efficient but safe equipment. When one sees some of the material that is sold in other countries it is apparent that the American electrical industry is fortunate in having as its manufacturers men like W. C. Bryant, president of the Bryant Electric Company, who have always taken a firm stand for high-grade output.

Mr. Bryant typifies those who saw from the outset that a great manufacturing industry could be created, built and sustained by applying scientific knowledge and business integrity to the fabrication and marketing of high-class technical products, and that the behavior of these products even in the smallest units under service conditions would be the measure of success. He was born at Winchendon, Mass., Dec. 17, 1863, and received the degree of B.S. in mechanical engineering in 1884 from the Worcester Polytechnic Institute. He immediately entered the "expert department" of the Thomson-Houston Electric Company at Lynn, Mass., and was soon transferred to Bridgeport and later to Waterbury, Conn., as assistant operator of the local electric lighting plant. Following his invention of the Bryant push-and-pull switch, in 1888, Mr. Bryant returned to Bridgeport and began the manufacture of electric lighting supplies under the name of the Bryant Electric Company. He patented various electrical devices used in distribution work and in 1889 incorporated the company with a capital stock of $5,000. From this small beginning the business has grown under his presidency to a capitalization of $2,000,000.

The first president of the Electrical Manufacturers' Club, Mr. Bryant has constantly been actively interested in the economic problems of the industry. He is a member of the American Institute of Electrical Engineers and a valued adviser in many banking and industrial and philanthropic organizations. During the world war he was district chief of ordnance for the War Department, in charge of munitions production in Connecticut and western Massachusetts.

Editorial Comment

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To Picture Foreign Trade Opportunity

AMERICAN manufacturers are interested in foreign trade, but as a generation we lack experience. Time was when the Yankee windjammer touched at every port and prospered. We were a seafaring people then in so far as our coast states were concerned. But our attention has long been absorbed in industrial development and providing for our own fast-growing population. Now new conditions focus more thought on the world's markets, and the possession of many ships impels us to traffic with the foreigner.

The situation appeals particularly to our industry, because it is with the products of our ingenuity that we, as a people, have won greatest success in selling across the seas. American labor-saving machinery has won its way against all competition, and the mass production of such distinctly American devices offers great opportunity to the manufacturer of electrical equipment and appliances. There is need, therefore, for information on these distant lands and intelligent advice as to what to sell and where to sell it. There being a lack of general experience, we need to take such knowledge as we have from individual contacts and disseminate the facts shared for the common good.

In this issue there appears the first of a series of articles on the market prospects for American electrical products in different quarters of the globe written by men who speak out of the fullness of broad personal experience. There is interesting opportunity in Latin America and in Spain. There is a waiting market in other European ports. There is profitable trade for us in the Far East. They will tell of it. And this more accurate knowledge of the conditions that exist among these far-off peoples, what they need and why, and how it can best be carried to them and sold, is information that should be valuable to more than the exporting manufacturer alone. It will bring a picture of the broader economic outlook for our industry that with the closer contact of international affairs is going to be a growing influence and in a greater or less degree to affect us all.

More Figures Wanted on Distribution Costs

THE recent publication by the Electrical Supply Jobbers' Association of summarized cost figures based on a six months' check in five jobbing houses has raised a cry for more figures on electrical distribution costs and more detailed information as to what these figures really mean. It is good to know the total "selling cost," but it is better yet to know how much is spent for advertising, salesmen's salaries, salesmen's expense and general traveling expense. "Operating expense" is interesting, but it is more useful to see what is charged to office supplies and expense, taxes, insurance, heat, light and water; to officers' salaries, office salaries, postage and stationery, telephone and telegraph charges; to freight and drayage, packing and shipping-room expenses.

In September, 1921, the volume of business done by the electrical jobbing industry, we understand, was about the same as in September, 1917. But the cost of doing that amount of business had just about doubled. These are conditions that cannot be mocked. They must be met with practical measures for the reduction of expense, so that the cost will bear the right relation to the volume. For the electrical business will not prosper until its goods are being distributed freely and prosperously by the individual distributers. The first step toward this is for the jobber to study his own costs and the other fellow's costs by such detailed comparisons as may be possible. A more explicit presentation of the component elements in the association's summary of costs will, therefore, be extremely helpful.

What Will Be the Outcome of the Radio Fad?

"WHERE is the dealer going to 'get off' in the radio game?" is the important question that many dealers and central-station men are asking at the present moment. Some of the manufacturers are beginning to ask the same question. Right now radio is a fad. So were the automobile, the bicycle, the sewing machine and a host of other things that are now classed as necessities in community life. Every important invention that brings apparatus into common use in the home and the store goes through this stage. However, radio has this important difference, that with only the home workbench and a few parts purchased from the dealer any ordinarily intelligent individual can put together at least a receiving set that will give satisfactory results. Sometimes even transmitting sets can be assembled. In addition, radio operation carries a fascination that is equaled by few other comparable hobbies.

There is no question that entertainment broadcasting has created the existing tremendous interest in radio, but its use has by no means been confined to the reception of amusement programs. Prior to this service government bureaus sent out market reports by radio. This was followed by the transmission by enterprising agricultural schools or state universities of material of tremendous value to the farmers. Sooner or later the existing fad may subside, but meanwhile radio is weaving itself into the fabric of business and home life in a way that will make it as much of a necessity as some of the older developments have become.

In the meantime the business man who is supplying the demand for equipment can well carry in mind the experience met in the development of some of the older businesses. Wild buying and still wilder commitments to heavy future financial obligations in the effort to obtain material to sell are a sure road to ultimate failure. The prudent man will buy carefully, will avoid overstocking and, above all, will keep fancy-free and foot-loose so that as the period of stabilization develops he will not have an unnecessary burden to carry. The best opinion available seems to indicate a belief that the present rush will continue through the next year at least, but that all manufacturers and dealers should proceed with caution until the business has settled down to a normal gait.

It is well to make hay while the sun shines, but be sure that the hay is not caught in the rain and ruined later on.

Italian Experience in Railway Electrification

IN VIEW of the consideration that is being given to railway electrification in connection with proposed superpower systems, it does not seem amiss to direct attention to what has actually been accomplished on the Italian State Railroads. They have been second to none in progressiveness. The interesting experimental feature of their work is that two distinct methods of traction have been tried out simultaneously, one a third-rail system at 650 volts, the other a three-phase system at 15 cycles and 3,000 volts deriving its current from two overhead wires while the track served as a third. During twenty years of operation both systems have given continuously a good account of themselves. But it is to be noted that the increase that has taken place is almost wholly upon the three-phase system, the total amount of track electrified being close to 800 miles, of which less than 80 miles is direct current.

Of course, very many American engineers will cite at least a dozen theoretical and practical reasons why three-phase traction must of necessity prove a failure, but the Italian experience of a score of years utters point-blank denial, particularly since one of the roads concerned, crossing the Apennines from the port of Genoa, is the most heavily laden of all of the Italian state railroads. Seventeen lines in all have now been electrified, not including privately owned lines aggregating something like 400 miles of track.

The saving of coal accomplished by bringing hydroelectric plants into service will run to nearly 400,000 tons annually by the end of the present year, and when the present electrification program of 2,800 miles is completed the saving accomplished will be nearly half of the total consumption of coal for railway purposes. Without comment on the systems employed or on how they might be improved, it may be asserted that every engineer who has given the Italian systems personal examination realizes that their entire operation is successful. The work in Switzerland and on the Swedish state railways goes also to demonstrate the same undeniable fact. There has been no failure recorded with any system which has been seriously tried.

Here, as in Italy and Switzerland, electric traction has proved successful to such extent as it has been tried in regular railway service, but the saving in fuel expense effected thereby is not so great as in Continental Europe owing to the great difference in price of coal here and there. The whole question as far as American railways goes turns upon their ability under existing conditions to sustain the weight of equipment bonds necessary to carry out electrification.

Selling the People Our Great Public Works

WE ARE living in an era of great engineering projects, in which developments are carried out that affect large and widespread populations having the most limited and perfunctory knowledge of the cost, value and purpose of the enterprise. The people of the South are concerned in the Muscle Shoals controversy because of the human-interest aspects of its war history, its promise of fertilizer for the farmer and the spectacular association with it of the name of Henry Ford. But it is safe to say that the real import of this project to the people of many cities and large towns scattered across a group of states is but little appreciated.

A recent full-page advertisement in the newspapers of Boston, signed "Boosters of New England," is an interesting example of the kind of good work that can and should be done in such a case to aid in carrying to people who, though they are concerned, are so remote from the scene of the project that they are not individually interested, as are those nearer at hand, through the natural reaction that comes with a personal contact and a knowledge of the plans. This advertisement presents in a most forceful manner the reasons why New England will be directly benefited by the St. Lawrence Canal project. It points out the inevitable influence that this great improved facility for transportation from the Middle West to the Atlantic will have upon the cost of shipping vital necessities into the New England States and the stimulating impulse that will come to all New England industries from such a quickening of trade. It calls upon the New England people to get behind the St. Lawrence project for the promotion of the united prosperity of the country. It meets each argument that has been raised against it by the partisans of Boston with a clear, informing statement of unquestionable facts.

Public education of this kind increases the public interest in public works and public service. It teaches the man on the street to think in terms of larger public opportunities and obligations. It gives him a keener understanding and a broader sense of justice in his judgment of his own local utilities. It is a work in which the central-station company should engage whenever the public interest in such an issue presents the occasion for contributing information for the common good.

Research Section Starting Its Sixth Year

WITH the page of "Scientific and Industrial Research" printed in this issue we start on the sixth year of this somewhat unusual section of our paper. Begun in March, 1917, at the height of the war excitement and preparedness talk, it has appeared regularly in the third issue of each month, furnishing information on research in progress or completed and containing suggestions for research to be undertaken. It may be said without exaggeration that hundreds of items have been briefly mentioned which otherwise would have never seen the light of publicity. To all those who have made this section possible by contributing items the sincere thanks of the profession and of the editors are due.

But the problem is only begun. However valuable the individual items may be, the real progress of the art demands their proper co-ordination and dissemination among those interested. The National Research Council, the Engineering Foundation, the American Institute of Electrical Engineers, the Physical Society—all these agencies look after the interests of electrical research in their respective fields. It has been our aim to co-operate with them as well as with the Bureau of Standards and with large laboratories maintained by industrial organizations and by colleges.

However paradoxical it may seem, such a co-ordination of research in a given branch of electrical engineering depends more upon the existence of a "school of thought" than upon any of the formal committees, sub-committees, bulletins, conferences, reports and the rest of the machinery for which we Americans have such an admirable aptitude. When a "school of thought" undertook vigorously to defend Faraday's ideas against the theory of electric action at a distance, or the principle of the armature counter-mmf. against the leakage reactance idea, or the cutting theory of induced emf. against that of change in flux, all important research bearing upon these ideas became quickly co-ordinated, large groups of people became interested in it, and the most important problems for future investigators became quite clear.

So with present-day research will greatest strides be made if "schools of thought" are promptly formed and extended in centers of industrial activity and scientific research.

Wireless Lights— Interesting if True

BEARING in mind the successive steps in the development of present-day electric lighting sources, showing as it has noteworthy and even sensational advances in successive stages, and remembering the relatively low luminous efficiencies of the best of these sources, it appears practically a certainty that still further improvement or new discovery will follow. Certainly no one would be rash enough to deny this possibility. Consequently this field not only offers promise to the sincere investigator, but provides a plausible opportunity for unscrupulous claimants of new discoveries, serving as bait to the credulous victim ostensibly allowed in on the ground floor. Improvements when they come may be expected in the form of new incandescent filaments and better types of luminous gas discharge, with the remote possibility of some hitherto unrecognized method of obtaining a high luminous efficiency in the phosphorescent or fluorescent field. Consequently fake claims usually masquerade as new types of filament, cold light, the wireless lamp, or other sensational suggestion taken from the field of known opportunity.

But completely revolutionary advances rarely, if ever, occur, and the most remarkable are generally announced through recognized channels of authentic information to the profession concerned. These advances are always found to rest on sound scientific principles, applied more widely, or perhaps on new materials, and their authors invite inspection, criticism and approval. For only in this way can a new device or method obtain adoption.

Therefore all new claims of remarkable discovery, whether in the lighting or other field, should be received with an attitude of "interesting if true," but should be viewed with the utmost suspicion if they are shrouded in mystery or surrounded by guards. Credence should be placed in and support given to them only when a complete explanation of the working method is forthcoming and endorsed by a competent expert.

Isolation of Disturbances the Tendency in Station Protection

THE concentration of large amounts of power in single stations is forcing careful consideration of means not only for the protection of service but also to insure that in the event of troubles the effect on apparatus and station wiring can be so localized that serious damage and interruption to service will not occur. The problem has got far beyond being one of insulation alone. In the event of an insulation breakdown the resulting arc, either to ground or between phases, can because of the concentration of power do a tremendous amount of damage to the apparatus and structures in the immediate vicinity. One of the outstanding features of the designs of the year, the segregation of bus phases, has been worked out to meet this problem. It is a feature of the new Calumet plant design in Chicago and of the Hell Gate plant in New York City. The use of reactors in this connection has the same aim. One of the larger plants in the country, which was originally laid out without any general use of reactors and with no provision for their use, is rearranging circuits and finding room for reactors as a means toward protecting plant and service.

The house turbine for handling all auxiliary service is another protective move that has been discussed rather intensively for several years. It seems to be increasing in favor. The question that has to be answered before it can be considered as a standard of good practice in the larger plants is whether the protection to service that it affords is worth the cost. The use of storage batteries with automatic throwover devices to protect exciter service in the large power plant falls in the same category. Some discussions being waged seem to hinge on the question whether the troubles due to the presence of resistance are not worse than those prevented. Time and thought are being put on this subject by several association committees representing several branches of the industry. All of the developments outlined need the careful attention of the men who design large plants.

Yourself—Applied as Capital

THE runaway slave in "Huckleberry Finn" prided himself tremendously on his cash value. "The widow" had threatened to sell him for a hundred dollars. He had himself. So he was rich. And, after all, this is a pretty good and practical point of view.

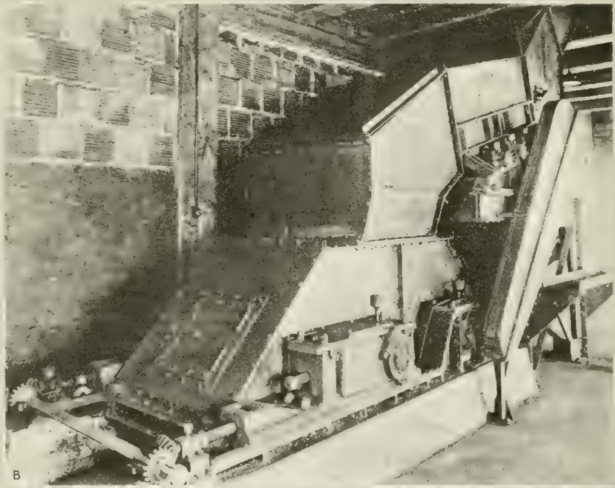
A man who earns $2,000 a year represents to himself a capital of $50,000 at 4 per cent. A four-thousand-dollar man can set himself down as having a personal valuation of $100,000. A man who earns $10,000 annually is a capital asset of a quarter of a million—all figured at this ratio. And such a man may well inquire of himself how wisely he has invested and applied this capital and what provision he is making for its permanent security.

There is a great deal more to any job than the day's work—particularly in such a business as ours. There is a great industrial progress to be guided, a vital service to mankind to be expanded and accelerated. In it are engaged a vast army of men and women with a potential capacity for achievement past all calculation. We are elements in this great resource and opportunity each one of us. The point is—how much of this capital do *you* represent and how well are you applying it?

Handling Fuel in Milwaukee Pulverized Coal Plant

THE conveyance of coal and its treatment preparatory to combustion in the boiler furnaces are two functions in which the Lakeside generating station of the Milwaukee Electric Railway & Light Company differs from the usual run of power plants. The details are given on the following pages, but some of the coal-handling apparatus is shown here. For example, A shows a rotary car dumper discharging into a track hopper from which the coal is carried over magnetic separators to the two-roll crusher and grizzly shown in B. The fuel then goes through the hammer mill D and is carried to the green-coal bunkers in the pulverizing plant by conveyor C. After pulverizing and drying the coal is fed into the furnaces E by screw conveyors.

A



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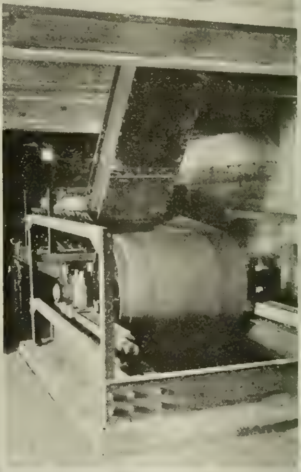

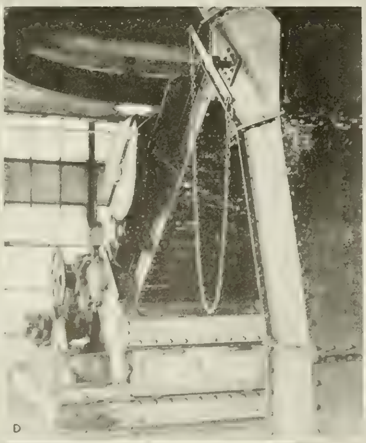

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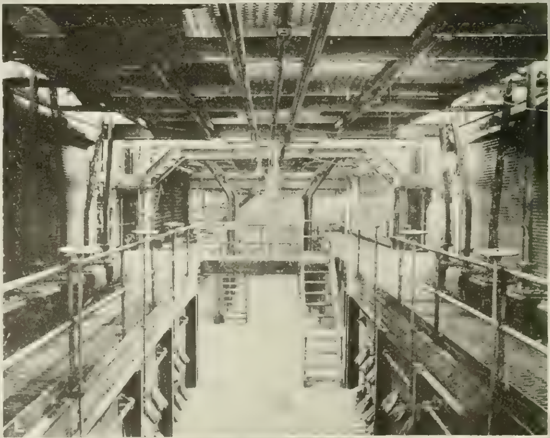


First Large Plant Using Pulverized Coal Exclusively

Lakeside Generating Station of Milwaukee Electric Railway & Light Company Designed for Initial Capacity of 40,000 Kva., with Ultimate Rating of 200,000 Kva.—Central Control and Minimum of Attendance

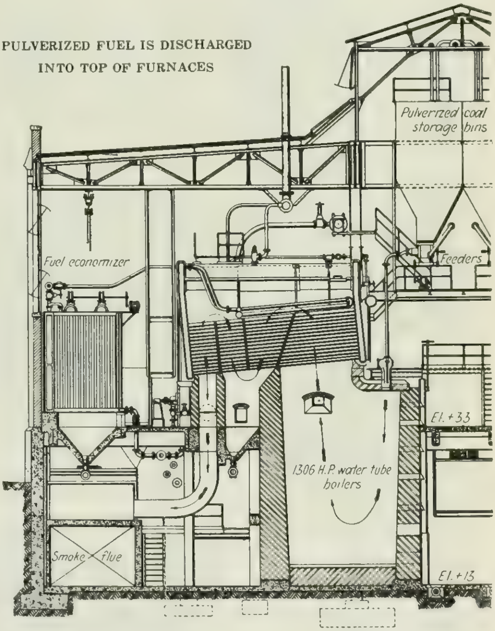
THE outstanding feature of the Lakeside generating station of the Milwaukee Electric Railway & Light Company is that it is the largest central station designed for using powdered coal exclusively. In addition, the circulating-water system, which takes its supply from Lake Michigan, had to be designed to operate through all kinds of weather, and this meant to meet the conditions caused not only by ice and ordinary storms, but also by the great lake storms that approach ocean tempests in their severity. To protect the intake against these conditions a rubble mound was built into the lake and the inclosure connected with the condenser piping by tunnels.

The plant was first projected in 1916, when the site at the southern boundary of Milwaukee on the shore of Lake Michigan was purchased; but, although excavation was started, the war then raging made it impossible to proceed with the construction at that time. Work was not recommenced until Jan. 21, 1920, and then the plans had to be revised to make arrangements for handling coal shipped by rail from the Illinois fields in place of the original plan to use fuel shipped from the Eastern fields by water. Consequently the harbor and dock plans were abandoned, although they remain a remote future possibility. Changes in plans were also influenced by the experiments which had been conducted with pulverized coal at the Oneida Street plant in Milwaukee.

To remove the coal from the cars a rotary car dumper is employed which drops the contents of the car into a track hopper fitted with bottom shaker feeders. From these hoppers belt conveyors carry the coal over a magnetic pulley which removes any iron which is present. Then the fuel is passed through a two-roll crusher and hammer mill, from which it is discharged onto belts that carry it to the distributing belts over the green-coal bunkers in the pulverizing plant. Three of these belts are provided, each having a traveling tripper which may be set to discharge the coal at any desired point. The crushers have a capacity of 150 tons of mine-run coal per hour and the belt conveyors a capacity of 250 tons per hour at a speed of 250 ft. (76 m.) a minute. When future needs require it, the coal can be bypassed around the crusher and conveyed to the storage dock, where it will be handled by a coal-handling bridge.

For pulverizing, eight mills with a capacity of 6 tons an hour each are provided. The coal is delivered from them in such condition that 75 per cent of it will pass through a 200-mesh screen and 90 per cent through a 100-mesh screen. Each mill is provided with a fan for separating the pulverized particles that have been reduced to the desired fineness. These particles are discharged into cyclone separators, where the fuel is separated from the air and allowed to fall into a screw conveyor which conveys the fuel to the pulverized-fuel storage bins. From these it is taken by the conveying system to the fuel bins in the boiler room.

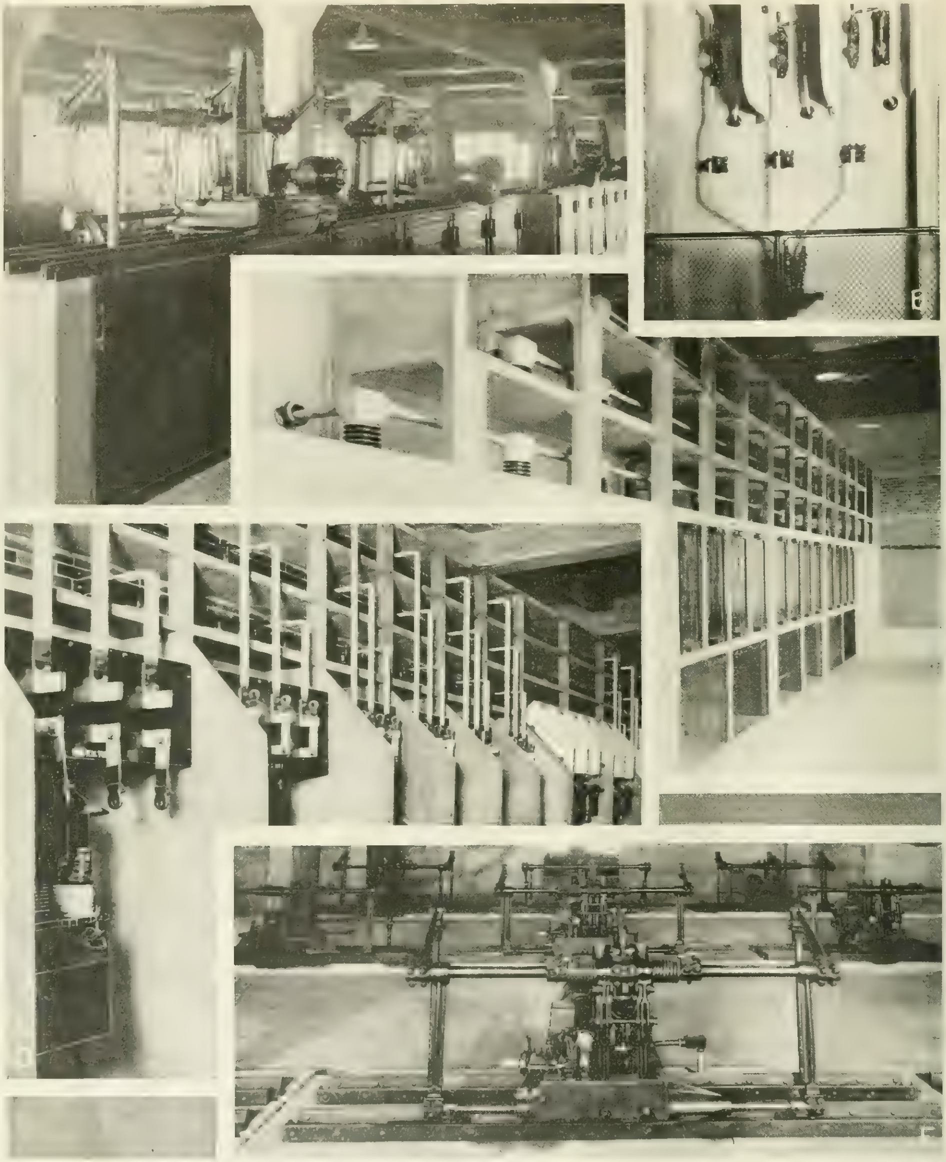
Three driers with a capacity of 10 tons an hour each are provided and will reduce the moisture content of the coal from 10 per cent to 2 per cent. Screw conveyors carry the coal so dried to bucket conveyors, which in turn deliver it to another system of screw conveyors for transferring to the dried-coal bins over the pulverizing mills.


PULVERIZED FUEL IS DISCHARGED INTO TOP OF FURNACES

The green-coal bunker into which the coal is first discharged by the belt conveyor from the unloading hopper is in the pulverizing plant. It has a capacity of 3,400 tons, or slightly more than three and one-half days' supply for maximum operation of all the boilers in this section of the plant. From this bunker the coal is taken by three screw conveyors, which deliver it to automatic scales. These in turn take it to another set of screw conveyors feeding into the driers. This arrangement permits the use of any one of the three driers and also makes it possible to check the coal accurately as it is used.

Coal is fed into the furnaces by screw conveyors from the storage bins overhead. Eight 1,306-hp. boilers designed for 300 lb. pressure (21 kg. per sq.cm.) are

Some Departures from Usual Practice in Electrical Construction



IN some ways the layout and construction of the electrical section of the Lakeside generating station of the Milwaukee Electric Railway & Light Company depart from the usual arrangements found in power plants. Some of the differences are illustrated: A and E show circuit-breaker operating mechanisms mounted for convenient inspection and maintenance. B indicates the methods of connecting outgoing feeders with underground cables and surge arresters, the devices to the right of the "disconnects" being fuses. C is a feeder bus, all parts of which are insulated and protected by a flame-proof covering. D is a section of the 480-volt auxiliary-service switch structure with leads also carefully protected.

Briefly, there are two main buses in the station with sectionalizing switches between generator sections. Generators may be connected to either bus by selector switches. The feeders are connected in groups of three to feeder-group buses which may likewise be connected with either main bus. The circuit breakers are on one floor and their operating mechanisms on the floor above as shown in A and E. To isolate disturbances, the generator circuit breakers are separated by three or four feeder circuit breakers; the group circuit breakers are also separated by being placed at each end of a section. All 13,200-volt conductors are taped with varnished cambric and protected by flame-proof covering. Main busbars are separated by gypsum barriers.

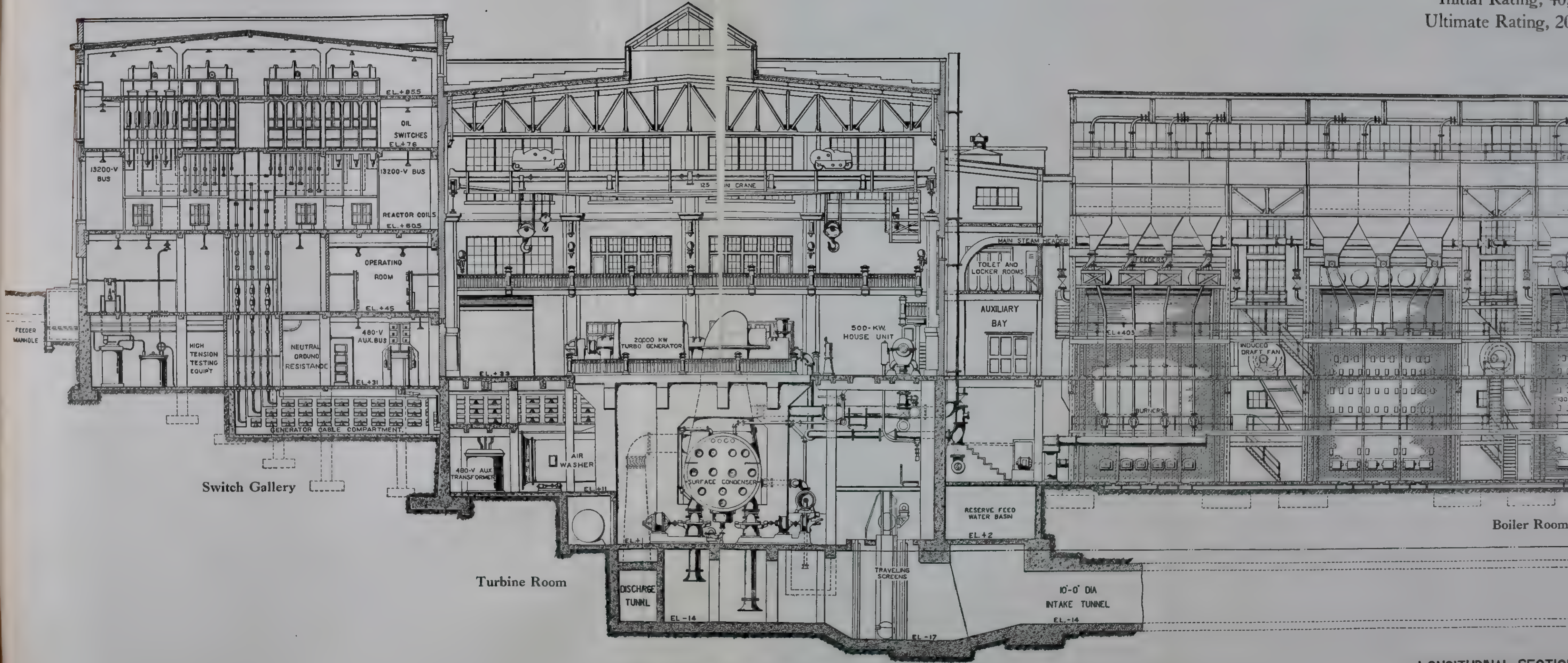
Lakeside Gener

of the

Milwaukee Electric Railwa

Operated Exclusively

Initial Rating, 40,
Ultimate Rating, 2



LONGITUDINAL SECTIO

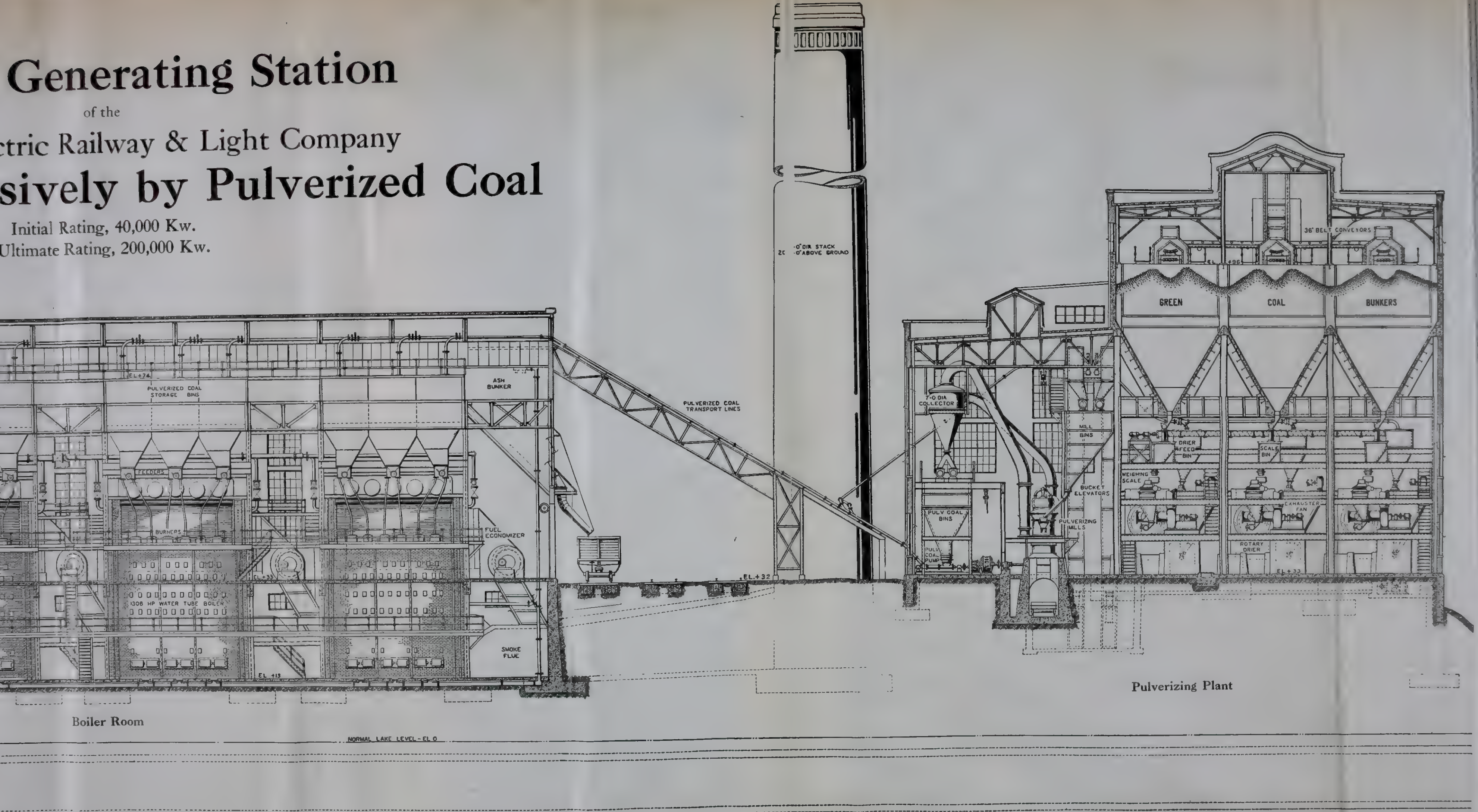
Generating Station

of the

ctric Railway & Light Company

sively by Pulverized Coal

Initial Rating, 40,000 Kw.
Ultimate Rating, 200,000 Kw.



LONGITUDINAL SECTION OF PLANT

installed. They are arranged in two rows, four boilers per row. At 250 per cent rating, which will normally be employed, three boilers are sufficient to furnish steam for one 20,000-kw. turbine, leaving two spare boilers for the two turbines now installed. Each boiler has a superheater capable of increasing the temperature of 90,000 lb. (40,800 kg.) of steam per hour from 411 deg. Fahr. (211 deg. C.) to 611 deg. Fahr. (322 deg. C.) and an economizer having 7,603 sq.ft. (716 sq.m.) of heating surface arranged with bypass connection to the stack. The induced-draft fans are driven by steam turbines. Water is received by the economizers at 140 deg. Fahr. (66 deg. C.) and is delivered to the boilers at 255 deg. Fahr. (124 deg. C.).

Condensate from the turbine condensers is pumped to an overhead hot well and fed by gravity to two heaters which raise the temperature of the feed water from 80 deg. Fahr. (27 deg. C.) to 140 deg. Fahr. (60 deg. C.). A reserve basin below the boiler-room floor is connected with the heaters by centrifugal pumps which deliver water to the heaters as needed. From the heaters the water passes by gravity through a V-notch meter so placed as to give a 15-ft. (4.5-m.) suction head on the boiler-feed pumps. A header capable of being connected with the condensate pumps on any condenser discharges into a separate V-notch meter so that tests can be easily conducted. The feed-water pump installation consists of two centrifugal pumps operated at 650 gal. (2,460 l.) per minute and two pumps operated at 400 gal. (1,514 l.) per minute, both motor-driven. Since the eight boilers at 250 per cent rating require 1,450 gal. (5,489 l.) per minute, two motor-driven pumps or one steam-driven pump can be retained as spare equipment.

Steam-Jet Ash Conveyors

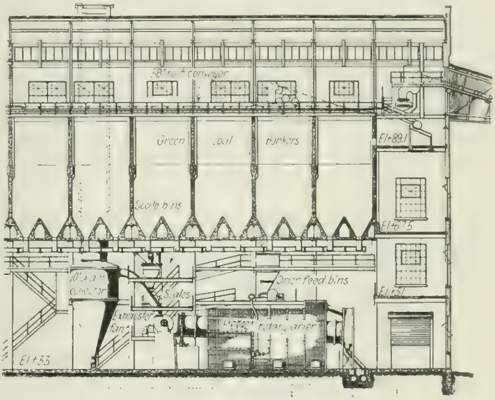
The quantity of ash is very small and is handled by means of steam-jet ash conveyors. The conveyor mains connect with the ash pits, and branches lead to the combustion chambers and soot pits. The conveyor discharges into an ash bunker and thence through spouts into railroad cars.

Two 20,000-kw., 13,200-volt, three-phase, turbine generators operating on 250 lb. (17.5 kg.) steam pressure are installed. Each unit is equipped with a 35,000-sq.ft. (3,253-sq.m.) three-pass condenser, two circulating-water pumps (one motor-driven and one driven by a steam turbine), one motor-driven condensate pump, one motor-driven turbo air pump and a steam-jet air pump. Both of the circulating-water pumps will be required in the summer months when the water is warm, and only one during the cooler months.

An air washer is provided for each generator. During the cold weather the air is admitted into the turbine room through the monitors on the roof. In mild weather it is admitted through ventilators in the windows. The warm air is discharged into the boiler-room basement for supplying the furnaces, and in cold weather part of it is bypassed into the turbine room to temper the air there. Automatic dampers are installed in both the intake and discharge ducts to act in case unusually high temperatures should occur.

To protect the generators from serious internal injury due to insulation breakdowns, both ends of each phase winding are run through current transformers which are differentially connected so that they will open the main-generator and field-circuit breakers in case of general trouble. Excitation is supplied at 240 volts, being normally provided by directly connected exciters, although emergency excitation can be furnished from the direct-current station-service system. Arrangements are made for automatically cutting off the normal source of excitation if trouble occurs. Oil-switch control is supplied from an independent 120-volt storage battery and special motor-generator sets, though, if necessary, it may be transferred to the direct-current station-service battery.

There are two main buses with sectionalizing switches between generator sections. Each generator may be connected to either main bus through selector oil switches. Feeders are connected in groups of three to feeder group buses, which may be connected to either main bus through group oil circuit breakers. The oil circuit-breaker mechanisms are installed on the fourth floor, oil circuit breakers on the third floor, main busbars, potential transformers, feeder current transformers, feeder reactors and feeder group busbars on the second floor, and generator-current transformers, feeder lightning arresters, feeder potheads and disconnecting switches on the first floor.



THREE DRIERS WITH CAPACITY OF 10 TONS PER HOUR ARE PROVIDED

The generator circuit breakers are separated a considerable distance from each other by placing three or four groups of feeder circuit breakers between them. The group circuit breakers supplying any one feeder group from the two main buses are likewise placed as far apart as possible, one being at each end of the section. This is done to reduce the possibility of trouble spreading from one feeder group to the other.

All 13,200-volt bare copper and cables are taped with approximately ¼ in. (6.3 mm.) of varnished cambric covered with a layer of cotton tape impregnated with a fire-resisting substance. Each generator lead consists of two 1,000,000-circ.mil single-conductor stranded-copper cable insulated with $\frac{7}{16}$-in. (11.1 mm.) cambric and covered with a flame-proof braid. The main busbars on either side of the room are made up of two or more ¼-in. x 4-in. (6.3-mm. x 10.1-cm.) copper. They are suspended from the ceiling and are separated by gypsum barriers 2 in. (5 cm.) thick.

The main circuit breakers are rated at 2,000 amp., 15,000 volts, and will rupture 18,000 amp. at the rated voltage. The group oil circuit breakers are rated at 800 amp., 15,000 volts, with a rupturing capacity of 18,000 amp. at the rated voltage; the feeder breakers are rated at 300 amp., 15,000 volts, and will rupture 10,000 amp. at the rated voltage.

Feeder reactors of two sizes are used. Those for the 500-amp. circuits are rated at 500 amp., 114 kva., and those for the 200-amp. feeders at 250 amp., 57 kva. In each case there is 3 per cent voltage drop across the reactor when carrying rated current. The percentage is based on the voltage from phase wire to neutral.

On account of the fact that some of the motor-driven plant equipment, such as that for coal crushing and pulverizing, is installed at a considerable distance from the source of supply, it was decided that such auxiliaries should operate at 480 volts. It was further decided that some direct-current auxiliary service should be made available for the turbine-room crane, motor-operated steam valves, magnetic pulley and other operations requiring variable speed. To make this direct-current service available as an emergency source of excitation 240 volts was selected. To simplify the station power service the control of main and emergency auxiliary feeders was placed under the switch-house operator, who handles this system exactly as if it was a substation supplying a group of customers. To protect the workmen and station attendants safety switches have been adopted for use at the various motors.

Service for the alternating-current auxiliaries is furnished by two 3,000-kva., 13,200/480-volt, three-phase transformers, one of which is a spare. They are installed in the turbine-room basement, so that the cables supplying them are short, do not pass through any part of the plant and will never be subjected to unusual heat. To insure continuity of service the busbars, transformers and feeder circuit breakers and feeders to each main division of the plant are in duplicate. The switchboards are constructed so that either half can be "killed" without interfering with the service from the other half.

Two 300-kw. motor-generators, one for reserve, supply the direct-current service. To guard against shutdowns a 150-cell storage battery is kept floating across the 240-volt direct-current bus.

The greater part of the station lighting is supplied from the 480-volt station-service bus through transformers stepping down to 120-240 volts, three-wire, for distribution. Emergency lighting circuits have two lamps in series across the direct-current station-service bus. Other circuits are arranged for throwing on the direct current if required.

This article is based on information furnished by John Anderson, chief engineer of power stations; R. H. Pinkley, engineer of way and structures, and G. S. Post, electrical engineer of the Milwaukee Electric Railway & Light Company.

Market Prospects for Electric Apparatus in Latin America and in Spain

The Opportunity in the Mining, Agricultural and Manufacturing Fields — Status of Power House, Substation Transmission and Railway Electrification—The Outlook for Motor Drive

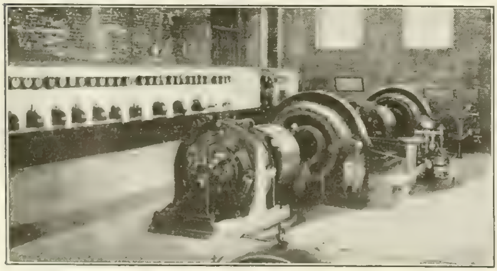
By PHILIP S. SMITH

Associate Editor "Ingeniería Internacional"

LATIN AMERICA, as the term is usually applied, consists of twenty republics with a combined population estimated at ninety-two millions. Comparatively undeveloped today, it requires only capital and an energetic state and individual initiative to bring forth the resources now lying untouched or but slightly exploited in the fields of mining, agriculture and manufacturing.

The mountainous countries of Mexico, Central America and the Pacific Coast of South America contain mineral deposits of proved extent and value. Cuba, Brazil and the Andean provinces of Argentina also have their active mining regions, which—in the last two, anyway—are capable of much greater development when better and cheaper transportation facilities are made available.

Operations being carried on vary from the little hand miner with a few Indian helpers to companies with tools, machinery and plant equipment costing several million dollars. The big mines have found that



TWO TYPICAL SOUTH AMERICAN POWER STATIONS, ONE A HYDRO-ELECTRIC, THE OTHER A STEAM PLANT. IT IS FROM STATIONS OF THIS KIND THAT THE SPREAD OF ELECTRICAL DEVELOPMENT IS IMPULSING electricity is indispensable to their success. Some of the smaller properties have also provided themselves with power machinery, while many more are yet to be so equipped. With the recovery in the price of metals a large number of mines will resume activities and again become purchasers of machinery of all sorts. This is true especially of Mexico, where low prices and other unfavorable conditions have rendered operations impossible for a long time.

Agricultural developments differ widely with the characteristics and topography of the particular country. Argentina, Uruguay and a few other sections have facilities for extensive grazing and cereal crops. In the remaining countries the land is divided into small, intensive farms, pastures or well-organized vineyards and banana, coffee, cacao, tobacco, cotton and sugar plantations. All have need for power, with the possible exception of the banana and cacao plantations. The latter will also need power if artificial dehydration should be introduced extensively.

GENERAL interest in the export opportunity for American manufacturers of electrical equipment is increasing steadily, and there is a real need for dependable information and expert advice regarding the existing conditions and prospective needs of foreign countries. Naturally the mind turns first to that great growing field awaiting development in South America, and a study of Latin America leads to consideration of Spain, since the trade customs and many aspects of the market link the two together. This article is the first of a series in which Mr. Smith will review the market for American electrical products in the different trade fields. This article embraces apparatus only. The second paper will cover supplies and appliances, also in Latin America and Spain. Subsequent articles will picture conditions in Europe and the Far East and will give some guidance toward the development of distribution in foreign fields. Mr. Smith has an intimate knowledge of the subject as a result of many years in the service of the Department of Commerce of the United States Government and can speak with particular authority on South America and Spain.

Irrigation projects are being terminated in some localities, and in others they are in the preliminary stages with fair chances of early completion. The canals frequently permit the generation of energy at different points sufficient for local needs. The most striking use of power in connection with agriculture is for sugar-mill electrification, and many opportunities are offered in this direction. Brazil, in particular, must renovate its system completely if it is to be a large factor in the world's sugar markets.

The equipment of the farm with mechanical appliances will probably be a slower process than in the case of the mines, but large estates and small alike are taking advantage of streams or irrigation ditches crossing their property to put in a waterwheel and dynamo for electric lights, and power is sure to be required later on. Where water power is not to be had, as in much of the farming region of Argentina and Uruguay, the self-contained set with dynamo and direct-connected internal-combustion engine is the logical successor of the kerosene and actylene outfits upon which the country dwellers have been forced to rely heretofore. The land owners have now taken up the idea of having their own electric plants, and the prospects for sales when money is again being made on the farm seem reasonably good.

The Manufacturing Field

Assembling and manufacturing is permanently gaining ground. Few of the factories are large, according to our conception, but in the aggregate they turn out a great volume of goods and require an increasing quantity of power-driven machinery. Many have seen fit to choose sites away from populous centers and to erect their own power plants, but the tendency is to concentrate where there is good central station service, as in Rio de Janeiro, São Paulo and Buenos Aires.

Spain, with its twenty-two million inhabitants, is well advanced in agriculture and mining. It has reached a higher plane of industrial progress than any country in South America, and with it has come an awakening to the possibilities of doing more than merely filling a few of the demands of the home trade. There is now a well-defined effort to enter foreign markets with various products. But in order to do so profitably manufacturers must acquire tools and processes as advanced as those of their foreign competitors. Old equipment is therefore giving way to new, while only the latest types are considered satisfactory for initial installment in industries recently established.

Many sorts of electrical goods are made within the country. Nevertheless, Spain is not independent of outside sources, and several million dollars' worth continue to enter each year. Foremost among the articles which continue to find a ready sale are generating units, both small and large; control and substation apparatus, transformers, transmission-line accessories, except insulators, street-railway motors, controllers and overhead supplies; railway electrification material, meters and measuring instruments, batteries, telephones and telegraph material and bare copper wire.

The Field for Prime Movers

Generators, switchboards and prime movers find a sale in three well-defined fields—namely, the plants already in operation which desire to increase their output, the small municipalities requiring equipment for original installations, and isolated plants owned by individual mining properties or industrial enterprises.

All types of prime movers find an application at one or another plant. In some sections the call is for a waterwheel suitable for high head and small flow, while not far distant one for low head and big flow may be needed. In countries where alcohol or petroleum is produced internal-combustion or Diesel engines for small towns or auxiliary substations are indicated. These may also be the type best adapted to out-of-the-way places where fuel of any kind is expensive. The steam plant burning coal, wood or petroleum may be called for anywhere, and either alone or as a reserve in conjunction with either of the other two.

Nearly every large station has seen its load increase greatly in recent years, and several, including those at Lima, Montevideo and Buenos Aires, were obliged to buy additional units even at the peak prices that prevailed during the period of the European war. Many others, able to wait longer for more favorable quotations, will be forced into the market before long. The large plants were not exceptional in this regard as the same pressure is felt on the smaller stations, which have not added to their capacity for several years.

Orders for big units are unusual and should not be considered as more desirable than the larger volume of plants of 100 kw. to 1,000 kw. that are being purchased continually. Each year sees an increasing number of electric light plants replace the kerosene lamp or the tallow dip, and even greater movement in this direction can be counted upon as the better prices for raw materials bring prosperity to the farming and mining regions that have been obliged to go slowly for some time on account of lack of funds.

For Ore Extraction

Just when these better prices will be forthcoming cannot be foretold, but it is certain that both Spain and Latin America are going to be called upon to renew the flow of their products to Europe and the United States concurrently with the increase of manufacturing activities, as they consist of basic industrial necessities such as petroleum, copper, lead, iron, coal, tin, manganese, nitrate, wheat, hides, wool and meat.

TWO LOCOMOTIVES NOW IN SERVICE IN THE EARLY STAGES OF THE ELECTRIFICATION OF THE ANDES

With the reopening of the mines, one of the principal improvements over the period antedating the war will be a widespread employment of machinery in the extraction and handling of ores and minerals inasmuch as labor of all kinds has generally become less efficient while wages, taxes, freight and supplies are all higher. The solution of the problem of keeping down the cost of production in the face of these adverse conditions, which are felt alike in Spain, Mexico and Chile, must lie in the use of labor-saving machinery with electric drive. Fortunately it is possible to extend the application of this form of power in a great many instances because of the proximity of the mines to waterfalls or sources of cheap fuel.

Large Distribution Schemes

There has been much talk and considerable study of a national distribution scheme to cover the entire country of Spain. This would consist of a high-tension network fed at different points by existing hydro-electric plants and by others to be constructed, as the one on the Duero River. Furthermore, it is proposed to erect steam plants to utilize low-grade coal at the mine. These would be useful in compensating for the lack of water power in seasons when the output from the hydro-electric plants is insufficient to meet the demand.

In Latin America there are several proposals for harnessing large waterfalls, notable among which are the Guayra or Sete Quedas in Brazil and the Iguazú between Brazil and Argentina. Energy from the latter would be transmitted a distance of some 750 miles to Buenos Aires to find a market, unless some chemical or metallurgical industry requiring power on a vast scale were to be established at or near the falls.

All of the projects are interesting as subjects for academic discussion, and it is not improbable that some or all of them will be accomplished at a later date, but they have not yet arrived at the point where they supplant the small town and infant industries as a real source of everyday business and profit to the manufacturer and dealer.

Transformers and Switches

Transformers and switchgear being an essential part of an alternating-current system, they will be in demand both for proposed new work, such as outlined above, and for the expansions of present capacity. They will be required also for the new circuits that are supplying the outlying districts of those cities that formerly employed direct current until it attained the limit of economical service. Steam-road electrification is going to absorb many large units, as will the street-car companies for sending power to their more distant substations to keep pace with their natural growth.

European practice in employing transformers appropriately located to feed areas of reasonably large consumption is followed rather than the American practice of putting up small units for purely local use, the sales of which are thereby limited in comparison with the larger sizes. Substations for the distribution of power to street railways and isolated residential districts are already well known. More are going to be required as these expand, and further sales can be counted on for newer uses, as at industrial plants, port works and small communities or rural estates along the transmission lines of the power companies.

Motors and Motor Drive

There has been a notable growth in the number of manufacturing establishments opened up since 1914 in both Argentina and Brazil. Many of the older ones have been forced to build extensions or move to new quarters to take care of their expanding business. Similar conditions exist in Spain. The high prices ruling for practically all finished commodities enabled these establishments to make a profit regardless of their imperfect organization and limited equipment. This cannot continue indefinitely, and the crucial time for them will come when foreign manufacturers are again pouring their goods into those markets. Some, possibly a very small number, will not be able to survive, but others have succeeded in so strengthening their position that the net result will be a substantial gain in local manufacturing.

Factory Re-equipment

They can retain this advantage and keep in business only by adopting modern power-driven machinery and cutting hand labor to a minimum. For, although the latter is cheap when measured in terms of money, it is fully as expensive as the more highly paid labor of other countries on account of its relative inefficiency. Progressive factory owners are beginning to analyze the situation and are learning that their salvation lies in a greater use of mechanical equipment. Once having arrived at this conclusion, they jump from their former primitive methods to those of the present day, becoming purchasers of modern machinery and skipping several of the preliminary steps that have made up the evolution of manufacturing in the United States and Europe.

INDUSTRIES TO BE EQUIPPED

By this it is not meant that automatic machinery or ultra-modern refinements are in demand or that it is likely that they will be for many years in any but a few industries, the consumption of whose products are great enough to take care of a large and steady output. Those that have reached this stage already are the shoe factories, cotton textile mills and nail and screw factories. Others which are approaching that stage are making glass bottles, crown corks, fur felt and straw hats, shirts, collars and ready-made garments in general.

Motor drive is not confined solely to the factories, but is being taken up by those engaged in mining and agriculture. Attempts have been made, for example, to run aërial lines through agricultural districts where the conditions seemed to permit it, in order to encourage the farmer to take power for the numerous purposes for which small motors are advantageous to him.

SUGAR AND NITRATES

The sugar industry must be conducted on more efficient lines to survive the present or future eras of low prices, and only mills showing low production costs will be able to continue. The experience of many Cuban mills converted from steam to electric drive has been that considerable savings were brought about through the change. This lead has been watched closely by other sugar-producing countries and isolated cases of electrification have been carried out. The more wasteful steam drive still continues to be in vogue, however, in Spain, Argentina and Peru in many mills that may reasonably be expected to adopt electric drive eventually.

A special case of the application of motors to mining and associated activities is found in the nitrate fields of Chile. Interesting possibilities are offered there because the producers must put themselves in position to get the nitrate out more economically than at present. Some of the things that play a prominent part in the number of mechanical aids to this industry are crushers, pumps and conveying and handling devices.

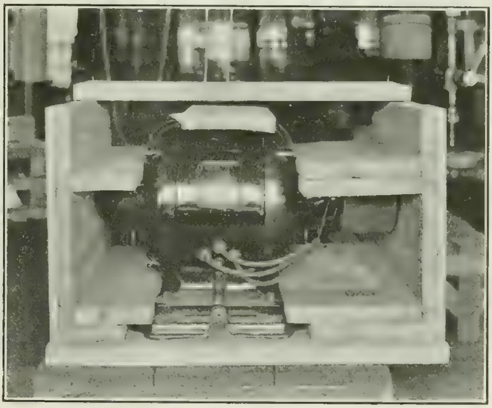
GROUP DRIVE PREFERRED

The favorite method of applying electric power is through the group drive. This seems to be due about equally to the economy in first cost over that of the greater number of small motors required for individual drive and to the influence of European practice, which is much better known than the American. The several sugar and textile mills afford unusual opportunities for trying to substitute individual for group drive.

Motor manufacturers in the United States will find various difficulties confronting them, but none that is impossible of overcoming. Those most common are the use of 50 cycles instead of 60, 440 volts direct current instead of 230 for the larger sizes, and a demand for slip rings with brush-raising and ring short-circuiting devices instead of squirrel-cage armature in induction motors even down to 5 hp.

Spain offers a very fertile field for the electrification of steam railways. Numerous projects have been studied, but up to the present time the only contract of any importance that has been let since the beginning of the war is the one for the section on the Northern Railway leading from Leon to Gijon, known as the Bajada del Puerto de Pajares. All of the others have been held up on account of the abnormal conditions of the last few years and will come up again for decision before long. Energy will be derived from the waterfalls in the districts where the roads run.

In Latin America two contracts have been awarded in the last two years, one for the line between Valparaiso and Santiago, Chile, and the other for a section of the Paulista Railway in Brazil. Both of these are but forerunners of other electrifications already planned for these countries.



A GOOD EXAMPLE OF GOOD EXPORT PACKING, SHOWING THE NEED FOR RUGGED STRENGTH IN THE CONTAINER

In Argentina there is one suburban section that has been functioning as an electric road with motor coaches for several years. Plans have been made for extensions of the service to other branches. Another road has finished its power house and the work on the roadbed for an electrified section. It should be carried to completion soon. A third line is contemplating seriously an electrification of its suburban lines.

RAILROAD ELECTRIFICATION

Aside from these three roads, there has been a great deal of agitation for this change, and it is thought that much more will be attempted along this line during the next few years. Street-railway systems are operating in every city of any size, although there are still a number of places where new lines or extensions are required. There has been virtually a complete cessation of construction for seven years and even repairs have been kept as low as possible. New equipment is needed to replace what has been wearing out during that time, and most of the business to be placed in the near future will be for materials of this character rather than for new construction. New construction, however, will be begun in earnest as soon as conditions are substantially better than they are today.

What's the Matter with Electric Shows?

Why the Old-Fashioned Jumble Show Has Been Almost Abandoned — How a Real Functional Electric Show Can Be Equipped—What It Will Do

By EARL E. WHITEHORNE
Commercial Editor ELECTRICAL WORLD

THE OLD-FASHIONED JUMBLE ELECTRIC SHOW, NOW ALMOST EXTINCT, WHERE PEOPLE COME TO SEE WHAT ELECTRICITY CAN DO AND FIND ONLY APPLIANCES

SEVEN or eight years ago electric shows were popular. They were held annually in all the big cities and in a large number of the smaller cities. Even big towns had them. We were hearing of them all the time from all parts of the country. But today they are almost as scarce as the dodo. New York has one regularly, Chicago less often, Philadelphia sometimes. I don't think Boston has had one for years. I may be wrong, but anyway the electric show as an institution has been practically abandoned by the electrical industry. In spite of the fact that it is obviously a good thing to exhibit appliances to the great crowds that flock to an electric show, we have turned against it. I believe I know the reason why.

I have attended a good many electric shows in a number of cities. I have never been to one of them that I have not realized that something was wrong. It didn't get over. Here was a great throng of people come to see. Here was a great display of electrical appliances. They were both in the same place and yet they didn't get together, and the results fell far short of the opportunity. And the reason was because always the people were deceived as to what they were to see. They came to see electricity do things and we showed them only appliances.

The weakness in the electric show that has caused it to languish and lose its popularity, I believe, can be charged up to wrong thinking on the part of electrical men. We have all been thinking of an electric show in terms of appliances, whereas the public thinks of an electric show in terms of functions. We advertise: "Come to the Electric Show. See how clothes are washed and carpets are cleaned by electricity!" And that night at dinner Mary says to John: "Let's go to the Electric Show down in the Armory and see if this electric refrigerator really is practical. I don't understand how it works and I'd like to." And John replies: "All right. And I don't know but that it would really pay us to buy a clothes washer. This washerwoman charges so much, plus food and carfare, that it seems as though we could buy a washing machine for less than that." And so they go. And what happens?

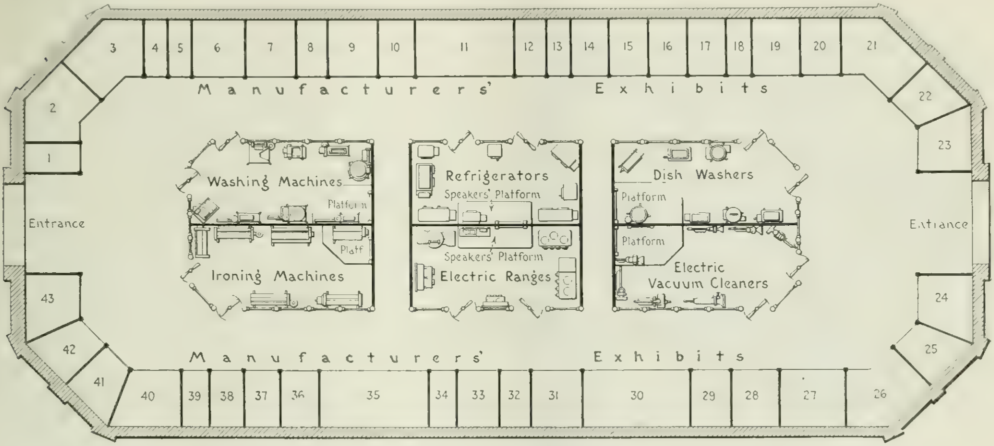
John and Mary enter the armory with a lot of other people and find the place thronged. But it looks gay, and a band is playing and apparently there is lots to see, so they pick the first aisle and start to work their way along from booth to booth. They have come, understand, to see how electricity washes clothes, sweeps rugs, does dishes, irons waists, cooks and refrigerates. And what does the electrical man show them? He presents to their eager eyes a great clutter of mechanical devices in endless duplication, a mass of flatirons, percolators, grills, vibrators, washing machines, cleaners and other junk. In other words, they come for milk and we give them a milk ticket. We show them fifty-seven varieties of clothes washers full of suds; we exhibit a scattered assortment of flappers spreading and cleaning up stage dirt on rugs; we let them smell the ozone and blink at the radio, but we don't show them and explain to them how electricity does housework. And that is just what they all come to find out about.

I went to the New York Electric Show last fall. It was as good a one as I ever saw—not as big or as elaborate as some former ones—but in an armory, all in plain sight and apparently lots to see. We were a party of five, three of them women who had asked me to show them just what every woman wants to see at an electric show—how clothes are really washed, how the electric refrigerator works, and if the dishwasher really washes dishes clean. One of the party also wanted to buy a percolator as a wedding gift. So we all went, and, of course, there was a jam of people there ahead of us. Around each booth there was a crowd. Those in front were talking to the demonstrators; those in back couldn't hear and couldn't see. If they wanted to find out anything they had to wait until they could work up to the front. Sometimes we did; sometimes we didn't.

Every little distance there was a clothes washer—not washing clothes, but tiring out a mess of suds. Here and there were dishwashers—not washing dishes, but wildly dashing water around behind a glass false front, with perhaps a couple of drowned cups inside. In between were always flatirons or vibrators or more toasters or something else that we thought we had just left behind. Of course, I knew the ropes and led my party into the side gate of a booth to meet the man in charge and pick out the percolator, or to get a real look at the washer I thought best. But the poor "pee-pul" who had paid to get in had to line up at the rail and wonder how we got away with it.

We worked our way to the place where the refrigerators were, and there we saw some beautiful white cabinets with glass doors. When we got through to the silk cord and unhooked the barrier, we went in. The man in charge graciously permitted me to open up the box and give a private "ballyhoo" on the principles of mechanical refrigeration. But the crowd outside couldn't hear, and all they saw was a very handsome white box. There was also a very interesting exhibit of wired furniture with some modest cards that admitted that it was so. I found a friend inside the rail who asked us all in, and I showed my party all about it and explained this new idea, but the throng beyond the rope gazed at the walnut suite and had to let it go at that.

I am not knocking this New York show. It was as good as any I have ever seen. But it was conceived and produced by electrical men based on the idea that electrical men have always followed in their electric shows. It was an exhibition of electrical appliances, with everybody's goods in his own booth, the more the merrier. But this is not what the people come to see. John and Mary are not interested in the appliance; they care only about the *function* of the appliance. They want to see the washer wash the weekly wash and know just how a mere machine can make clothes clean, and if they are invited to see these things and come to the Electric Show, I believe that John and Mary are entitled to be shown.



A LAYOUT FOR A REAL FUNCTIONAL ELECTRIC SHOW, WHERE THE STORY OF EACH APPLIANCE CAN BE TOLD IN TERMS OF ITS HUMAN INTEREST AND THE SERVICE THAT IT RENDERS

"Well," says the central-station man and the manufacturers who read this far, "what are you going to do about it?" I'm going to make this suggestion—that in future electric shows electrical men play fair with the public in this regard. And I believe there is a way it can be done.

I am enthusiastic about the "home electric" as an influence for the popularizing of electrical appliances. It shows the appliance in the atmosphere of a real home. The device is demonstrated before a small group and it makes a deep impression. I believe that we are going to see the "home electric" an annual or semi-annual or quarterly event in every progressive city in the land, located each time in a residence section where one has not been established before. But in the large cities there is also a place for an annual electric show. The "home electric" is a neighborhood affair in the bigger communities, a demonstration of the complete electrical equipment of a single home; but the electric show is a great mass exposition of everything electrical to be shown to all the city. It supplements the "home electric." It brings the opportunity to talk to all the people at once, to show everybody all about it in this bigger way—and the people come. The question is, what can you do when they get there? And the answer is, do what they want you to do. Show them not just the appliance but the function of the appliance. Show them how and explain why.

I have prepared a layout for a functional electric show that I believe will tell the people what they want to know and still give the manufacturer his own booth for the display of his own line, with a better chance to make a profit than he has ever had before. According to this plan, as the diagram shows, the manufacturers will all be given numbered booths around the outer wall of the armory, each to have one booth or as many as he wants and to display his goods as he sees fit. This is the appliance exposition where the people can buy any device they want and listen to as many manufacturers' arguments as they desire. But in the center section will be the functional electric show that shows what electricity can do and how it works.

How the Functional Show Works

Here in the center there will be, say, six demonstration spaces, one each for clothes washers, ironing machines, refrigerators, ranges, cleaners and dishwashers. Each of these demonstration spaces will be built with partitions, say, 12 ft. high at the back and sides and a rail in front broken for an entrance and an exit, with a rope or turnstile. It will be large enough to accommodate from twenty-five to fifty people standing. Around the walls will be one each of all the types of washers or cleaners exhibited in the show. At the back there will be a platform large enough for a lecturer and one washer, range or dishwasher for demonstration. Above each appliance there will be a placard on the wall, saying: "This is the Wishy Washer, manufactured by the Wishy Washer Company, Booth No. 46." Behind the lecture platform will be a blackboard, a rack for charts, and the clothesline, kitchen cabinet, china closet or other properties needed for the demonstration.

In each demonstration space, during each afternoon and every night, a five- or ten-minute lecture will be given every fifteen or twenty minutes to as many people as may be in the space. The lecturer for the clothes washer, for instance, will tell what makes clothes dirty and how the process of saponification breaks up the greasy binder and releases the dirt. He will demonstrate with real clothes in the washer before him, telling how the machine makes the clothes clean. He will explain that there are three types of electric washers, all good, but each having its own particular advantages. He will point to the different makes of the several types on display and state that each washer may be examined at the manufacturer's booth. "Good-by. Please leave by the exit gate so that the next group may enter promptly." And out they will go and in will come the new crowd, and anybody who is really interested in the purchase of a washer will look them over in the demonstration booth and then go to the booth where they are sold.

The same process will be followed in each of the six or more demonstration booths. And there might well be other spaces equipped as a model kitchen, dining room, bedroom, laundry, each with a lecturer.

Who will do the lecturing? The demonstrating will be done by representatives of the manufacturers, each afternoon and every evening being allotted to a fresh lecturer, these lecturers to be schooled in advance by the show authorities and provided with an outline of a talk on the function of the appliance. The speaker will not talk on the advantages of this type of machine, but while he talks he will use his own machine for demonstrating and the other will be on display. The show authorities may listen in on these demonstrations to see that nothing but a straight functional story is told, because that is what the people have come to hear.

In this way every twenty or thirty minutes in each of these demonstration spaces a new group of people will hear a new and interesting story of how to do it electrically. The crowd will flow along with a purpose and some degree of satisfaction, for they will be learning something, and a show of this kind, I believe, will sell more goods and do more educational work, with smaller crowds and added comfort, so that the general distribution of free tickets by the central-station companies to pack the house need not be carried so far. And such a functional show clearly explained in the advertising should also attract a better class of visitors, because those who really want to find out will come, knowing that they will not just be shown a mass of ingenious household devices, but will be really told how to reduce the burden of household work and expense.

Electrify the Business Shows

There is a place in every city for this kind of an electric show. It will tell the story to thousands of people and certainly should prove more resultful both for central stations and manufacturers than the old jumble show that has been slowly counted out in more and more cities. And then there is another kind of an electric show that I believe in, which is not an electric show at all, but the conspicuous electrification of the other kinds of business shows that are constantly being held in every good-sized city. Electricity may be made a feature of each one of them and year by year tell a diversified story that will have tremendous selling value.

Here is a partial list of the variety of business shows that are held in New York City every year:

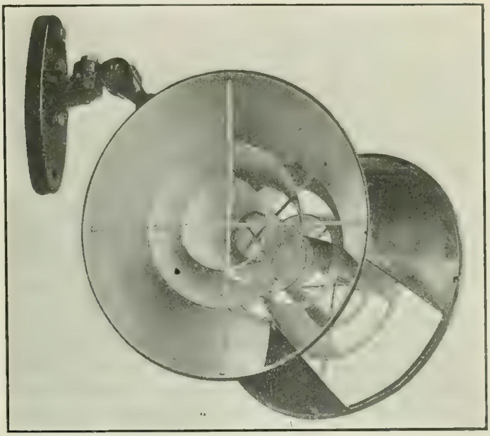
Automobile Show,
Clothing Designers' Show,
Industrial Exposition,
Poultry Show,
Business Show,
Auto Equipment Show,
Ready-to-Wear Show,
Dry Goods Show,
Motor Boat Show,
Toy Show
Flower Show,
Food Show,
Auto-Body Builders' Show,
Travel Exposition,
"Own Your Own Home" Show,
Sample Fair,
Retail Clothiers' Show,
Chemical Show,
Public Health Show,
Carriage Builders' Show,
Marine Show,
Hotel Men's Show,
Silk Show,
Cotton Show,
Printing Show,
Music Show.

There is hardly one of these in which some kind of an electrical feature would not be appropriate, each show attracting different groups of people. Among them all—plus a real functional electrical show—the story of electricity can be told to all the people in the most appealing way. And this kind of an educational influence is fundamental, since it creates an appetite for the things that electricity will do and the comforts it will bring, and will lead to the wiring of houses and the buying of appliances. For no man wants wire for itself alone or a grill because it is ingenious. It is the function of the appliance that interests and appeals, and such an interest and appeal must be the forerunner of every sale. I believe that every central-station company in America should plan to organize and conduct this year a functional electric show and to electrify each business show that comes to town.

Improved Lighting System to Be Installed on Lincoln Highway

Among the Features Which It Is Intended Shall Mark the Completed Work Are the Concentration of Light on the Roadway, Flexibility of Arrangement and Reasonable Cost of Installation and Maintenance

By H. H. BELL
Illuminating Engineering Laboratory, General Electric Company

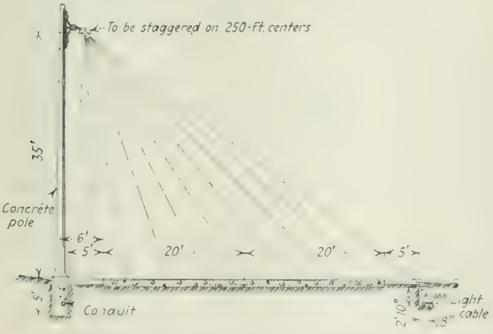


BRACKET-TYPE SERIES HIGHWAY LIGHTING UNIT

CONSTANTLY increasing night travel by motor vehicles has brought about a congestion of traffic, accompanied by an appalling succession of accidents, and one result has been a demand for improved highway lighting. Equipment intended for lighting city and village streets is not suitable. Hence a new system has had to be developed. This system has recently been successfully used in several places, notably on the Albany-Schenectady highway, and is now to be demonstrated on a 1½-mile (2.4-km.) section of the Lincoln Highway in Lake County, Ind. Preliminary plans for lighting it have been approved by the technical committee of the Lincoln Highway Association, and features of these plans will be presented in this article.

Before the system was developed it was necessary to determine the essentials of a satisfactory lighting unit. The most important were: (1) Concentration of the light on the roadway instead of diffusing it upward and over the adjoining fields; (2) a flexibility of arrangement that would make it possible to keep the light in line with the surface of the roadway under any condition, thus permitting the units to be placed on poles either near the road or some distance from it and to illuminate curves and grades, this plan necessitating a bracket that would permit adjusting the unit in both a vertical and a horizontal direction; (3) reasonably moderate cost of installation, operation and maintenance.

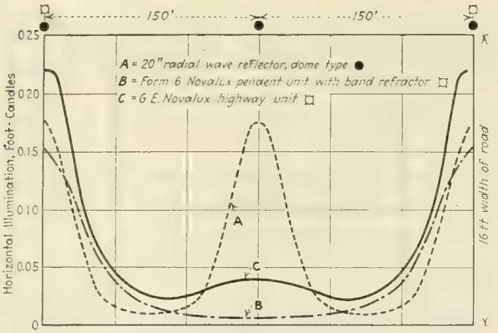
Obviously, units designed for lighting city or village streets would not answer. Their purpose is to diffuse light over a wide lateral area and in some cases upward to illuminate the front of buildings. The expense of installing and maintaining most such types contributes to rendering them impracticable for highway lighting.



TYPICAL SECTION ACROSS LINCOLN HIGHWAY

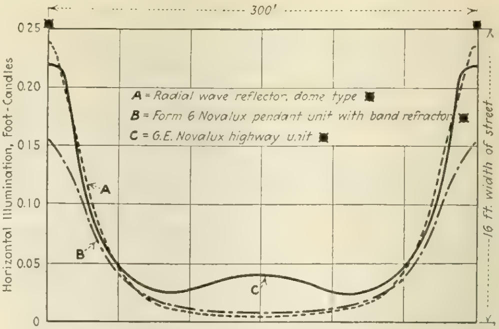
The study of the requirements involved led to the development of a highway lighting unit with a parabolic nest reflector and embodying certain new features for collecting the light rays and directing them where most needed. Described in simple terms, it consists of a nest of three reflectors, one within another, and with an opening in each, one each side of the lamp. By this means the greater part of the light that would be lost under ordinary conditions by reflecting upward and outward to the adjoining fields is collected and cast in both directions on the surface of the roadway. The rays that would escape if only one reflector were used are picked up by the inner reflectors and directed toward the roadway at an angle of 10 deg. below the horizontal. Two single parabolic reflectors to give the same effect would have to have approximately 15 ft. (4.5 m.) spread. The white reflecting surfaces of the unit reduce the glare, which might be objectionable if polished surfaces were used. This fixture also gives a much better distribution of the light rays than that given by the types of reflectors now in use along some highways on the outskirts of cities. The bracket holding the reflector is adjustable in both a horizontal and a vertical direction, making it possible to mount the fixture either on poles near the roadway or on those some distance from it and providing for turning it so as to illuminate curves or hillsides.

The Lincoln Highway lighting units are to be spaced on 250-ft. (76-m.) centers, staggered, the distance from the road surface to the light center of the lamp to be 35 ft. (10.5 m.). They are to be mounted on concrete



COMPARATIVE ILLUMINATION WITH APPROXIMATELY EQUAL WATTAGE

Illumination is calculated along the center line of the road on its surface with "Mazda C" series lamps mounted 10 ft. from the center line. With system A a 100-cp. lamp mounted 20 ft. above the road is used every 150 ft.; with system B and C 250-cp. units mounted 30 ft. are used every 300 ft. The ratio of minimum illumination to maximum is 0.062 with system A, 0.045 with B and 0.11 with C.



RELATIVE ILLUMINATION BASED ON EQUAL SPACING AND POWER

Illumination is calculated along the center line of the road on its surface. Units are assumed to be 250-cp. "Mazda C" series lamps, mounted 10 ft. from center line of road at 30 ft. above ground, every 300 ft., making the energy consumption 0.51 watt per linear foot. With system A the ratio of minimum road illumination to maximum is 0.022, with system B it is 0.045, and with C the ratio of minimum to maximum is 0.11.

standards, and these standards are to be placed along the outer edges of the gravel shoulder. The lamps will be 2,500-lumen (250-cp.) "Mazda C" series lamps, operated from a constant-current circuit supplying 6.6 amp.

The circuit is to be buried 12 in. (30 cm.) underground, using No. 8 B. & S. solid conductor with 4/32-in. (3.1-mm.) red-core rubber insulation and a 1/16-in. (1.6-mm.) lead sheath having a band-steel armor. No conduit will be necessary. Where the cable crosses the roadway, which will be in two places, it will be pulled through a 3-in. (7.6-cm.) conduit. Thus, if any accident happens to the cable at these points, it can be drawn out of the pipe without disturbing the road surface. The supply circuit will be a single loop of cable carried along one side of the roadway and brought back to the transformer on the other side.

The transformer, which may be installed at either end of the circuit, is a 7.5-kw. type "R. O." constant-current unit, the primary supply being at 2,300 volts and 60 cycles and the secondary output 6.6 amp. constant current. This transformer is entirely automatic in action and can be installed in a manhole. It is controlled by an oil switch in the substation or from an oil time switch at the transformer.

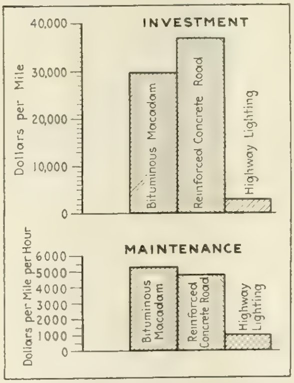
Following are some electrical data relative to the proposed installation:

Watts at lamp terminals	153
Line loss (watts)	15
Transformer loss (watts)	9
Watts at primary of transformer	177
Kilowatt-hours per 4,000-hour year per lamp	708
Kilowatt-hours per 4 000-hour year for system	31,152

The material called for by the preliminary plan is as follows:

Concrete standards complete with brackets	44
"G. E. Novalux" highway units	44
2,500-lumen (250-cp.) "Mazda C" series lamps	44
7.5-kw. type "R.O." constant current transformer	1
Primary cutouts, Cat. No. 104,227	2
Type IL series transformers, one-to-one ratio, to be installed in the base of each standard	44
No. 8 B. & S. solid conductor, 4/32-in. rubber insulation, 1/16 in. lead sheath, "CLAI" finish (ft.)	12,000
No. 8 B. & S. solid conductor, 1/16-in. rubber insulation, "T. B. W. P.", for wiring from series transformer to fixture, inside of standard, (ft.)	3,200
Time switch, oil type	1
3-in. conduit (ft.)	100

From the standpoint of the motoring public and those pedestrians who, living in the vicinity of cities and towns, use the highways for walking, efficient highway lighting is imperative if the constant succession of accidents is to be ended and the congestion of the highways is to be reduced to a point where motoring at night will be safe and comfortable. More and more motorists frequent the roads at night, and an increasing number of truck drivers utilize daylight for loading and unloading and the night for travel. Headlamps, while absolutely necessary, do not solve the problem; in many cases they complicate it by throwing a blinding glare into the eyes of approaching drivers and pedestrians. That the lighting unit described does solve it is the enthusiastic verdict of both drivers and pedestrians who have observed it. It is possible to drive a car or truck either without or with headlamps along sections illuminated by it. The roadway is brilliantly lighted and clearly defined. The glare of approaching headlamps is nullified. From the central-station viewpoint more extensive highway lighting is going to encourage and promote the extension of rural power circuits to the surrounding territory. As to expense. The improved highway-lighting system can be installed at a very small percentage of the cost of constructing the highway, and the operating cost represents a comparatively small sum per year.



RELATIVE EXPENSES OF HIGHWAYS AND LIGHTING

The maintenance includes interest at 6 per cent and depreciation on the investment amounting to 10 per cent for macadam, 5 per cent for reinforced concrete and 20 per cent for lighting equipment (highways 16 ft. wide). The investment cost of lighting equipment is based on 300-ft. spacing, "G. E. Novalux" highway unit with 250-cp. "Mazda C" series lamp 30 ft. above roadway.

It seems fair to say that highway lighting, especially for the more traveled and congested roads, is a logical and legitimate part of highway improvement.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Temperature Only One Factor Limiting Rating

To the Editors of the ELECTRICAL WORLD:

Your issue of March 18, 1922, presents under the title "A Machine Rating Should Express a Definite Limitation" one side only of a much disputed subject. It is claimed that in order properly to apply electrical apparatus it is essential to know the real, reasonable limit of capacity of motors or generators; also that the 40-degree rating selects arbitrarily one of the many ratings which could be put upon the machine instead of giving the reasonable limit at which the machine could function indefinitely without injury.

Since temperature is only one of the factors causing motor deterioration, many engineers in this country and abroad do not deem it advisable to make the maximum temperature that insulating materials will withstand the basis of motor rating. Vibration, moisture, expansion and contraction and other causes tend to shorten the life of electrical machinery. Basing their opinion on experience, the adherents of the 40-degree rating consider this as the reasonable operating limit at which rotating electrical machinery can function indefinitely without injury.

For the application engineer's purpose the limit at which motors and generators can function indefinitely without injury is the name-plate time rating. This fact is known and thoroughly understood. Any engineer knowing the application can make his allowances, and there cannot be any danger of piling one margin of safety upon another, as stated in the editorial.

The public buying electrical machinery has a right to expect, and does generally expect, overload capacity or margin in the apparatus it buys. Margin or factor of safety is used in all branches of engineering and does not in any way interfere with intelligent application. It has been pointed out before that the electrical apparatus under discussion are self-destructive as compared with other apparatus—such, for example, as gas engines—which protect themselves by "lying down" when overloaded. Hence a statement regarding overload capacity becomes a necessity.

There has been no improvement in the art of insulating motors with class "A" insulation which would warrant a change in the method of rating general-purpose motors away from the 40-degree C. rating. According to the A. I. E. E., a rating of a machine, apparatus or device is an arbitrary designation of an operating limit, while the maximum possible rating is defined in paragraph 3504 of the 1921 "Standardization Rules" of the A. I. E. E. as the machine's capacity or capability.

Does the ELECTRICAL WORLD editorial advocate making a machine's capacity its rating? We note the statement that "the 50-degree rating, which has received the indorsement of the Electric Power Club . . ., is a more definite conception of the limitation of the machine than the earlier rating of 40 degrees."

The Electric Power Club has adopted as standards:

A. A rating giving a 40-degree C. temperature rise guarantee under continuous operation with a two-hour, 25 per cent overload guarantee at 55 degrees C., to be designated as the 40 degree rating.

B. A rating giving a 50-degree C. temperature rise guarantee under continuous operation without overload temperature guarantee, to be designated as the 50-degree rating.

The Electric Power Club has indorsed the 50-degree ratings "for conditions in which the load requirements are accurately known."

The Electric Power Club's 1920 "Handbook," Reference No. 5303, Sub. 3, as modified November, 1921, reads:

> Machines having 50-degree ratings are designed for conditions in which the load requirements are accurately known and under which the machine will not be subjected to load in excess of its rating.

Standardization, in the field under discussion, has for its purpose the protection of the public against unscrupulousness. When applied to general-purpose motors, the 40-degree rating accomplishes this end better and should have preference.

JUSTIN LEBOVICI,
Engineering Department.

The Triumph Electric Company,
Cincinnati, Ohio.

The "Electric Fire" Reporters Make a Double Score

To the Editors of the ELECTRICAL WORLD:

Reportorial sleuths who delight in tracing fires to their source and three times out of four find the electrician guilty seldom let a week go by without convicting one of these culprits, but it is not often that they catch two electrical firebugs in one issue of a newspaper. Yet in the New York *Times* for March 30 there appears on one page this slightly hedged indictment:

> Fire *starting apparently from a short circuit* between the walls of the Astor Theater and the Gaiety Theater Building, Broadway, between Forty-fifth and Forty-sixth Streets, last evening at 8 o'clock, was fought by members of the fire department with the assistance of stage folk, while the dense and excited theater crowds in Times Square looked on,

while a few pages further along this bolder accusation is made:

> QUEBEC, March 29.—The famous shrine of Ste. Anne de Beaupré was destroyed today by flames, with a property loss of $1,200,000. *Defective wiring* ignited a pile of crutches cast down by pilgrims, who, after kneeling in the basilica, had risen, announcing themselves cured. Soon the church and the monastery of the Redemptorist Fathers were aflame, and for a time the whole village was threatened.

Thus the theater and the church are alike the victims of the universal malevolence of these persistent incendiaries. In the theater, where they have to deal with men of the world, they hide their fire-starting devices "between the walls," but in the church, where simple piety suspects no harm, they brazenly coil their defective wires around the pile of crutches near the altar. Can the witness be false? If so, who will detect the detectives? Perhaps the Society for Electrical Development, which has done good work along such lines, will put its own investigators on their trail and clear the accused even though the verdict has been rendered.

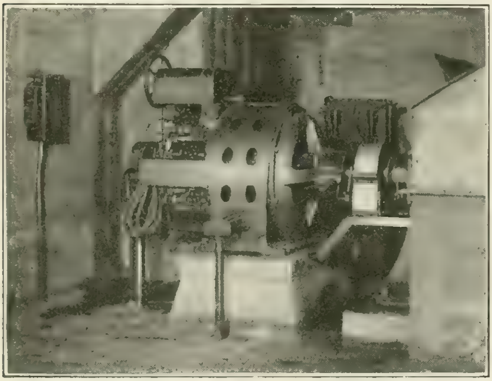
Brooklyn, N. Y. FRANK W. CHASE.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Variable-Speed Alternating-Current Motors for Auxiliaries

IN THE application of the alternating-current motor to auxiliary drive one of the chief problems has been the development of satisfactory equipment for variable-speed service. The direct-current motor until recent years has been used to a great extent for this service, principally because of its very satisfactory inherent characteristics for such application. The development of the alternating-current motor to replace satisfactorily the direct-current motor for variable-speed service has presented many difficulties and has so far included the following types of equipment:



BRUSH-SHIFTING MOTOR CONTROLLED BY NEAR-BY PUSH BUTTON DRIVES FORCED-DRAFT FAN

(a) The constant-speed motor with some form of mechanical speed-changing device or the multi-speed pole-changing motor with or without mechanical speed-changing device.

(b) The wound-rotor type of motor with external resistance.

(c) The brush-shifting commutator type of motor.

Four-speed motors of the pole-changing type, driving stokers through two-speed gear boxes, have been operating satisfactorily for some years in several generating stations of the Public Service Electric Company.

The wound-rotor type of motor has been extensively used, but has the disadvantage of very poor efficiency and low power factor when operated at speeds much below maximum.

The brush-shifting motor, while only very recently applied to station auxiliary drive, has been used for several years for mine fan service and for some industrial applications. This motor is of the series type arranged to give variable speed by brush-shifting and is more efficient for such service than the wound-rotor type, particularly when the average running speed is much lower than the maximum. Its cost, however, is considerably higher than the wound-rotor type, and it has the disadvantage of a commutator.

Brush-shifting motors have been in service for fifteen months for forced-draft-fan drive in the Springdale station of the West Penn Power Company and are reported to be operating satisfactorily. The accompanying illustration shows one of these motors installed at this plant. In the Hell Gate station in New York 350-hp. motors of the brush-shifting type have been installed for forced-draft-fan drive, and their operation will be watched with much interest.

This information was embodied in a recent paper read by H. C. Albrecht, electrical engineer, connected with the Philadelphia Electric Company, before a combined meeting of the New York Section of the American Institute of Electrical Engineers and the Metropolitan Section of the American Society of Mechanical Engineers.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Ready Method of Detecting Moisture in Transformer Oil

THE following approximate method of detecting the presence of moisture, either entrained or separate, in transformer oil has been found highly valuable to the writer because of the simplicity of the equipment necessary and the ease with which the tests may be performed in the absence of the more elaborate testing transformers.

A sample of the oil to be tested is drawn and placed in a clean flat-bottomed metal pan, such as a pie pan, and allowed to remain several hours undisturbed to permit the excess of moisture, if present, to separate out and collect at the bottom. If such an excess does exist, its presence can be readily detected in the small water beads that collect at the bottom. A hot blowtorch flame is then played on the bottom of the pan, when, if entrained moisture is present, a frying or crackling sound will be heard as soon as the oil has become thoroughly warm. This results from the formation of minute steam bubbles that can be seen rising to the surface. Some idea as to the amount of moisture present can be obtained by observing the quantity of bubbles and the intensity of the crackling sound. Failure of the bubbles to put in their appearance may be considered a good indication that the oil is fit for service, without further filtration, except possibly on high voltages, in which case a testing transformer should be used.

A word as to obtaining the test sample will not be amiss. With practically all transformer tanks other than those in which the oil has previously been well filtered and the tank sealed and provided with breathers, some traces of moisture will be found collected usually in the bottom around the drain valve. It is therefore suggested that oil be drawn from the tank until visible moisture beads are no longer in evidence. The contents of the tank should then be allowed to settle from several hours to a day before a test sample is drawn. Such a sample will more certainly indicate the entrained moisture, which is the important thing, as the presence of very small quantities of water will greatly lower the insulating value of the oil and likewise its puncture point.

L. H. Hardin,
Electrical Engineer.

Mees & Mees, Consulting Engineers,
Charlotte, N. C.

Closed-Circuit Ventilating System for Cooling Turbo-Generator

To prevent generator fires arising from the deposition of dust in the ventilating ducts, the closed-circuit system of generator cooling has been adopted for the Fairmont (W. Va.) station of the Monongahela Power & Railway Company, the same air being used over and over again. This system was considered necessary because in the coke-oven and blast-furnace districts of Pennsylvania and West Virginia the atmosphere carries an unusually large content of sooty byproducts of the ovens.

To obtain an idea of the volume of impurities encountered in this district consider the air used in cooling a generator of 25,000-kva. capacity. The generator fans draw 50,000 cu.ft. of air per minute, which, taken over a period of twenty-four hours, weighs approximately 5,500,000 lb. About two cubic feet of impurities would be carried in this amount of air. With the old scheme of air washing, using a continuous blast of air from outdoors, if the washer removes 98 per cent of the impurities, three or four cubic feet of dirt would pass into the generator in three months of operation, much of which would be deposited in the ventilating spaces. These figures are borne out by experience gained in cleaning generators equipped with older schemes of air washing. This accumulation of dirt is very often the cause of generator fires.

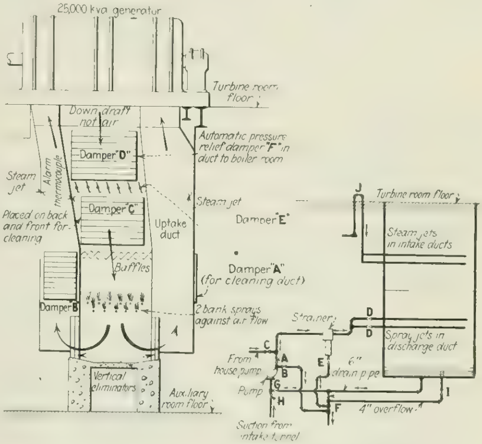
In the installation of the air-cooling apparatus, built by the Spray Engineering Company, in this plant the designers placed the greatest importance on preventing the accumulation of dirt as a means of increasing the reliability of the unit, which has a capacity of 25,000 kva. The cost of pumping cooling water for the sprays and the loss of generator heat, which is not recovered, is of minor importance if fires can be prevented. Consequently it was decided to use a closed air circuit, simply cooling and humidifying and continuously repassing only one volume of air through the generator. No outside air with its content of dirt is used, and obviously the cooling air can pick up no new dirt after passing through the sprays.

OPERATING INSTRUCTIONS FOR AIR AND WATER SYSTEMS FOR TURBO-GENERATOR COOLER

Case	Operation	Dampers Open	Valves Open	Notes
I.	Normal air recirculates	*E*	*A, D, F, H, I*	Uses no outside air
II	Emergency — waste air (high water), water recirculates.	*C, E*	*A, D, G*	Used in flood periods, which rarely occur
III.	Emergency same as normal, but (high water) pump against head......	*E*	*B, C, D, G*	Dampers normal, but valves and pumps differ
IV.	Emergency - waste air and water (high water)...........	*C, E*	*B, C, D, G*	For very hot weather, both air and water hot
V.	Emergency operation stops at (fire) operator's convenience.........	None	*J*	Damper *F* may open in case of fire; desirable but not essential to close *E*
VI.	Emergency—repair and cleaning, *C* or *D*...............	*A, B, C, D* or *F*	*F, I*	Short duration
VII.	Special to control (room atmosphere same as VI.).......	... .	Depends on conditions	

The relative positions of the dampers, baffles and air passages are shown on the left of the accompanying illustration. A long period of thorough contact between the hot air and mist is secured by arranging the sprays to discharge against the flow of air in a vertical direction, thus increasing the efficiency of heat removal and rehumidifying. The arrangement of eliminators in a vertical position is the most effective possible. Above the sprays a series of baffles is used to prevent a jet of water from reaching the generator laminations directly above, in case of breakage of a spray head.

In removing the heat from the air that has been carried away from the windings and laminations water is normally wasted to the condenser water-discharge tunnel. At times of high water the circulating pump of the cooler is used to pump against external head, since the washer is installed below the flood level, and the supply of cool water is taken from the house-service system instead of being pumped from the condensing-water intake. The temperature of the air discharged from the generator is measured by a Brown indicating thermometer, the bulb being placed, as indicated in the illustration, in the discharge duct. An alarm contact automatically closes if the temperature reaches a dangerous limit. This, with the switchboard temperature indicator, is depended on to warn operators of any unusual conditions. The alarm attachment may be easily reset for checking at normal temperatures to ascertain that it is operating properly.



CLOSED-CIRCUIT COOLING SYSTEM FOR GENERATORS IN SOOTY DISTRICTS PREVENTS DIRT FROM ENTERING MACHINES

Left—Air-cooler arrangement showing locations of dampers. Dampers *A*, *B*, *C*, *D* and *F* open to atmosphere for cleaning, repairing, etc. *E* is across the discharge duct to prevent circulation of air during an emergency. In case of steam being used for fires, damper *F* automatically opens to relieve internal pressure.

Right—Water-piping system for cooling air. Valves *A* and *D* control sprays. *B* is used for discharge during high water. *C* is for emergency. *E* is a quick opening to clean strainer. *F* is a 6-in. drain closed during flood. *G* a 6-in. drain opened to use pumps against head. *H* is in the pump suction line. *I* is a 4-in. overflow to sewer, closed in flood to prevent back water, and *J* is a steam valve on operating floor for fire control.

It is believed that the chief cause of fires has been overcome by this arrangement, but should any condition cause a fire, the means of quenching it are much more effective in this type of cooling. This is because the volume of air and oxygen to support a fire is limited to that of the ducts alone and would soon exhaust itself. In the systems using a continuous fresh supply of air the fire is augmented rather than stopped until the operator's attention is attracted and the air-washer inlet dampers are closed.

In addition to the small supply of oxygen, steam inlets have been provided further to quench the fires. In some previous installations of steam fire prevention the jets caused steam at 650 deg. Fahr. or more to impinge directly on the end turns of the generator coils. In this installation it was considered better practice to place the jets as far down in the ducts as possible and allow thorough expansion and reduction of pressure and temperature before the steam could reach the coils.

These steam jets are controlled by hand only, since the high temperature alarm would give warning to operators in time to ascertain conditions. Higher than normal temperature might be caused by overload or loss of water in the air-cooling system without the existence of a fire. In case the steam should cause greater than safe pressure in the air ducts, a set of dampers will relieve the pressure, automatically opening against a counterweight, releasing smoke, steam and gases into the boiler-room basement.

C. R. Beardsley,
Electrical Engineer.
Fred T. Ley & Company, Inc.,
Springfield, Mass.

SOME FEATURES OF THE AIR-COOLER DESIGN AND OPERATION

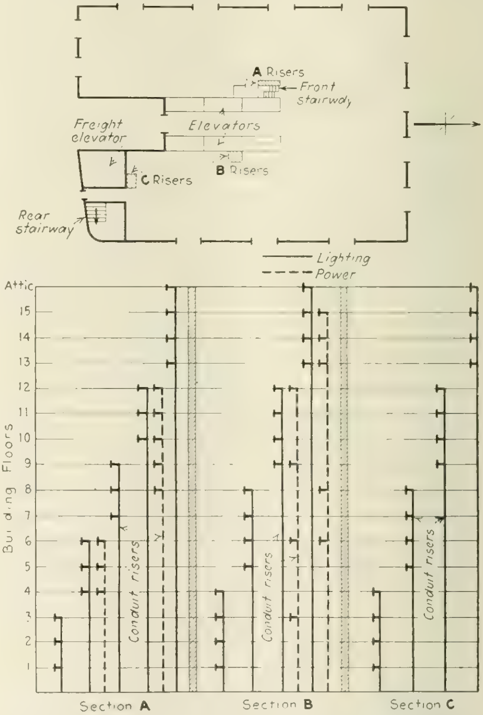
Pump capacity at 85 ft. head (gal. per minute)	370
Motor rating (hp.)	15
Pump discharge (in.)	4
Rise in water temperature (deg. Fahr.)	14
Temperature air less temperature water leaving cooler (deg. Fahr.)	7
Number bronze nozzles	230
Cooling chamber dimensions	10 ft. x 8 ft. 7 in. x 7 ft.
Casing (gage)	12
Eliminators (gage)	20
Tank (gage)	10
Door dimension	18 in. x 30 in.
Maximum temperature river water approximately (deg. Fahr.)	83
Temperature water leaving cooler (deg. Fahr.)	97
Temperature air leaving cooler (deg. Fahr.)	104
Temperature rise in generator (deg. Fahr.)	45
Temperature air leaving generator (deg. Fahr.)	149

Value of Drainage and Separated Feeders Demonstrated During Fire

Certain types of engineering construction proved to be very effective in maintaining electric service and in minimizing damage to electrical equipment during the recent Burlington Building fire in Chicago. The features were: (1) Separation of distribution feeders into groups feeding different sections of the building, (2) adequate drainage facilities, and (3) entire inclosure of all elevator shafts.

The distribution feeder system consists of three sets of risers. The main set, installed directly behind the west elevator, furnished light for the west and front sections of the building, each riser serving three consecutive floors in this section. The second set of risers was situated on the east side of the elevators, each riser serving four consecutive floors in the front and east section of the building. The third set, in the back of the building, supplied current for the south part, four floors per riser. With this separated distribution it was much easier to maintain service during the fire than it would have been if all feeders had been grouped in one tower.

After the fire it was found that the fire had had varied effects on each of three distributing boxes for each floor above the ninth. While the east and south boxes were in bad condition on a few floors, the majority escaped with merely having the distributing panels warped. However, it was found that the main feeder panel on each of the fifteen floors had been subjected to more intense heat than the other two, nearly all of these panels having been distorted and damaged so that replacements are necessary. All the insulation on the wires directly behind these panelboards was completely burned off, and inspection of some of these wires taken from the conduit below showed that the heat had penetrated even that far.



THREE SEPARATE SETS OF RISERS, EACH FEEDING A DIFFERENT SECTION, MAINTAINED SERVICE DURING FIRE

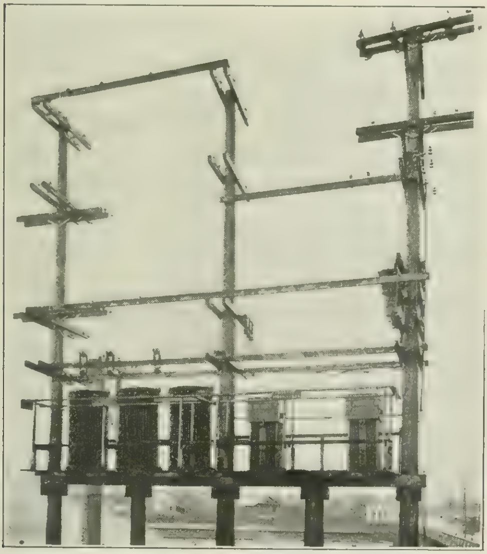
The main reason why the engine room of the Burlington building was able to maintain service during the fire was that beneath the sub-basement there lay an abandoned water tunnel which had a diameter of about 7 ft. When the great flood of water began pouring into the sub-basement from the fire hose, it was necessary to siphon the water into a draining well which extended down to the abandoned water tunnel and then pump the water out into the sewer. Without this tunnel it would have been impossible to maintain service, since flywheel generators were used and once the water had run into the flywheel pits it would have short-circuited the dynamos.

The importance of having inclosed elevator shafts was also emphasized by this fire. Since all the elevator control equipment was placed directly above the elevator shafts, it would have been impossible to save this equipment if the fire had once broken through the elevator shafts. As it was, the fire only bulged in the elevator-shaft doors, and service was available the next morning up to the eighth floor.

This information was contributed by J. O. Batzer, chief engineer of the Chicago, Burlington & Quincy Railroad. FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Pole-Top Substation That Serves City Distribution

FOR supplying 2,400-volt distribution circuits from 11,000-volt primary feeders and loads of from 500 kva. to 800 kva. the Northwestern Electric Company has selected a more or less standardized design of outdoor substations which are erected on poles. The photograph shows one such substation completed to nearly its ultimate capacity, though space is still left for the addition of one more regulator. The top position on the poles is occupied by the 11,000-volt primaries, and a hand-operated disconnecting switch is arranged for sectionalizing them. The transformers are connected to the 11,000-volt feeder through fuses of the disconnecting-switch type. Outdoor-type current transformers are connected between the transformer secondaries and the regulators, and 2,400-volt potential transformers are mounted on one of the poles. A by-pass connection, with the necessary disconnecting switches, is provided to shunt the regulators when desired. If meters are wanted, these are placed in wooden boxes for protection from the weather and used in combination with the type of standard outdoor current and potential transformers necessary.



OUTDOOR SUBSTATIONS OF THIS TYPE SERVE CITY LOAD

E. F. PEARSON,
Engineer.
Northwestern Electric Company,
Portland, Ore.

Is High-Tension Outdoor Metering Always Desirable?

THERE are some angles of the problem of outdoor metering of electric service which appear to be worthy of considerable attention. If it were not for the expense entailed in the maintenance, and to some extent the first cost, high-tension metering would be preferable to any other, in view of the fact that all losses are so measured and that possible neglect by a consumer in not disconnecting his station when it is not in service would be in a measure paid for by the consumer. However, burn-outs caused by this neglect would not be paid for.

High-tension metering sets, as well as other metering sets for that matter, are subject to burn-outs, but in the case of high-tension metering sets the replacement of the burned-out parts is generally quite costly and delays in making replacements are greater than in the case of other metering equipment. Moreover, if it is attempted to carry spare metering sets, an outlay for additional equipment is involved, in addition to the extra cost of transporting such equipment to the places where it is needed and of installing it. All these factors must be taken into consideration.

COSTLINESS OF REPLACEMENTS MAIN OBJECTION TO HIGH-TENSION OUTDOOR METERING

In the case of high-tension metering where individual current and potential transformers are used, an objection is apparent in the costliness of replacements. Of course, there is also the investment tied up in spare current and potential transformers. It is the writer's opinion that high-tension metering equipment is subjected to greater strain from lightning than is low-tension equipment, and for this reason burn-outs are more likely to occur. If they do occur, the likelihood of turns in the current transformers becoming shorted is greater than in the case where the metering is done on the low-tension side.

If the metering is done on the low-tension side of the transformer, a very neat installation can be made by using a small house lined with sheet asbestos and mounting therein the current and potential transformers and the meter. This makes an installation that can be mounted at a point near where the secondary leads leave the transformers and one that is virtually fireproof so far as fire originating internally is concerned and is weatherproof so far as the protection of the meters and the other equipment is concerned. In addition to this, the cost of the low-voltage current and potential transformers is considerably less than that of high-tension metering transformers, especially if the latter are of weatherproof design.

Another advantage of low-tension metering equipment is that short secondary wiring may be obtained because of the close proximity of the current and potential transformers to the meter itself. In the case of high-tension metering it is always necessary, and especially so in outdoor metering, to mount the transformers at a considerable elevation and then in order to make the meter accessible bring the leads through conduit from the metering transformers down the pole from the crossarms to the house or cabinet containing the meter itself.

E. C. FERREE,
Electrical Superintendent.
Trinidad Electric Transmission, Railway & Gas Co.,
Trinidad, Col.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Making Safety Regulations Acceptable

Suggestions for Drafting Rules by E. L. Milliken, Assistant Manager Blackstone Valley Gas & Electric Company, Before New England Division, N. E. L. A.

EXPERIENCE has shown that the manner of expressing safety regulations has an important influence upon their effectiveness with public utility employees. No one set of safety instructions can be of universal application, and conditions in the industry are so continually changing that the rules of one company today will not be sufficient for tomorrow. In drafting a set of rules, however, a few fundamentals may be laid down which will be of value to those compiling or revising existing instructions. In the work which the sub-committee on safety rules has been doing, these points have stood out impressively:

1. The term "rule" is psychologically wrong. No one minds being instructed, but the worker today, in general, objects to having to follow a rule. Therefore the term "Safety Instructions" or "Safety Code" is better.

2. Safety instructions should not be confused by being incorporated as part of the general operating instructions of any company. Rather let them be drawn up as a separate book or pamphlet.

3. As far as possible, they should be written in the vernacular of the particular department to which they are to apply. Too often safety instructions read more like a page from some legal document.

4. Let them be written in the affirmative as far as it is possible, that is, point out what should be done rather than what should not be done. There is a certain innate "cussedness" in human nature which many times manifests itself by one doing the opposite when told not to do something.

5. Particular attention should be paid to the printing and arrangement. The rules for any one department should be segregated and considered in a separate section of the instructions. Sub-headings should be liberally employed and the rules applying to that particular sub-heading grouped under it. By illustrating certain rules there would be evinced a tendency to humanize our safety instructions.

6. Keep out any extraneous rules that do not apply to your company. A smaller number of carefully chosen rules, rigidly enforced, is better than dozens of ill-considered instructions that are ignored.

7. Make every effort to include no instructions that cannot be enforced. Some employees are very critical and are always on the lookout for such slips, which they use to discredit the entire set of instructions.

8. In drawing up a code of instructions be certain that all classes of employees are comprehended.

9. No code of instructions would be complete unless there is included in it the N. E. L. A. instructions for "resuscitation."

10. After the instructions have been completed let them be thoroughly indexed.

11. Amend the instructions as often as changes in the art, additions to equipment or growth of the company warrant. When equipment with which employees are not familiar is to be added to plant, have the new instructions covering the use of this equipment issued before the equipment is placed in service.

12. In amending the instructions from time to time let the entire staff co-operate in compiling the changes.

13. Let it be known that suggestions from any employee as to the workability of existing instructions or the desirability of new ones are always welcome. When such suggestions are made, make certain that the employee making them is finally advised of the disposition of his ideas.

14. Keep a "weather eye" out for additional worth-while rules gleaned from the experience of other companies.

15. After instructions are once issued, it is important to keep everlastingly at the enforcement of them.

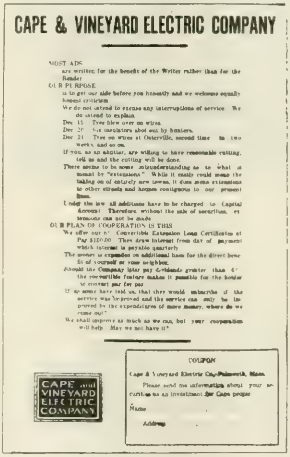
16. Some sort of periodic "follow-up" of safety instructions should be prescribed. This may take the form of periodic examinations of individual employees as to their knowledge of the rules or of systematic talks by officials.

17. Enforcement of safety instructions will be easier if employees are taught to realize that the instructions are primarily for their protection, rather than for the protection of the company. The company can replace material and even men lost or injured through accident, but the man cannot replace that which he himself has lost.

18. Safety instructions should be tied in with safety bulletins when an accident occurs. Immediately a suitable bulletin should be posted directed against this type of accident, and along with each bulletin may well go a copy of the instruction out of the instruction book which, if it had been observed, would have prevented the accident.

19. Let the public know that you have a code of safety instructions and that its purpose is to protect life and property, not only of employees but of the public as well.

Service Interruptions as an Object Lesson for Customers



CAPE & VINEYARD ELECTRIC COMPANY

MOST ADS
are written for the benefit of the Writer rather than for the Reader

OUR PURPOSE
is to get our side before you honestly and we welcome equally honest criticism

We do not intend to excuse any interruptions of service. We do intend to explain.

Dec 15 Tree blew over on wires.
Dec 20 Six insulators shot out by hunters.
Dec 21 Tree on wires at Osterville, second time in two weeks, and so on.

If you, as an abutter, are willing to have reasonable cutting, tell us and the cutting will be done.

There seems to be some misunderstanding as to what is meant by "extensions." While it easily could mean the taking on of entirely new towns, it does mean extensions to other streets and houses contiguous to our present lines.

Under the law all additions have to be charged to Capital Account. Therefore without the sale of securities, extensions can not be made.

OUR PLAN OF COOPERATION IS THIS

We offer our 6% Convertible Extension Loan Certificates at Par $100.00. They draw interest from day of payment which interest is payable quarterly.

The money is expended on additional lines for the direct benefit of yourself or your neighbor.

Should the Company later pay dividends greater than 6% the convertible feature makes it possible for the holder to convert par for par.

If as some have told us, that they would subscribe if the service was improved and the service can only be improved by the expenditures of more money, where do we come out?

We shall improve as much as we can, but your cooperation will help. May we not have it?

CAPE and VINEYARD ELECTRIC COMPANY

COUPON

Cape & Vineyard Electric Co., Falmouth, Mass.

Please send me information about your securities as an investment for Cape people

Name

Address

CAPITALIZING SERVICE INTERRUPTION

THAT tree trimming is a necessary adjunct to good service is the opening point displayed to advantage in the advertisement of the Cape & Vineyard Electric Company, Falmouth, Mass., shown herewith. In connection with a brief discussion of the importance of tree cutting the company turns the reader's attention to line extensions, their definition and how they can be financed. The advertisement concludes with an invitation to the public in the territory served to investigate its securities, the participation of the public in the development of the company and of the territory through improved electric service being designated as a plan of co-operation. Eugene Carpenter, Falmouth, Mass., is treasurer of the company.

A Tonic for Fair Weather Salesmen

WHENEVER it rains or snows or the sun gets a little warmer than usual every central station commercial manager knows that some of his salesmen will turn in a "weather report" instead of a sales report for the day's work. As a matter of fact, inclement weather offers the salesman his best chance to find people at home and willing to give him time to explain his proposition. One of the best arguments in favor of rainy-day selling appeared recently in the "Fuller Bristler" and can profitably be studied by every central station salesman. It says:

> Have you ever gone skating in zero weather, played baseball or golf in the rain, gone swimming on a chilly day, or blistered yourself on a sun-baked beach? Haven't you put up with many discomforts in pursuit of pleasure? And haven't you, regardless, always maintained that you thoroughly enjoyed yourself? Of course you have. We all have. And if a man willingly put up with such discomfort in pursuit of pleasure, is there any real reason why he should not put up with the same things in business?
>
> Still many who would willingly play ball in the rain, seek shelter under the same conditions when in pursuit of business. The rainy, sloppy, cold days are the best days in our business. Here are seven points for the outside salesman to consider.
>
> 1. During better days, work your scattered territory or streets that are muddy or bad.
> 2. Save your "close together" territory with the good sidewalks and save your apartment houses for bad weather days.
> 3. Never track mud, snow or water into people's homes.
> 4. Get the "overshoe habit." Just a lightweight pair. Begin kicking them off as the lady comes to the door. This shows her by a positive suggestion that you figure on coming inside, and it shows her that you will not track her carpets.
> 5. Wear a lightweight overcoat, raincoat or cravenette. Drop it off your shoulders as soon as you enter. Don't let a wet coat drip on her floors, either.
> 6. An umbrella is not bad, but many umbrellas are lost and not easy to handle. Better than nothing, but a light coat is better.
> 7. Wear clothes that really protect you. Good warm gloves, good stout shoes, etc. Be prepared.
>
> Remember, rain, sleet, snow, slush, zero weather are but little obstacles on the road to success in this business. If you cannot overcome the small obstacles you will never overcome the larger ones that stand in your way of big success.

A Complete Demonstration of Central-Station Service

ONE of the best examples of showing the public the actual workings of central-station service comes from the Lee Electric Company of Clarinda, Iowa. The picture shows the Greater Clarinda Community Club as guests of the company at dinner and an evening's entertainment of the club members. Following the dinner and a general jollification at the city's leading hotel the guests were taken through the company's power plant.

After leaving the power plant the office of the company was visited, where illustrations of the daily business routine were given. The cashier and the meter clerk demonstrated various operations, among them the procedure when an applicant for service calls at the office, an actual demonstration being given of the customer's application at the desk, the signing of contracts, the making of a deposit to guarantee payment of bills and making of connection tickets. All functions were explained as the different steps of the work were shown. A representation of a customer coming in to ask for discontinuance of service was also given, the supposititious customer bringing his contracts to show a deposit with the company, which was refunded after the meter had been read and a bill rendered. Among other phases of the work shown were complaints registered with the company.

ENTERTAINMENT OF CLARINDA COMMUNITY CLUB

This demonstration by the Lee Electric Company of its work in serving the public has gone a little farther than most of the civic entertainment programs which have been conducted by central-station companies. Much of the publicity thus far has been given to the physical aspects of the property without any consideration of the great volume of routine work which is necessary in rendering 100 per cent service.

What Other Companies Are Doing

Hartford, Conn.—As a result of studies of lighting installations on its system during 1921, the Hartford Electric Light Company added 463 kw. in increased lamp sizes in existing installations and in increased intensities in new installations above those which would have been used had no surveys of this kind been conducted. Of this increase, 66 per cent was in office buildings, 16 per cent in factories and 18 per cent in stores.

Minneapolis, Minn.—Applications for light and power service received by the Northern States Power Company during 1921 were 10 per cent greater than for 1920, the best previous year. In Minneapolis alone 7,206 already-built houses were wired for electric service and connected to the lines of the company. More than 37,000 electric household appliances of all kinds were sold in Minneapolis—representing a 15,000-kw. load.

Boston, Mass.—Bill-payment agencies in localities remote from the stores and offices of the Edison Electric Illuminating Company of Boston are being established on the premises of certain electrical contractor-dealers, who handle the accounts on the basis of a small commission. These establishments carry attractive stocks of electrical appliances, and in one outlying town forty customers daily settle their service bills.

Oklahoma.—When the towns of Billings and Lamont were connected to the transmission lines of the Oklahoma Gas & Electric Company the city officials of the former carried out an appropriate celebration by suitably decorating the antiquated municipally-owned plant with a bow of black crape as the current was turned on.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Fuse Problem Common to All Who Make or Sell Appliances

By H. T. Bussman
Vice-President Bussman Manufacturing Company, St. Louis

ALL manufacturers and jobbers of lighting equipment and household appliances have a common interest and a common problem in the plug fuse. Times have changed with the conditions of the average residence installation, and more consideration of this point and more co-operation in meeting the situation will be exceedingly profitable.

Twelve years ago nine out of ten plug fuses were used on new installations. But the increasing popularity of heating and power devices has reversed the conditions entirely, and today but one fuse out of ten goes into new work and nine are furnished to the householder for the replacement of blown fuses. When there were only lamps in the home few fuses blew. The large variety of appliances now in habitual use by persons who give scant attention to whether circuits are overloaded or not has increased the consumption of fuses very greatly. It has also increased the annoyance of their use, and unless something constructive is done to make them easier to buy and easier to replace, the fuse is going to hold back materially the growing popularity of electric comforts. The public has not been educated to an intelligent understanding of why fuses blow and what to do when they do blow. There has been no means at hand for either the central-station company or the dealer to give to the consumer information on fusing that will be available for reference when a fuse blows and show how to replace a fuse quickly and easily and why fuses of the wrong size or pennies under the plug should not be used. Plug fuses have also been carelessly made with dark interiors and still darker mica windows that have made it impossible to see which fuse is blown. And no convenient way has been evolved until recently of selling plug fuses in such a manner that the customer will be influenced to purchase a reserve supply and be ready to replace blown fuses at any time, with the minimum of annoyance and the least possible delay in the use of the appliance affected.

Out of trouble with blown fuses a very serious and extensive resistance to the use of appliances and the free enjoyment of the comforts of complete electric service gradually developed. The leading fuse manufacturers, recognizing their responsibility, have met the situation in a most effective manner by making fuses with white interiors and clear windows, so that locating the blown fuse is facilitated, and by putting an end to the old cracker-barrel basis of selling. They have introduced an element of service in the merchandising of fuses by putting them up in cartons which bear full information as to why fuses blow and understandable directions as to what to do when fuses blow. Varying numbers of fuses are packed in these unit cartons by different manufacturers. I believe that at least ten fuses should be sold at once, because the average residence, we find, uses ten fuses annually and because ten fuses can be sold for a sufficiently small sum to make it worth while for the householder to have an adequate reserve. It helps the dealer to elevate his fuse business to a basis that is profitable for over-the-counter selling. It will materially reduce the fuse-trouble expense of central-station companies that do not renew fuses gratis.

The fuse manufacturers have thus provided the way to relieve, if not overcome, the annoyance of blown fuses in the home. It remains to bring into universal use the habit of buying fuses in quantity in a carton that tells clearly what to do when a fuse blows and how to do it. I believe that every appliance manufacturer and jobber and every central-station manager should consider it important and profitable to use his utmost influence with all his dealers to establish as standard practice the selling of clear windowed fuses in these educational cartons.

Time He Was Bracing Up

BUT, MA! I'M AN AWFUL SICK GUY!
YOU GET UP OUT OF THAT AN' SHOW SOME PEP! YOU ONLY THINK YOU ARE SICK!
MA COMMONSENSE
AMERICAN BUSINESS

Copyrighted 1922, by The Star Company

A HOMELY suggestion for the man who thinks business is bad. Conditions are improving right along, but every one must go after his share himself. It is not going to come in voluntarily and seek you out.

Composite Data on Cost of Doing Business in Large Stores

COMPARISONS of the cost of selling electrical material with the costs of other merchandising businesses are interesting in determining the relative conditions. The table shows the cost of doing business represents a composite figure confidentially secured from twenty-five of the largest department stores in the

United States, constituting a chain reaching across the continent. These figures were taken from stores doing a business of $25,000,000 per annum and are fairly representative of an average of the different items named. The figures afford an easy method of comparing the various items of cost of marketing electrical merchandise with the same costs in other successful businesses.

DEPARTMENT STORES' COST OF DOING BUSINESS

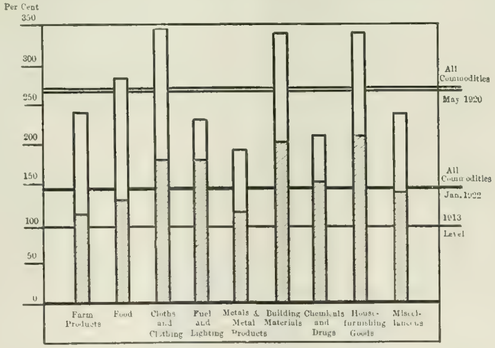
	Per Cent of Gross Sales
Rent	1.220
Salaries, including owners'	8.380
Advertising	3.930
Heat and light	1.100
Deliveries	2.820
Supplies	0.940
Insurance and taxes	0.838
General expenses	2.110
Depreciation	0.750
Bad debts	0.197
Total	25.285

A Comparison of Prices in Nine Commodity Groups

THE accompanying chart shows the relative price levels of nine groups of commodities for May, 1920, and January, 1922, based on statistics prepared by the Bureau of Labor. The chart brings out several points which need no detailed comment, but the pronounced differences in relative levels among the groups on each of the two dates are significant. At the peak of prices the cloths and clothing, building materials and housefurnishing goods groups were more than 200 per cent above pre-war figures. On the other hand, in spite of the very high general level, metals and metal products were only 93 per cent above their 1913 level, although far higher prices were reached by this group during the war.

Differences in relative levels at the present time are also shown. The tremendous decline in prices from the peak to current levels is also indicated by the chart The January, 1922, index number for "all commodities"—148—is as low as the index has gone during the present period of declining prices.

Relative Commodity Prices 1920-1922



THIS chart shows that the general price level reached its highest point in May, 1920, when the "all commodities" index number stood at 272. The full length of the upright bars indicates the relative prices of the respective groups at the high point while the shaded portion indicates their relative levels in 1922.

The relative prices plotted on the chart are as follows:

	May, 1920	January, 1922
Farm products	244	116
Food	287	134
Cloths and clothing	347	183
Fuel and lighting	235	183
Metals and metal products	193	117
Building materials	341	202
Chemicals and drugs	215	159
House-furnishing goods	339	214
Miscellaneous	246	146
All commodities	272	148

The Jobber Must Produce Volume Sales of Specialties as Well as Staples

BY A JOBBER

ONE thing that a great many men engaged in the distribution of electrical materials seem to overlook is the fact that to function economically the wholesaler and the jobber must provide the manufacturer with a volume of business sufficient to make his warehouse really decrease the cost of distribution over some other method of shipping and stocking. This clearly is the jobber's function in the sale of staple lines, and it must be no less so in the sale of such specialties as washing machines, vacuum cleaners and the like. The jobber must produce a volume of business that justifies his warehouse as a factor in the selling of these commodities or he cannot hope to be a permanent agent in the distribution of appliances.

To do this the jobber will be compelled to cast about for new and larger retail outlets for electric household appliances than are provided at the present time by the stores of the central stations, contractors and dealers, and this may mean that he must definitely develop the department store, which is already established with a large housefurnishing business. The obstacle to such an outlet, of course, lies in the fact that the department store is not in a position to service such appliances and that it is desirable that electrical men rather than outsiders may maintain the service contact with the householder who buys electric labor-saving appliances and should be guided to a proper and satisfactory use of the machines. There seems to be a way to reconcile the situation, however, by arranging a contract between the jobber and the department store or a local contractor and the department store whereby the entire service function for all appliances sold by the store shall be carried out by the electrical men. It has been done in a number of cases and proved entirely practicable, for the big store has the contact with the home and can sell many more appliances than a small shop can. But to sell successfully it must be schooled and organized and supported by a service staff under the direction of an electrical man.

The jobbing of appliance specialties is not the same process as the jobbing of staple lines. There is a very clear distinction, and it must not be forgotten that with either the staple or the specialty the jobber must produce a volume of sales or he is not doing the work that he is supposed to do. If the jobber is to be established as a prosperous and successful distributer of large appliances, the larger outlet must be created to insure the adequate volume of sales.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Flux Distribution in Air Gap and Teeth of Dynamos. —ALFRED STILL.—This article deals with flux distribution from the standpoint of fundamental laws and principles, avoiding many of the empirical methods used by practical men. The subject is dealt with under headings concerning permeance of the air paths, the air gap, and the conditions in highly saturated teeth. Calculations of tooth density in terms of air-gap density and mmf., with a correction for the tapering of the teeth, are made, the whole argument being illustrated by a numerical example.—*Electrician* (*London*), Feb. 10 and 17, 1922.

Traveling Cranes with Single-Phase Brush-Shifting Motors.—E. ALTSCHUL.—The Brown-Boveri company has developed an electric crane system in which brush-shifting single-phase motors are used for all three motions. Such a motor can be started by exciting the stator and shifting the brush holder from the neutral position more or less forward or backward. No controllers or resistors are required. This simplifies materially the electrical equipment of a three-motor crane. The mechanical equipment is, however, somewhat complicated. As two of the three motors change their position relative to the crane, it is necessary to provide some means to actuate their brush holders from the operator's cabin. This is achieved by using two flat steel bars along the crane girders, which can be rotated by levers from the cabin. On these bars specially formed steel clamps slide, transmitting the turn of the bars with levers to the brush yokes of the motors. Two levers are used for each motor, one actuating the stator-closing switch and the other the brush yoke. For a three-motor crane the operator has only two levers to manipulate, one for the traveling of the entire crane and one for a combined lift and cross-traveling motor. — *Brown-Boveri Mitteilungen*, February, 1922.

Lamps and Lighting

Use of Light in the Surgical, Dental and Ophthalmological Professions.—L. P. TINGLEY.—This article deals with the problems of the medical profession in securing proper lighting. It discusses the use of daylight, artificial light and combined lighting. With artificial lighting there is at the present time a tendency on the part of medical men to use too much light. This often does not result in the most efficient illumination with the least eye strain.—*Transactions of the I. E. S.*, January, 1922.

Making Electricity More Accessible in Offices and Public Buildings.—In order to allow for the more extensive use of electricity in offices and public buildings various methods of installation have been introduced, all of which tend to give increased flexibility. One method described in this article solves the problem of increased outlets by using as an electric conduit a metal base in the place of the baseboard ordinarily run around the room. Another method of obtaining increased flexibility consists of installing numerous receptables and plates fitted for interchangeable fixtures. Various special outlets, floor boxes and fittings are described and illustrated, as well as a device for providing additional outlets which consists of a standard receptacle for use in the "knock-outs" of regular outlet boxes.—*Electrical Record*, March, 1922.

Generation, Transmission and Distribution

New Type of Suspension Insulator with Spherical Head.—Description of a new type of suspension insulator which avoids the rigid bond between the metallic part and the porcelain and thus preserves the porcelain from cracking when the iron and cement expand with increase of temperature. The insulator has a cylindrical head in which is inclosed a sphere of porcélain flattened on two sides. This sphere is first baked, then introduced into the unbaked head, and finally the assembled unit is placed in the oven. Because of the 18 or 20 per cent shrinkage of porcelain during baking, the head narrows itself around the flattened sphere, but by a special device the sphere is kept from adhering to the interior of the head. Beneath the sphere is attached a metallic cap adjusted at an angle of 180 deg. to the sphere. All the iron parts extending into the head of the insulator are surrounded by elastic material, and the rod is not absolutely rigid, though, like the cap, it is prevented from turning. The space between the sphere and the surrounding part of the head is filled with an elastic substance which distributes uniformly the strain caused by the rod. This insulator, it is said, is able to resist stresses of 5,000 kg. Its resistance under oil and its insulating capacity are also held to be superior to those of other types.—*Industrie Electrique*, Jan. 25, 1922.

Efficient Burning of Fuel and Use of Waste Gases in Iron and Steel Plants.—W. W. PETTIBONE.—A general discussion of boiler-room operation in the iron and steel industry, comparing the efficiencies, economies, etc., of stoker-drive furnaces, powdered-coal furnaces and furnaces burning waste gases.—*Paper presented before Association of Iron and Steel Electrical Engineers*, February, 1922.

Traction

When Should Battery Locomotives Replace Mules and When Be Preferred to Trolley Equipment?—CHARLES E. STUART.—The author favors mules in early states of mine haulage, later accumulator locomotives, then trolley equipment. Comparative costs of hauling with mules and storage-battery locomotives show that in one instance $14,863 was saved by a storage-battery locomotive in one year. A very complete table is given of the performance and operation of a combination locomotive at a mine of the United States Coal & Coke Company, at Lynch, Ky.—*Coal Age*, Feb. 16, 1922.

Installations, Systems and Appliances

Locomotive Boiler Welding.—This article is the report of a committee of the Master Boiler Makers' Association on determining the best methods of reconditioning boilers. Methods are given for preparing and welding the various parts of engine boilers.—*Welding Engineer*, January, 1922.

The "Estrade" Farm System.—A. Delamarre.—An electric windlass for plow operation is described, with a number of novel features, such as a specially designed guide roll for the pulling cable, a hydro-pneumatic shock absorber to guard against suddenly arising overloads due to irregularities in the soil, an overload clutch between the drum and the 35-hp. motor, and so forth. If the windlass car is properly anchored, a pull of 3,500 kg. may be exerted upon the plow cable. To minimize the cost of temporary electric power lines the use of extremely heavily creosoted wooden poles so strongly penetrated with creosote as to be called "poteaux moirs" (black poles) is suggested. Wooden poles so treated have such a high electric resistance that it is possible to nail bare wires directly to them, resulting in a negligible loss at voltages up to 550. At 500 volts and 50 cm. between wires a current of 0.066 amp. was measured to flow through the wood. Finally a simple but very effective double-roll friction drive for slow-turning farm machinery is described.—*Revue Générale de l'Electricité*, Jan. 28, 1922.

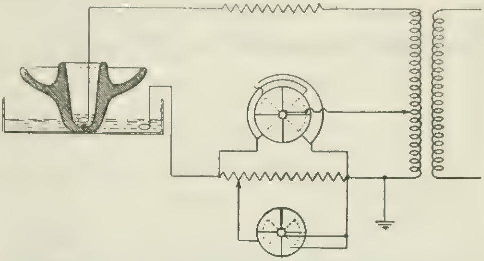
Electrophysics and Magnetism

Effect of Heat on the Electric Strength of Some Commercial Insulating Materials.—W. S. Flight.—The variation in electric strength of many of the solid insulating materials at present employed in the manufacture of electrical machinery and apparatus were investigated between the temperatures of 30 deg. C. and 100 deg. C. The materials used were various kinds of prepared paper, micarta, fuller board, varnished cloth, mica and some miscellaneous materials. These tests showed that in the case of some of the materials used at present the breakdown voltage at 100 deg. C. may be only one-half that at 30 deg. C. Consequently all insulating materials should be judged and used in accordance with the breakdown voltage at 100 deg. C. and not on the results of tests carried out at air temperature.—*Institution of (British) Electrical Engineers*, February, 1922.

Units, Measurements and Instruments

Electric Railway Disturbances and Detection of Passing Electric Trains by a Galvanometer.—E. S. Bieler.—Investigations to determine the effect of disturbances on delicate electrical measurements made in the neighborhood of electric traction lines.—*Journal of Franklin Institute*, March, 1922.

Electrical Tests for Porosity of Electrical Porcelain.—J. E. Shrader.—This article describes a method of testing insulators without danger of puncturing them as is often done with the flash-over test. Of course, a properly designed insulator free from mechanical defects should flash over on a high-voltage test. However, if the porcelain is porous and has absorbed moisture to any considerable extent, this test will result in a puncture which means a loss of the insulator. Where power-factor or resistance measurements can be made which will indicate the dielectric strength of an insulator, there is a distinct advantage gained in that these measurements may be made without the destruction of the sample. In the accompanying illustration apparatus for making power-factor tests of insulators is shown. From this power-factor determination of the dielectric strength of an insulator a very good and sure indication of moisture absorption can be obtained and in turn an indication of the porosity of the porcelain. Results of this method show that the power factor of porcelain insulators has a direct relation to their dielectric strength and that, barring mechanical troubles or faulty design, the power factor depends upon moisture absorption as result of porosity.—*Electric Journal*, March, 1922.



CONNECTIONS FOR MEASURING POWER FACTOR OF PORCELAIN INSULATORS WITH ELECTOSTATIC WATTMETER

Telegraphy, Telephony and Signals

The Rheinland Telephone Cable.—F. A. Buchholz.—To insure an absolutely reliable telephonic connection between Berlin and the industrial centers on the Rhine the German federal postal authorities decided in 1911 to lay a 600-km. cable across the empire. At that time this cable exceeded in length by far any existing telephone cable. Many original mathematical and experimental investigations had to be conducted to design the cable, which was calculated and built by the Siemens concern and the Felten-Guillaume works. Up to the fall of 1914 Hanover was reached. Then, on account of the war, the work had to stop until 1920, and the following year the line was completed, reaching Düsseldorf. The original pre-war cable contained seventy-eight double lines, but the later pieces were made with ninety-one and finally 207 double lines. The cable is equipped with a Pupin inductance coil about every 1,700 m. and every 30 km. an inspection hut is erected along the line. For its entire length the cable is in concrete ducts buried under highways. About 6,000 individual lengths of cable were needed, varying in length from 170 m. to 200 m. —*Siemens Zeitschrift*, February, 1922.

Miscellaneous

New Bearing Metal.—F. Schneider.—The Braunschweiger Hüttenwerk have developed a new bearing metal which consists of an alloy of suitable metals with graphite powder. It is claimed that the graphite is uniformly suspended throughout the entire thickness of the blocks and will stay so even after being remelted and cast around the shaft. A polished photo-micrograph is reproduced substantiating this claim. Trial runs with a shaft in different kinds of bearings show that with the new alloy a heating of only 20 deg. C. was observed after a run of one and one-half hours, while the other bearings under same conditions burned out or heated up to 90 deg. and 40 deg. respectively. Even if not oiled, the new metal prevents damage to the bearing.—*Elektrotechnik und Maschinenbau*, Feb. 5, 1922.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

LABORATORIES, RESEARCH, DIRECTORY OF.

A revised and enlarged directory of about 300 industrial and consulting research laboratories in the United States has been published. The information is classified alphabetically by the names of the companies, nature of research and names of directors. Under the first division are given the names and addresses of the companies, names of directors, number on staffs, chief lines of research and special equipment available. The foregoing information was issued in the *Bulletin* of the National Research Council, Vol. 3, Part 1, No. 16.

STEEL, ELECTRIC FURNACE VERSUS OPEN-HEARTH

A series of tests was completed during the month on samples of electric and open-hearth heats of silico-manganese spring steels carrying equal proportions of C, Mn, P, S and Si. The tests included microscopic examination, tensile test and determination of proportions of certain gases present, particularly nitrogen and hydrogen. In general, the microstructure of the electric steel was somewhat different from that observed in the open-hearth when both steels were subjected to the same heat treatment.—*Bureau of Standards, Washington, D. C.*

OIL, TRANSFORMER.

Research information of the following nature is now available on transformer oils: I. Properties, physical and chemical, of transformer oils: (1) Emulsions, water content; (2) specific heat, viscosity and thermal capacities; (3) flash and fire points; (4) boiling point; (5) volatility; (6) insulation value, variation with kind of oil and ascending series paraffine; (7) impurities and their effect on insulation value; (8) specifications for transformer oils. II. General problems: (1) Breakdown of oils (electrically)—(a) arc phenomena (disruption of oil), (b) magnetic precipitation of colloids to assist in the prevention of sludging; (2) breakdown of oils (chemically)—(a) catalytic oxidation of oils, (b) sludging rates—methods of measurements, (c) types of sludge; (3) solubility of gases in oils—air, CO_2, O_2, N_2, CH_4, C_2H_2; (4) prevention of sludging—(a) chemistry of oils and sludging phenomena, (b) inert gas space (central expansator), (c) conservator; (5) prevention of acidic condition of the oil. III. Circuit-breaker oils: (1) Oils for circuit-breaker purposes, characteristics; (2) electrical discharge in oils—(a) changes in oil (gases, liquids, solids), (b) deposition of carbon, (c) deposition of cupric oxide, (d) explosive limits of gases liberated; (3) pressure decomposition of oils, inert gases; (4) compounded dielectrics—(a) variation in breakdown value with time of arcing, (b) decomposition products; (5) reduction of fire hazard of circuit-breaker operation; (6) recovery of used circuit-breaker oils. IV. Mineral oils, compounded oils, vegetable and animal oils for miscellaneous electrical application.—*C. J. Rodman, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.*

LAMPS, INCANDESCENT, MEASURING PRESSURES IN.

In one of the papers to be presented at the meeting of the American Electrochemical Society, April 27, 28 and 29, Dr. Duncan MacRae of the Westinghouse Research Laboratory describes a new method for determining the pressure in a tungsten vacuum lamp by a McLeod gage. The measurements on lamps immediately after the process of exhaust (before "flashing") and after "flashing," as well as on life-tested lamps, are given. The operation known as "flashing" consists in lighting the lamp during the exhaust in the presence of phosphorus or other chemical substance.

CLUTCH, ELECTROMAGNETIC.

An electromagnetic clutch has been developed in which the torque between the driving and the driven shaft is transmitted by means of a magnetic flux in an air gap, without actual mechanical contact between the two. Such a clutch is suitable for a connection between a prime mover and an alternator, in case the latter is to be operated at times as a synchronous converter. The clutch is also adapted to the Diesel engine drive, to operating heavy machinery by electric motors and as a connection between a synchronous motor and its load.—*Sperry Gyroscope Company, Brooklyn, N. Y.*

INDUCTANCE COILS, HIGH-FREQUENCY RESISTANCE OF.

The resistance of short single-layer solenoids at high frequencies has been computed, taking into account the skin effect and the distributed capacitance of the layers. The computations have been applied to coil aërials and the results verified experimentally.—*G. Breit, Bureau of Standards, Washington, D. C.*

AUDION, OPERATING CHARACTERISTICS OF.

The grid-voltage plate-current characteristics are usually obtained experimentally for each value of the contemplated impedance of the plate circuit. It has been shown that these characteristics can be computed from the ordinary static characteristics of the tube which are measured with negligible impedance in the plate circuit.—*Lynde P. Wheeler, Yale University, New Haven, Conn.*

SPEECH, ENERGY DISTRIBUTION IN.

Human speech was received by an electrostatic transmitter whose voltage output, amplified about three thousand times, was impressed upon the grids of twin single-stage amplifiers. The output of one of the amplifiers was measured unmodified, while that of the other was limited by a resonant circuit to a narrow band of frequencies. The energy was measured by thermocouples. The results show a great concentration of speech energy at low frequencies.—*I. B. Crandall & Donald Mackenzie, Western Electric Company, New York, N. Y.*

MAGNETS, PERMANENT, EFFECT OF NASCENT HYDROGEN ON.

The magnetic moment of well-seasoned magnets undergoes a further reduction when the magnets are exposed to the action of electrolytic hydrogen. Newly manufactured magnets age rapidly under the action of the hydrogen. This aging process is accelerated by raising the temperature of the electrolyte in which the magnets are treated. At 60 deg. C. the final value of the magnetic moment is reached in less than an hour's exposure. A sudden fall in the magnetic moment occurs after a few minutes' exposure, which amounts in some cases to 19 per cent.—*John Coulson, Department of Physics, University of Pittsburgh, Pittsburgh, Pa.*

Suggestions for Research

INSULATOR, SELF-RINSING.

In localities where dry farming is practiced or where industrial dust and soot are deposited on the lower surface of high-tension insulators it is necessary to use larger insulators to reduce the number of flashovers. A driving rain washes the sides of an insulator but not its bottom surface. It is thought that by arranging proper baffles or a deflecting surface below an insulator a rainstorm could be made to wash the lower surface.

SUBSTATIONS, AUTOMATIC.

With the advent and growth of automatic substations for railway and industrial purposes the subject of economics of distribution has acquired a new interest. Old formulas and data do not always apply any more, and a new investigation is desired covering the most economical size of feeders and the best location and size of substations, assuming them to be of full automatic or semi-automatic type.

AUTOMOBILE HEADLIGHTS.

In view of more and more stringent regulations and antiglare laws, some public garages have begun to specialize in adjusting headlamps as part of their service. Illumination specialists should develop simple photometric devices and a proper procedure for using them, in order that a service station attendant may be enabled to adjust headlamps to comply with given laws, irrespective of personal judgment.

DRY CELLS, REGENERATION OF.

During the war it was necessary in Germany to regenerate manganese dioxide used in dry cells, and some workable methods were developed. Several accounts of these methods have recently appeared in the German and Austrian electrical periodicals, and the subject is well worth investigation if the life of dry cells can be prolonged at a reasonable expense.

EDDY CURRENTS IN EMBEDDED CONDUCTORS.

R. E. Gilman presented a paper on this subject before the 1920 A. I. E. E. annual convention. Prof. W. V. Lyon presented a paper on the same subject before the 1921 annual convention and a second paper at the 1922 midwinter convention. The mathematical methods used by these two writers are different, and it is not clear whether or not the results check quantitatively in a given case. It is desired to unify the treatment and to obtain a set of tables or curves to enable a designer to use the results without going deeply into higher mathematics or spending much time in tedious computation. The whole subject is closely related to the temperature rise in machinery and is therefore of considerable interest to both the makers and users of large alternators.

DIRECT CURRENTS, LARGE, MEASUREMENT OF.

The magnetizing current of a choke coil or transformer is greater if a direct-current magnetization be superposed on the alternating-current magnetization. If the voltage and frequency of the alternating current be kept constant, the ammeter which indicates the idle current can be calibrated in direct-current ampere-turns. For carrying this method into practice it is only necessary to build round the bar carrying the direct current a choke coil to which alternating current is supplied. In order to avoid an additional alternating induction in the direct-current conductor, two choking coils may be used which generate opposed alternating emfs. in the direct-current conductor. This arrangement, which has been tried with success in Germany, should be of interest to electrochemical works and in testing large direct-current plants, because it is not necessary to disconnect the conductor.

BABBITT FOR BEARINGS, TIN VERSUS LEAD BASE.

Most operating engineers seem to favor a tin-base alloy, although lead-base alloys are considerably less expensive. Experience shows that satisfactory results can be obtained with the latter provided that they are poured under proper conditions, especially as to temperature. Thoroughgoing research as to the best conditions and the resulting properties of lead-base alloys as bearing lining is desired, in order that standard specifications may be prepared.

PIPES, STEAM, STRESSES IN.

In large power plants some bends on steam pipes are subjected to considerable mechanical stresses due to changes in temperature. Formulas and methods of computation of such stresses are desired.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Transportation Arrangements for N. E. L. A. Convention

TRANSPORTATION arrangements for the Atlantic City convention of the National Electric Light Association, to be held May 15 to 19, have been announced by Clarence L. Law, master of transportation. Delegates may secure round-trip tickets for a fare and a half. A *de luxe* special train is scheduled to leave Chicago May 14 for the convention with special Pullmans from Detroit and Cleveland.

Public Utilities Not Financing Enough by Common Stock

PUBLIC utilities are doing too much financing through bond issues and not enough through common stock, according to a statement made last week by the John Nickerson, Jr., organization of New York, which specializes in public utility securities.

"If public utility credit is to be maintained at its present favorable position," says the statement, "managers must give earnest thought to the matter of securing more partners in their enterprises rather than more lenders to them. An investigation into the relative amounts of note and bond financing compared with the stock financing being noted, month by month, in the sheets which we send will indicate that at present utilities are doing relatively too much borrowing. This is probably on account of the present investment market, but also probably due to the difficulties experienced in securing additional partners. After a certain amount of bond financing preferred stock can be sold, but ultimately even that form of financing becomes limited and additional capital must be furnished by common-stock holders."

Opposition to State Development of Water Power Growing in Maine

WATER-POWER policies formed one of the chief topics of discussion at the Republican state convention at Bangor, Me., last week, and evidence of a growing desire to keep hydro-electric development out of politics appeared in the give-and-take of platform framing. In the proposed Deering plank, which was fully discussed prior to the convention and at Bangor, appears the principal issue of one of the candidates for the gubernatorial nomination. This declared strongly against all further agitation on behalf of state ownership or operation and commended the work of the Maine Water Storage Commission and of the Maine Public Utilities Commission in safeguarding the public interest in natural resources. The final wording of the water-power platform was modified to avoid controversy and to emphasize the benefits of hydro-electric development under impartial scrutiny by the Legislature; but the long discussion over the proposed Deering plank clearly shows that opposition to state ownership agitation is gaining momentum. General agreement was voiced in the convention as to the soundness of the now celebrated Maine policy of prohibiting the exportation of hydro-electric energy to other commonwealths.

A Record in Railway Electrification in Europe

WHAT is said by the Italian press to be the longest electrified railway line in Europe was opened on March 20 between Genoa and Modane, via Turin, the total length being 272 km. (169 miles). Notwithstanding the unusual load carried by the first train run along the entire line, an average speed of 100 km. (62 miles) an hour was reached, even on the Dusino ascent, which is 7 miles long and has a 1.4 per cent grade.

The work of electrification of the line was executed by the State Railways. A delay occurred in the opening of the service, the government desiring to wait until all restrictions on the use of power were repealed. Conditions being now normal in northern Italy as to the production and distribution of power, the service on this line will be continued regularly.

The electrification of the new road cuts by two hours the time previously required between Modane and Genoa and is heralded as the beginning of an era in the work of electrification of the entire railway net in Italy.

Underwriters to Facilitate Investigation of New Electrical Products

THE electrical committee of the National Fire Protection Association, better known as the National Electrical Code committee, has appointed a new subcommittee known as the committee on new developments. The chairman is Dana Pierce, chairman of the main committee, and the members are the chairmen of the ten standing committees, among whom the general work of code revision is divided as follows: W. H. Blood, grounding; W. S. Boyd, signal systems, wireless and lightning; A. P. Denton, wiring standards and systems; W. Devereux, theaters, motion pictures and places of public assembly; J. C. Forsyth, fixture heaters, signals and lamps; G. S. Lawler, industrial applications; M. G. Lloyd, outside wiring, building supply and services; A. M. Schoen, generating stations and substations; M. Schreiber, cars and railways, and A. R. Small, devices and materials.

It is expected that through this channel it will be possible to provide for an orderly and well-understood investigation and field trial of new developments in the electrical field in their relation to the National Electrical Code in cases where the code does not expressly prevent or prohibit the proposed appliance or method of installation. It is not the intention of the electrical committee that this new work shall supplant the work either of its regular standing or technical sub-committees or of Underwriters' Laboratories, but that it shall be supplemental thereto.

Beck Denounces Attacks on Ontario Hydro-Electric Commission

PROPAGANDA—this is what Sir Adam Beck, in a two-hour speech delivered at Toronto before the Ontario Municipal Hydro-Electric Association on March 21, termed the opposition to the Hydro-Electric Commission of the province. Referring to the speech of Premier Drury reported in ELECTRICAL WORLD for March 25, Sir Adam declared that if the extra cost of the Chippawa development and "lack of frankness" on the part of the Hydro-Electric Commissioners were the only faults disclosed, then the government was equally responsible, for the government had been advised of the extra cost as soon as the commission was informed by its engineers and the government had been consulted in all the developments. For himself he welcomed the coming investigation, which would establish for once and all the confidence of the people of the province in the loyalty and hard work of the whole staff of the commission. It was a monumental work, one unique in the history of the world. All knew that the propaganda against it was so extensive and so bitter that it would almost take away the reputation and certainly the courage of any man. It was cowardly in its attacks on the engineers and others of the working organization, men who had been slaves to the project for sixteen years, during which time there had never been the slightest basis for any intimation of wrongdoing. It was the success of the enterprise, to his mind, that had given birth to the attacks on it.

At the conclusion of his address a resolution expressing confidence in Sir Adam Beck and the Hydro-Electric Commission was adopted.

Niagara, Lockport & Ontario Power to Supply Jamestown

CONTROL of the Jamestown (N. Y.) Light & Power Company passed on April 1 to the Niagara, Lockport & Ontario Power Company of Buffalo, and central-station business in Jamestown will hereafter be carried on by the latter company through the medium of the Western New York Electric Company, which, with the same executive officers as the Jamestown Light & Power Company, has hitherto operated in Chautauqua Lake towns outside the city of Jamestown. Almet N. Broadhead retires as president of the two local companies, although retaining his place on the board of directors, and Fred D. Corey, president of the parent company, succeeds him.

The reorganization and recapitalization of the Western New York Electric Company, which was recently authorized by the Public Service Commission, includes an extension of its operations into all the counties of western New York as far east as Binghamton and north of Syracuse.

Jamestown has also a municipal electric plant.

Georgia Operator Scores State Operation of Water Powers

STATE ownership and operation of water powers was severely arraigned by Preston S. Arkwright, president of the Georgia Railway & Power Company, in an address recently before the Rotary Club of Rome, Ga. Mr. Arkwright said that he had no doubt that a state body would develop all of the state's water powers at once provided that body had the unlimited power of state taxation placed in its hands.

"They tell you," said Mr. Arkwright, referring to advocates of state ownership, "that the water power is being wasted; that the little kilowatt-hours are running in play down the river when every one of them ought to be made to work. Merely building a dam and installing a power house doesn't keep the water from wasting and the little kilowatt-hours from running away. If a water power development is made without reference to the possibility of utilizing it, the water soon rises to the top of the dam, flows over it, wastes down the river just as it did before. But the crime of it is that where you wasted only water before, these little runaway kilowatt-hours are taking dollars along with them, wasting with the water too. Getting the money, building the dam and the power house and the transmission line aren't all you've got to do. You've got to build the market along with them.

"If the power is overdeveloped, one of two things will happen; either the price to such consumers as you have must be increased to carry the interest on the unnecessary development, or if the consumers won't or can't be made to bear it, then this unnecessary charge must be carried by the owners. Under private ownership and public control this interest on the unnecessary development is not permitted to be passed on to the consumers.

"On the other hand, if it's done on behalf of the state, this unnecessary charge will be passed over to the taxpayers. Politicians, even though running a business enterprise, if running on the state's credit, can't 'bust' as long as the taxpayers of the state have a red copper cent left, but they can place new loads on already overburdened taxpayers so as utterly to destroy all hope and all courage in these individuals and have them all seeking a job where the state will take care of them."

Distribution of Commonwealth Edison Energy

ENERGY sales of the Commonwealth Edison Company for January and February increased 11 per cent over the same period last year, it was stated in a paper presented by L. A. Ferguson, vice-president of the Commonwealth Edison Company, before the mid-winter meeting of engineers held on March 22 under the joint auspices of the Western Society of Engineers and other engineering societies. A total of 1,700,000,000 kw.-hr. was sold for the year, which was distributed as follows: 163,000,000 kw.-hr. for residential lighting, 136,000,000 kw.-hr. for small stores, 65,000,000 kw.-hr. to small power users, 383,000,000 kw.-hr. to wholesale users, 87,000,000 kw.-hr. in refrigeration plants, 52,000,000 kw.-hr. for pumping water, and 771,000,000 kw.-hr. for electric railways, including the surface and elevated lines. This load was carried on a generating capacity of 652,000 kw. and with a coal consumption of 2,140,247 tons, or 7,000 tons daily. The 1,500 electric trucks in Chicago alone purchased 12,000,000 kw.-hr. of energy. The investment for the entire system was $224 per kilowatt. Since 385,000 tons of coal were in storage, equivalent to seventy days' supply, Mr. Ferguson said that service would be kept up regardless of the coal strike.

General Electric Billed $221,000,000 in 1921

Although orders received in 1921 fell to $179,722,000 as compared with $318,470,438 for 1920, the sales billed by the General Electric Company in 1921 amounted to $221,007,991.64, which compares favorably with the 1920 figure of $275,758,487.57. The annual report further shows, as was naturally to be expected, a great falling off in unfilled orders at the close of the year. These, after eliminating cancellations, were $45,391,000 for large apparatus, as against $111,778,000 at the end of 1920. However, these figures are not altogether comparable because the accounts of the International General Electric Company are not included in the 1921 report. If the 1921 sales of $38,359,000 of the International company are added to the 1921 report or the 1920 sales of $32,775,000 taken from the 1920 report, then the figures read $259,366,000 in 1921, compared with $275,758,000 in 1920 if the foreign account is included, or, if excluded, $221,000,000 in 1921 and $242,983,000 in 1920.

When it is considered that the 1921 prices were, if anything, lower than those that held during 1920, it becomes apparent that the volume of work that went through the General Electric factories in 1921 was little if any less than that in the boom year of 1920.

Net sales billed*		$221,007,991.64
Less: Cost of sales billed, including operating, maintenance and depreciation charges, and provision for federal taxes		199,331,308 58
		$21,676,683.06
Sundry income:		
Interest and discount	$2,405,998.72	
Income from securities	2,967,918.89	
Sundry revenue	1,105,066.80	6,478,984.41
Net income		$28,155,667.47
Less: Interest and discount on debentures	$2,078,683 20	
Other interest payments	724,171.95	
	$2,802,855.15	
Investment securities reserve	$3,700,000.00	6,502,855.15
Profit available for dividends		$21,652,812.32
Less: 8 per cent cash dividends		13,409,522.00
Surplus for the year		$8,243,290.32
Surplus, Dec. 31, 1920	$70,048,610.57	
Less Sundry adjustments (net)	1,418,865.33	68,629,745.24
		$76,873,035 56
Less: 4 per cent dividends declared in stock		6,746,114.00
Surplus at Dec. 31, 1921		$70,126,921.56

* Net sales in 1920, $275,758,487 57

That conditions are getting much better, moreover, is indicated by the statement that the orders received by the company for the first quarter of the current year have been at an annual rate of $200,000,000.

Inventories of goods on hand or in consignment were taken at the lower level of cost or market and are carried at $64,848,188.87, as against $118,109,173.99 at the close of 1920. Customers' notes and accounts receivable showed a stronger position, being carried at $52,514,901.62, as compared with $64,962,682.28 at the end of 1920. Investment securities are now carried at $75,326,382.17, an increase of approximately $12,000,000. As usual, the patent account is shown at a net value of $1.

It is interesting to note that the number of square feet added to factory floor space in 1921 was exceeded only in 1912 and then by but a few square feet. The 1921 total was 23,201,000 sq.ft. owned and 1,841,000 sq.ft. leased, or 25,042,000 sq.ft. all told. This was an increase over the previous year of slightly more than 2,300,000 sq.ft.

The income account for the year 1921 is shown in the accompanying table.

Cohoes Power 6 per Cent Bonds Issued at a Premium

A new issue of $675,000 first-mortgage 6 per cent bonds of the Cohoes (N. Y.) Power & Light Corporation came out this week at 101½, yielding 5.75 per cent. These bonds are callable on thirty days' notice at 105. That so small an issue could be floated for such a high price is excellent evidence of the strength of the electric light and power bond market.

The Cohoes company has a 40,000-hp. hydro-electric plant on the Mohawk River at Great Cohoes Falls and a gas plant at Cohoes. It also leases land to industrial plants which as a part of the lease agree to purchase a certain minimum amount of power.

Another interesting issue of the week was $3,500,000 of series B unifying and refunding mortgage 6 per cent non-callable thirty-year bonds of the San Joaquin Light & Power Corporation, which was floated at 99½, yielding 6.05 per cent.

Both of these prices compare favorably with that received early in the week for the $15,000,000 non-callable thirty-year bonds of the Province of Ontario, which operates the largest government-owned power system in the world. The bonds came on the market at 99¼, yielding 5.05 per cent.

Bidders for Muscle Shoals Likely to Be Asked to Increase Offers

A series of "informal conversations" between members of the House military affairs committee which will have far-reaching results has been in progress this week in connection with the committee's investigation of the Muscle Shoals water-power and nitrate projects. These preliminary exchanges of views, which have taken place in executive session and upon which members of the committee refuse to talk for publication, may or may not lead to a reappearance before the committee of the representatives of Henry Ford, the Alabama Power Company, Frederick E. Engstrum and Charles L. Parsons. It is authoritatively stated that they may lead to the appearance before the committee for the first time of Mr. Ford in person, and there is every indication that unless Mr. Ford does personally appear and materially alter and increase his offer it will not stand much, if any, chance of being favorably reported by the committee.

Although members of the committee refuse to talk for publication, it is understood that almost all of them are agreed that Mr. Ford must eliminate from his proposal the Gorges plant on the Warrior River. There is ground for the belief, too, that in order to receive consideration he must materially increase his first offer of $5,000,000. It is stated that the increases suggested in the committee run to a figure as high as $25,000,000. It is understood also that the conversations in some quarters have developed a definite desire that there shall be furnished by Mr. Ford a certain, fixed, specific guarantee that he or his company, heirs or assigns will make and continue to make fertilizer irrespective of whether it is now thought that it can be made at a profit, the question of cheap fertilizer for the farmers having been one of the principal elements injected into the Ford offer as a reason for its acceptance. It is understood that there is present in the committee a feeling that if Mr. Ford desires to receive consideration he must see to it in any final offer he may make that the government will be put to no permanent expense whatever in connection with turning the projects over to him, and also that should a suit be brought by the Air Nitrates Corporation to enforce its contract with the government for the purchase of Nitrate Plant No. 2, Mr. Ford must stand the expense of that suit and must defend it.

NO CHANCE FOR FORD OFFER AS IT STANDS

What these informal committee conversations will lead to next week, when it is expected that the atmosphere will have cleared, it is not possible to say at the moment that this is being telegraphed from Washington. But it is evident from the few points mentioned that there is absolutely no chance of the Ford offer being favorably reported by the military committee. The Ford representatives in Washington are apparently not united on the question of whether or not Mr. Ford will make any modifications or increase of his offer. Mr. Ford's chief engineer, W. B. Mayo, who has represented him formally before the committee, arrived in Washington at the end of the week.

In the Senate committee on agriculture and forestry Senator Norris, the chairman, not only began his hearings on the various proposals for Muscle Shoals, but drew, introduced into the Senate and had referred to his committee a bill of his own to provide at Muscle Shoals for the manufacture of explosives for the army and navy, to provide for the manufacture of fertilizer for agricultural purposes, and to incorporate "the Federal Chemical Corporation," a government-owned and operating company, to take over the water-power projects and nitrate plants at Muscle Shoals. Senator Norris also carried out his plan, announced in the ELECTRICAL WORLD last week, to pave the way for a temporary government appropriation of $7,500,000 to go on with construction work at Muscle Shoals for one year. This was done by attaching a rider to the army appropriation bill which is now in the Senate and which has been passed by the House. It is doubted, however, whether the House will accede to the amendments.

It is expected that the hearings in the Senate will continue for some time. As this is written most of the testimony being presented before the Senate committee is by the army officers in charge of construction, design and maintenance at Muscle Shoals, and much of it follows along the line of similar testimony presented at the House hearings, except that Senators are directing questions toward the feasibility of Senator Norris' plan for a temporary appropriation. Many of the questions also bring out the fact that members of the Senate committee believe that Nitrate Plant No. 1 (the Haber process plant) should be maintained.

New York Township to Illuminate All Its Highways

THE township of Amherst, N. Y., which is adjacent to Buffalo, has decided to illuminate all the highways within its borders and has entered into a contract with the Buffalo General Electric Company for a lighting system for its entire road mileage, a total of about 100 miles. This is the first instance, so far as can be recalled, in which a township has decided to light all its roads. The work will be spread over three years, and the complete installation will consist of between 1,000 and 1,500 units, including those to be placed along the portion of the Buffalo-Niagara Falls Boulevard, which will be lighted jointly by the Buffalo General Electric and the Tonawanda Power Companies.

The contract calls for the installation of 212 units at once, the others to be added as directed by the supervisor of the township. These first units will be placed along 5 miles of the east-and-west highway leading eastward through the township from the Buffalo city line, one of the great trunk motor-travel routes of the United States, as well as along a number of parallel stretches of improved roads and crossroads. Work on the main-road installation has already been started beginning at the Buffalo city line.

The new General Electric highway-lighting units will be used with 250 cp. gas-filled lamps. The units to be placed along the main road will be spaced at intervals of approximately 400 ft., 30 ft. above the surface of the highway and about 20 ft. back from the shoulder of the road. On the less important highways, such as dirt roads, it is planned to space the units 600 ft. apart, but the lamps will be of the same size and type.

Pacific Power & Light Asks Permit to Develop 650,000 Hp.

THE Pacific Power & Light Company of Portland, Ore., has applied to the Federal Power Commission for a preliminary permit to cover a large power project on Snake River. The proposal is to erect ten concrete dams between the Grande Ronde River and a point 20 miles below Homestead, Ore. In that distance a fall of 600 ft. would be developed, according to the application. The project, it is estimated, will develop 400,000 hp. of primary power. The plan is to install the equipment necessary to generate 650,000 hp.

G. M. Thomas of Marianna, Fla., has applied for a preliminary permit covering a dam and power house which he proposes to build on the Chipola River, 11 miles below Marianna. The primary power of the project is estimated at 2,000 hp. It is proposed to install 6,000 hp.

The Black Mountain Telephone Corporation of Black Mountain, N. C., has applied for a license to cover a transmission line across the Boone National Forest.

The Great Western Power Company of San Francisco has applied for a preliminary permit for the diversion of waters from Bucks, Pine, Rock, North Valley, Little Kinshew and Crane Valley Creeks to a power house to be built on the north fork of Feather River. The amount of primary power which will be developed is estimated at 24,000 hp., and it is the intention to install equipment rated at 30,000 hp. The power is to be used for public utility purposes.

The California-Oregon Power Company of San Francisco has applied for a license to cover the construction of a transmission line across three tracts of public lands in Shasta County, Cal.

James H. Mays and Harry L. Gandy, Salt Lake City, have asked for a preliminary permit to cover a diversion dam, conduit and power house on Huntington Creek, Emery County, Utah. The power is to be used for mining purposes. The primary power available is estimated at 400 hp. It is the intention to install equipment to generate 1,000 hp.

Merger of Large Tennessee Power Interests Proposed

STEPS are being taken toward the formation of the Tennessee Electric Power Company to effect a consolidation of the companies controlled by the Tennessee Railway, Light & Power Company with the Chattanooga & Tennessee River Power Company. The properties of these companies have been operated as one system, and it is now proposed to bring them together as nearly as possible into one ownership, thus providing for the funding of current floating indebtedness and for the permanent financing of necessary improvements.

The existing companies all have large floating debts. Their securities do not command a ready market and their financial structures and the securities available for sale, those interested in the properties state, do not admit of funding their floating indebtedness nor of future financing on reasonable terms under existing conditions.

The Chattanooga & Tennessee River Power Company owns the Hales Bar plant on the Tennessee River. This plant was built by the Brady interests, which control the company. It has 50,000 hp. installed, which is leased to the Tennessee Power Company for a term of years. The other properties in the merger are under E. W. Clarke management. The Tennessee Power Company owns and operates two hydro-electric plants in the Ocoee River having a combined capacity of 45,000 hp., a 13,000-hp. water-power station at Great Falls and a 20,000-hp. steam station at Parksville. It also controls the steam stations of the Nashville, Knoxville and Chattanooga companies, with an aggregate capacity of 29,000 hp., making a total rating of 157,000 hp.

Another 30,000 Kw. for Philadelphia to Take Care of Anticipated Business

TO TAKE care of new business, the Philadelphia Electric Company has started work on the installing of a new 30,000-kw. generator at its station on the Delaware River at Beach and Palmer Streets. A contract has been awarded to Stone & Webster, Inc., for the construction of the preliminary foundations, consisting of tunnels, wharves and other necessary foundations. The generator, when completed, will bring the total capacity of the plant up to 90,000 kw.

Joseph B. McCall, president of the Philadelphia Electric Company, in speaking of the work to be done, said: "Anticipated new business has led the Philadelphia Electric Company to begin work on the installing of a new generator at its Delaware River station. The preliminary work, however, does not necessarily mean that the contract for the building of the entire structure will be let in the near future."

Senate Reports Out Elastic Tariff with Foreign Valuation

AFTER nearly nine months of study the Senate finance committee has reported out an electric tariff. To give the measure the flexibility which the Senate committee believes to be necessary, fundamental changes had to be made in the bill which was passed by the House of Representatives last July.

The Senate committee based ad valorem rates on the foreign values of imported merchandise. The American valuation plan as embodied in the bill passed by the House was abandoned because of the limited number of exactly comparable domestic and foreign products and the difficulty and probable litigation involved in defining comparability to the satisfaction of importers, domestic manufacturers and customs officials.

Chairman McCumber states that the plan of assessing ad valorem duties on the American selling price of the imported article was abandoned largely because of the unstable basis for assessing duties growing out of the importers' profits when selling in the American market. Tariff elasticity has been provided, the committee believes, by authorizing the President to modify rates within prescribed limits, to change the basis of ad valorem duties on certain items from the foreign value to the value of the domestic article in the American market, to impose penalty duties and prohibit the importation of particular goods, and to impose additional duties against any country which discriminates against the United States.

Generally speaking, the Senate rates are higher than those recommended by the House or now in force under the Underwood tariff. A parallel-column analysis of these three tariffs as they pertain to electrical goods or raw materials entering electrical production follows:

	Senate	House	Underwood
Incandescent lamps and bulbs, per cent	70	35	30
Insulated wire and cable, per cent	40	30	15
Storage batteries, plates, etc., per cent	45	30	20
Wood poles, per cent	10	10	10
Molded insulators and other insulating material of india rubber, per cent	10	10	10
Molded insulators of shellac, copal or synthetic phenolic resin, per cent	50	30	15
Carbons and electrodes, per cent	45	35	30
Graphite, amorphous, per cent	10	10	Free
Insulating machinery, per cent	50	..	20
Mica, unmanufactured:			
Under 15 cents per pound, per lb.	4c.	4c + 17%	4c.
Over 15 cents per pound, per lb.	25c.	4c + 17%	25c.
Cut or trimmed, per cent	30	10c + 17%	30
Plates and built-up, etc., per cent	40	10c + 17%	30
Scientific and laboratory instruments, per cent	55	40	Free
Scientific glassware, per cent	75		45
Asbestos crude	Free	Free	Free
Asbestos electrical paper not exceeding 0.05 in. in thickness, per cent	8	8	10
German silver, per cent	20	20	15
Brass rods, per pound	4c.	4c.	20%
Seamless brass tubing, per pound	8c.	8c.	20%
Brazed brass tubing, per pound	12c.	12c.	20%
Bronz rods and sheets, per pound	4c.	4c.	20%
Bronz tubes and sheets, per pound	8c.	8c.	20%
Quicksilver, per pound	25c.	35c.	10%
Nickel pigs, per pound	3c.	5c.	10%
Nickel bars and sheets, per cent	25	30	20
Tin bars and pigs, per pound	Free	2c.	Free
Copper unmanufactured	Free	Free	Free
Aluminum, per pound	5c.	5c.	2c.
Aluminum prepared, per pound	9c.	9c.	3½c.
Seamed steel tubes, per pound	¾—1¼c.	¾—1¼c.	20%
Flexible metal tubing, per cent	35	25	20
Pliers, pincers, nippers:			
4 in. to 6 in., each	10c. + 50	10c. + 25	30%
Over 6 in., each	12c. + 50	12c. + 25	30%
Steam engines, per cent	20	15	15
Lodestones	Free	Free	Free
Machine belting			
Cotton, per cent	30	20	15
Leather, per pound	40c. + 5%	Free	Free

American Welding Society's Annual Convention April 26-29

THE annual meeting of the American Welding Society will take place at the Engineering Societies Building, New York, April 26-29. Pressure-vessel welding will be discussed during the morning of April 26, while the afternoon will be given over to meetings of the welding wire specifications committee and the resistance welding committee. The next afternoon the committee on specifications for steel to be welded will meet.

The first technical session will be held in the evening of April 27, with the following program: "Welding of Heavy Copper Plate," by A. S. Kinsey; "Electric Welding of Dredge Pipes," by J. H. Nead and R. L. Kenyon; "Thermit Welding," by J. H. Deppeler. The next afternoon after electing officers plans for future activities will be discussed.

The morning of April 28 will be given over to the electric arc-welding committee, while the next morning will be devoted to simultaneous sessions by the committee on training of operators and the committee on welding of storage tanks.

Appellate Court Again Upholds General Electric Lamp Patents

THE United States Circuit Court of Appeals for the Second Circuit has handed down an opinion written by Justice Charles M. Hough in the suit of the General Electric Company against F. Alexander and the Alpha Laboratories, Inc., affirming the previous decree of the District Court which held the Just and Hannaman patent for the tungsten-filament lamp and the Langmuir patent for the gas-filled type C lamp valid and infringed by the defendants.

The decision just rendered is considered of great importance since the defense was raised that the Just and Hannaman patent was not infringed because the tungsten-filament contained a small proportion of thoria. The conclusion reached by the court is that the presence of thoria does not make the lamps any the less an infringement of the patents.

Topics of Electrical Interest to Come Up at Spring Meeting of A. S. M. E.

FOR the spring meeting of the American Society of Mechanical Engineers, to be held at the Piedmont Hotel, Atlanta, Ga., from May 8 to May 11, a tentative program has been adopted which includes a number of topics of interest to electrical engineers. On Tuesday, May 9, a material-handling session will be held, with a paper by F. L. Leach on "Material-Handling Equipment as Used in the Iron and Steel Industry." In the general session on that day Alfred Cotton will discuss "Accuracy of Boiler Tests" and J. Stumpf and C. C. Trump "Turning Exhaust Losses Into Work in Reciprocating Engines."

There will be a fuel session on Wednesday, May 10, with papers on "Reduction of Fuel Wastes in the Steel Industry," by F. G. Cutler; "The Control of Boiler Operation," by F. A. Uehling, and "Boiler-Room Performance and Practice at Colfax Station, Duquesne Light Company," by C. W. E. Clarke. In the general session Major J. K. Clement will present a paper on the Muscle Shoals nitrate plant.

On Thursday, May 11, the power session program will include papers on "Power Development in the Southeast," by Charles G. Adsit; "Economics of Water-Power Development," by C. A. Mees, and "New Developments in Hydro-Electric Design," by John A. Sirnit. There will also be presented a report upon efficiency tests of a 60,000-kw. cross-compound, triple-cylinder steam turbine, by H. B. Reynolds and W. F. Hovey.

For a symposium on welding, also to be held on Thursday, these papers are scheduled: "The Strength of Electrically Welded Pressure Containers," by R. J. Roark; "Some Principles of the Construction of Unified Pressure Vessels," by S. W. Miller; "Steel for Forge Welding," by F. N. Speller, and "Tests on Welded Cylinders," by E. A. Fessenden and E. J. Bradford.

Two More Industrial Heating Courses Begin April 24

INTEREST in the courses in industrial electric heating which have been conducted this year by the Westinghouse and General Electric companies under the auspices of the industrial heating division of the Power Sales Bureau of the National Electric Light Association has increased so much of late that two more courses will be given this spring. These will be parallel and will run from April 24 to May 6 at the Mansfield (Ohio), Pittsburgh and Newark (N. J.) works of the Westinghouse company and at the Schenectady and Pittsfield works of the General Electric Company. Fifty-seven men took the first five courses.

ENGINEER INSTRUCTORS AND STUDENTS AT INDUSTRIAL HEATING COURSE AT MANSFIELD, OHIO

As previously outlined in the ELECTRICAL WORLD, these courses are designed to give the central-station power engineer an up-to-the-minute knowledge of the development, characteristics and applications of industrial electric heating service, supplementing lectures, factory and laboratory instruction by expert engineers with visits to installations. The manufacturing companies furnish this instruction without charge to those registering. This movement represents a practical attempt on the part of the N. E. L. A. committee and the manufacturers to put in the hands of the power sales engineer concrete information which will equip him to attack the industrial electric heating problems of his company's territory with understanding.

V. M. F. Tallman, 201 Devonshire Street, Boston, is chairman of the N. E. L. A. committee having this matter in charge, and additional registrations will be received by him up to the limit practicable.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

University of Illinois Undergraduates to Hold Electrical Show.—The eighth biennial electrical show of the electrical department of the University of Illinois, Urbana, will be held on April 20, 21 and 22. More than 300 students have been working since October in preparation for this show, which is the largest affair of its kind held in the country.

Rate Decrease in Indianapolis.—The electric rate reduction in Indianapolis ordered by the Public Service Commission March 11 became effective April 1. The new schedules, which supersede all others and all special contracts and practices, will decrease rates generally in the city. Residence rates drop half a cent a kilowatt-hour, and homes are placed on a room basis instead of a socket basis as now.

Scholarships for Trade and Technical Teachers.—The director of vocational and extension education, State Department of Education, Albany, N. Y., calls attention to the annual award of twenty-five industrial teachers' scholarships to qualified persons. The men selected spend one year in the Buffalo State Normal School preparing to teach their trade to apprentices, boys in public trade schools and men attending evening trade extension classes. Scholarships are worth at least $1,000.

Water Power in Jugoslavia.—Announcement is made of the formation of a syndicate for the development of hydro-electric plants in Jugoslavia to be worked in connection with the large government projects of this nature. The syndicate is to study the water powers of the Bosna and Drina Rivers. The erection of an 8,000-hp. power station near Modric and of a 20,000-hp. station on the lower Drina has been agreed upon. It is said that the capital can be raised in the country itself.

Eastern Connecticut Power Company Purchases Putnam Utility.—The purchase by the Eastern Connecticut Power Company, Norwich, of the Putnam Light & Power Company has been approved by the Connecticut Public Utilities Commission. The Putnam company operates steam and hydro-electric plants aggregating 2,320 kw. and is interconnected with the Eastern organization's lines. It is expected that under the transfer of ownership the production of both systems will be stabilized and more efficient operation secured. The Eastern Connecticut company supplies energy to various utilities, municipalities and other users in the region between New London and Putnam.

War Department Radio Net.—The War Department, which has now approximately fifty radio stations within the continental United States, has established a radio net from Washington to the Ninth Corps area headquarters in California for the distribution of army orders and messages under the supervision of the Signal Corps. Eight of the nine areas have established separate nets for their own work.

Edinburgh University May Become Center of Hydro-Electric Engineering Training.—Agitation of water-power development in the Scottish highlands has led to a movement, backed by the Edinburgh Chamber of Commerce, to promote training of engineering students in the special field of the hydro-electric art and it is thought that the University of Edinburgh may become a center of teaching along this line, through the employment of specially qualified lecturers and the installation of apparatus and plant.

Proposed Consolidation in Wisconsin.—The Wisconsin Utility Company and the Wisconsin Power, Light & Heat Company have applied for permission to consolidate. These two companies furnish the entire power for southern and western Wisconsin. Under the proposed merger, the Wisconsin Power, Light & Heat Company would assume all present outstanding bonds and debts. There would be no change in ownership, the principal result being centralization of control. The new concern, if permission is granted to consolidate, will, it is promised, enlarge and greatly extend its properties.

Yale Appoints Lecturers on Electrical Subjects.—Yale University, New Haven, Conn., has announced the following appointments of graduate lecturers in the department of electrical engineering: Lyman F. Morehouse, development engineer of the American Telephone & Telegraph Company; Allan D. Colvin, assistant general manager of the Hartford (Conn.) Electric Light Company; Philip Torchio, chief electrical engineer of the New York Edison Company; Percy H. Thomas, consulting electrical engineer, and Arthur B. Leslie, general manager Narragansett Electric Lighting Company, Providence, R. I.

Radio Used to Make "Talking Movies" a Fact.—By the use of radio telephony to transmit the voices of actors it is claimed that at last a practicable method of synchronizing speech and action in motion pictures has been devised. Recent experiments at Chicago by the Rothacker Film Company are reported to have been entirely successful. The actors who are to furnish the vocal part of the entertainment are assembled at the broadcasting station, where a master projection machine furnishes the cues. A device has been invented, it is said, whereby any number of projection machines at the theaters can be operated in synchronism with the master machine, thus insuring that the spoken part of the play will keep even pace with the development of the plot.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Coming Meetings of Institute Sections.—Section meetings of the American Institute of Electrical Engineers are scheduled as follows: April 18, Erie, Pa., "Electrical Measurements and Meters," by C. P. Yoder; April 18, Cleveland, "Automatic Substations," by L. B. Bale, Cleveland Railway Company; April 20, Fort Wayne, Ind., "The Practical Uses of the X-Ray," by Dr. C. C. Grandy; April 21, Baltimore, "Wireless Telephony," by E. F. W. Alexanderson, General Electric Company, and L. W. Chubb, Westinghouse Electric & Manufacturing Company; April 24, Toronto, "Rocky Mountain Trails to Mount Robson," by Prof. A. P. Coleman; April 27, Atlanta, "Modern Dam Construction," by R. S. Burroughs, Ambersen Construction Company; April 28, Salt Lake City, "The Manufacture of Dielectric Porcelain," by A. M. Jackson, Locke Insulator Corporation; May 5, Vancouver, B. C., "The Alternating-Current Potentiometer," by James Stott.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, April 22; Philadelphia, April 18 and May 6; Chicago, May 8; Cleveland, May 8.

A. I. E. E. Section Meetings—Cleveland, April 18; Erie, April 18; Fort Wayne, April 20; Baltimore, April 21; Toronto, April 24; Atlanta, April 27; Utah, April 28; Vancouver, B. C., May 5.

A. I. E. E. Spring Convention—Chicago, April 19-21. (For program see issue of April 1, page 644.)

Tri-State Water and Light Association—Spartanburg, S. C., April 19-21. (For program see issue of April 1, page 648.)

American Association of Operating Engineers—Columbus, Ga., April 20-22.

American Physical Society—Washington, April 22.

American Electrochemical Society—Baltimore, April 27-29.

Missouri Association of Public Utilities—Columbia, Mo., May 4-6.

A. S. M. E. Spring Meeting—Atlanta, May 8-11.

Florida Engineering Society—Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19.

National Electric Credit Association—Detroit, May 18-19.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Rates Should Be Definite and Certain.—The Public Utilities Commission, in placing a public utilities service customer on the standard schedule of rates, notwithstanding a long-term contract, should according to the Supreme Court of Utah in Utah Hotel Company vs. Public Utilities Commission, a case in which steam-service rates were concerned, make an express finding as to whether the service is to be furnished at a wholesale price, or at least make the rate to be paid by such customer definite and certain. (204 Pac. 511.)*

Court Not Bound by Conclusion of Commission on Undisputed Evidence.—The Supreme Court of Utah, annulling an order of the Public Utilities Commission of that state which closed a private crossing over a railroad in the erroneous belief that it was a public one (Bamberger Electric Railway Company vs. Commission), asserted that, although the court is ordinarily bound by the findings of the commission when the evidence is conflicting or admits of more than one inference, the findings by the commission on undisputed evidence which admits of only one inference is a mere conclusion of law, not binding on the court. (204 Pac. 314.)

Powers of West Virginia Commission.—In Wheeling Steel Corporation vs. Public Service Commission of West Virginia, the Supreme Court of Appeals of that state has found that the commission has no authority to entertain a complaint for the purpose of determining that a public service corporation has charged rates in excess of those authorized, when it appears that the rate which it is contended was applicable and which such corporation is charged with exceeding is no longer applicable to the service rendered, and the decision sought could only be for the purpose of fixing a basis for recovery of the amount of the excessive charge. (110 S. E. 489.)

Court Refuses to Grant Rate Increase Pending Determination of Appeal from Commission Ruling.—The Okmulgee Gas Company having brought suit against the State of Oklahoma to reverse a decision of the Corporation Commission denying its application for increased rates, the Supreme Court of Oklahoma found that while the commission has power to agree to an increase of rates over those allowed by a city franchise, it is not compelled to grant such an increase unless the facts disclose that the franchise contract is confiscatory or that during its entire term the rate will be unprofitable. The facts adduced by the plaintiff were held to be insufficient to justify the court in granting the application for supersedeas and permission to collect the increased rates pending final determination. (204 Pac. 443.)

Utility Entitled to Fair Return but No More.—In Northern Illinois Light & Traction Company vs. Illinois Commerce Commission ex rel. City of Ottawa, the Supreme Court of Illinois, remarking that the Legislature cannot compel a public utility to serve without reasonable compensation, said further that, although a utility is entitled to a rate which will yield a fair return and is not merely non-confiscatory, the public, on the other hand, is entitled to demand that the rate be no more than will yield a fair return. The fact that a corporation is making a profit on its light and power business does not, the court held further, authorize a requirement that it operate its street-railway system at a loss. (134 N. E. 142.)

Utility Operating Under Ordinance Fixing Minimum Charge Cannot Make Additional Readiness-to-Serve Charge.—The Supreme Court of Ohio decreed, in Ashtabula Gas Company vs. Public Utilities Commission, a delayed case in which an ordinance of the city of Ashtabula was in question and in which the city, as intervener, joined the gas company in asking for a modification of the commission's order, that where a minimum charge for service to be rendered is made or prohibited by the ordinance under which a public utility is operated the utility is not authorized to make a readiness-to-serve charge to be paid in addition to or substituted for the just and reasonable rate fixed for the rendering of the service. (133 N. E. 915.)

What Constitutes an Injury "Arising Out of and in Course of Employment."—The chief engineer of the Dakota Light & Power Company undertook to assist workmen who were removing a wall preparatory to the enlargement of the power house and brought down a part of the wall upon himself, losing his life in consequence. The board of arbitration and the Industrial Commissioners of the state awarded compensation to the relatives of the man killed, but the Supreme Court of South Dakota has sustained the lower court (Wilson vs. Dakota Light & Power Company) in reversing this action on the ground that the accident did not arise "out of and in course of employment." "There was no more justification," the court held, "for his attempt to assist in tearing down the wall than there would have been for one of the bricklayers to have gone into the engine room and undertaken to operate the engines or dynamos." A dissenting judge deprecated the "hopeless confusion" that has been caused by attempts to define the statutory phrase quoted above and declared for a liberal interpretation of the law. (186 N. W. 828.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Investment Cost as Basis for Valuation Condemned.—The Indiana Public Service Commission, in considering the valuation of the Indiana Railway & Light Company, said of investment cost as a basis for rates: "It is urged that the value of a public utility now is the number of dollars actually invested in the property. There is no reason why such a rule should be applied to public utility property when it has never been applied to the measuring of the value of any other kind of property under any circumstances. . . . Basing the value of a public utility on the actual investment or original cost would be proper and equitable if it were practicable to have a fluctuating rate of return which would vary from, say, 6 to 10 per cent. In that case the actual investment might always be used and the return, measured in purchasing power, kept the same by varying the rate of return. It is not expedient to do that, and it is therefore necessary to protect the interests of the public as a whole by recognizing the greater or less value of a dollar in measuring the value of the property."

Service Extensions on Customer's Demand.—In granting an application made by the Canon Reliance Coal Company for an order directing the Trinidad Electric Transmission, Railway & Gas Company to install immediately the additional equipment necessary to meet an increased demand of the coal-mining company for electrical energy, the Colorado Public Utilities Commission held: (1) That a contract entered into between a public utility and a consumer relating to service extensions is material evidence in determining whether added service should be ordered, although the commission will not undertake to enforce specific performance of such a contract; (2) that such a demand by a power consumer is a demand for additions and betterments rather than a new extension in a new field; (3) that, as a general rule, when a utility has voluntarily entered a field and undertaken to serve the customers therein it must thereafter continue to serve them adequately, which naturally involves the furnishing of reasonably adequate facilities and all necessary extensions or betterments, although the income may not at once produce a return on the added investment. The coal-mining company was ordered to bear a portion of the burden of raising the additional capital necessary, the same to be refunded monthly out of the revenues received from power bills.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

S. M. Kintner has been appointed manager of the research department of the Westinghouse Electric & Manufacturing Company, succeeding C. E. Skinner, who has been appointed assistant director of engineering in the Westinghouse company. Mr. Kintner's workplace will be the research laboratory at East Pittsburgh, Pa. He was graduated from Purdue University in 1894, immediately after graduation spending a year in telephonic construction and operation, after which he was instructor and later professor in the department of electricity of the Western University of Pennsylvania, now the University of Pittsburgh. In 1903 he joined the forces of the Westinghouse Electric & Manufacturing Company as research engineer concerned with high-tension phenomena, lightning arresters, line and apparatus protection and so forth. Four years later he became connected with the railway engineering department and had charge of alternating-current railway-motor design. He held this position until 1911, when he joined the National Electrical Signaling Company as general manager. During this period he made telephonic-interference investigations and also investigations of alternating-current electrolysis. In 1917 this company was reorganized as the International Radio Telegraph Company, and Mr. Kintner served at different times as its vice-president and president. He again became associated with the Westinghouse Electric & Manufacturing Company in September, 1920, and since that time he has been engaged in research and engineering studies in the development of radio apparatus. He has just returned from an extensive trip through Europe made to study engineering developments in foreign countries.

S. M. KINTNER

John V. L. Hogan, consulting engineer and specialist in electrical and patent matters, has moved his office to 41 Park Row, New York City. Mr. Hogan has played a prominent part in the development of the radio telephone and was the first person to build and operate a radio-telephone broadcasting station, transmitting bulletins and music by wireless on daily programs. He was born in Philadelphia and was graduated from the Sheffield Scientific School, Yale University. He entered the radio field as chief laboratory assistant to Dr. Lee de Forest in the development of the grid audion receiver and amplifier and the radio telephone. In 1909 he became connected as telegraph superintendent with the National Electrical Signaling Company and was later chief of the operation, inspection and erection department of that company. When this company was reorganized as the International Radio Telegraph Company, Mr. Hogan was appointed chief research engineer, a position he held until 1917, when he was promoted to be commercial manager and later manager, having until 1921 executive supervision of design, manufacture of apparatus, construction of stations and sales and operation of the company. He has obtained a large number of patents both in the United States and foreign countries on radiotelegraph and radio-telephone transmitting and receiving apparatus, and he has applications pending in the allied electrical lines. He has contributed extensively to the technical press, especially on radio communication.

J. V. L. HOGAN

H. A. Lane, for several years manager of the Oklahoma Utilities Association, has been selected to direct the organization and activities of the joint committee on business development of the National Electric Light Association. Mr. Lane will be stationed at the association headquarters, New York City, and will be the executive operating under the direction of the joint committee to co-ordinate the activities of the association with those of other associations and organizations. He was born in Rochester, Wis., in 1881 and was graduated from the University of California. Since graduation Mr. Lane has been associated in an administrative and organizing capacity with the Alameda County Chamber of Commerce, the Alaska-Yukon Pacific Exposition, the Chamber of Commerce of Los Angeles, the Panama-Pacific Exposition, the Missouri Pacific Railway Company and the Chamber of Commerce and Oklahoma County Free Fair. Mr. Lane's previous experience therefore supplies an excellent background for the direction of the business development committee of the N. E. L. A.

H. A. LANE

W. F. Bellinger has been appointed superintendent of operations of the Georgia Railway & Power Company, Atlanta. Mr. Bellinger has been connected with this company for the last sixteen and a half years and has filled many posts in the operating department.

F. J. Bullivant, who was appointed chief engineer of the Valley Electric Company of St. Louis on Jan. 1 last, was born in St. Catharines, Ontario, Canada, Dec. 25, 1882. He came to the United States at the age of twelve years and was graduated from Missouri University with a degree of B.S. in electrical engineering in 1907. Immediately after graduation he became connected with the engineering department of the Wagner Electric Manufacturing Company, specializing largely in electrical design and industrial application of motors.

Morton McDonald, formerly of the sales engineering staff of the Cutler-Hammer Manufacturing Company, Boston, has been appointed Boston district manager of the George H. Wahn Company, electrical supply jobber, Boston.

J. Leo Scanlon, until recently sales manager of the Maloney Electric Company, St. Louis, has resigned that position to establish the J. Leo Scanlon Company, manufacturers' agent, Buffalo, N. Y. Mr. Scanlon was graduated from the College of Applied Science at the State University of Iowa in 1914 and in 1919 received the degree of electrical engineer from the same institution. At the beginning of the war he joined the Air Service, Aëronautical Section, U. S. A., and served in the British Isles and in France. On his return from the army he became connected with the Moloney Electric Company as salesman, later being promoted to the sales managership.

J. L. SCANLON

Robert M. Gates has become associated with the Superheater Company, New York. Mr. Gates was formerly a partner of the Herron Gates Company, Cleveland, which handled power-plant equipment, and later was connected with the Lakewood Engineering Company.

F. F. Sengstock, formerly connected with the Chicago Board of Underwriters as electrical engineer and for the past two years with the Sprague Electric Works of the General Electric Company as conduit specialist at the Chicago district office, has resigned to take up the duties as northern Illinois representative of the Trico Fuse Manufacturing Company, Milwaukee.

Albert B. Cudebec has severed his connection with the Ohio Brass Company to join the staff of the Canadian Porcelain Company as foreign representative, with headquarters at the office of the Guaranty Trust Company, 1 Rue des Italiens, Paris. Mr. Cudebec was with the Electric Bond & Share Company before the war. During the war he served in France on power development work.

E. A. Tulis has been appointed manager of the fixture department of the George H. Wahn Company, Boston, which recently became distributer for the Crescent Brass Products Company, Cleveland.

H. L. Jones, formerly assistant superintendent, has been appointed superintendent of the switchboard and detail department at the East Pittsburgh works, Westinghouse Electric & Manufacturing Company.

A. J. Bastian, formerly assistant superintendent, has been appointed superintendent of the insulating department at the East Pittsburgh works, Westinghouse Electric & Manufacturing Company.

Ernest Bradley, field representative of the Pettingell-Andrews Company, Boston, in the New Hampshire district, has been appointed head of the department of radio apparatus which has been established at the headquarters of the company.

A. S. Duncan, formerly storekeeper at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company, has been appointed general storekeeper of finished stocks. His new duties comprise the general supervision of the organization of warehouse personnel, the methods used in the warehouse, the keeping of records and the mobility and accounting control of all finished stocks.

S. L. Case, for fourteen years connected with the purchasing department of the Stone & Webster Company, has resigned to accept a position as sales engineer with the Westinghouse Electric & Manufacturing Company. He will have charge of the Pacific Coast division and will specialize on high-tension insulators for transmission work, for which his long experience along these lines peculiarly fits him.

W. C. Allen, formerly manager of the Black & Decker Manufacturing Company's Philadelphia branch and subsequently special representative, has been made branch manager of the company's Chicago territory, which includes Wisconsin, Illinois, Missouri, Iowa, Minnesota and North Dakota. Mr. Allen has been connected with the Manley Manufacturing Company as assistant sales manager and has been associated with the Black & Decker company for about three years.

Norman L. Snow has resigned his position as vice-president and active head of the Terry Steam Turbine Company, Hartford, Conn., to become president and treasurer of the Diamond Power Specialty Corporation, Detroit, a new company which has purchased the business and plant of the Diamond Power Specialty Company. Mr. Snow has been connected with the Terry company for the past thirteen years. He is a graduate of the Sheffield Scientific School and Massachusetts Institute of Technology. He has been in the power plant field for the past eighteen years.

Paul L. Battey, formerly vice-president of the Arnold Company, engineers, Chicago, and for many years chief engineer in charge of all industrial operations of the company, has opened an office at 123 West Madison Street, Chicago, and will practice as a consulting engineer, taking charge of the design, supervision and construction of complete industrial plants and power plants.

T. H. Hays, formerly of the Indianapolis office of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of manager of the Indianapolis office.

T. H. HAYS

W. A. Garside has been appointed New England sales representative of the Simplex Electric Heating Company, with headquarters at Cambridge, Mass. Mr. Garside was formerly sales representative of the company in the territory from Washington, D. C., to Florida, with headquarters at Charlotte, N. C.

Obituary

Horace M. Williams, president of the Electrol Manufacturing Company, battery manufacturer, Providence, R. I., died at his residence in that city on April 5. Death was due to heart failure. Mr. Williams was born in Elizabeth, N. J., July 24, 1854. He went to Providence about 1900 and had since been engaged in various battery enterprises. In 1917 he organized the present Electrol Manufacturing Company.

George R. Prout, president of James Leffel & Company, waterwheel and turbine manufacturers, Springfield, Ohio, died recently at his home in that city at the age of fifty-three. Mr. Prout had been engaged in manufacturing in Springfield since 1902 and before accepting the presidency of the Leffel company in 1919 was connected successively with the Superior Drill Company and the American Seeding Machine Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Steel Revival Helps Market for Carbon Products

SALES of carbon products, such as furnace electrodes, illuminating carbons and carbon brushes, have improved considerably since Jan. 1 and are running much ahead of last year. Increasing steel production, according to the carbon manufacturers, is responsible for the greater demand for furnace electrodes, a large percentage of the total production being used in that industry. Within the past month production of steel has jumped to the point where the plants of the United States Steel Corporation are operating at almost 75 per cent of capacity, while independents are doing almost as well. It is felt that steel is just getting into its stride and that the coal strike will act as only a temporary hindrance.

The demand for illuminating carbons has not come back in the same proportion as has that for electrodes, and this can be traced to the motion-picture business. The depression in the amusement world is still noticeable, and though prospects are very good for a revival, it is not apt to come before fall. Carbon brushes are in somewhat better demand, and central stations are purchasing in satisfactory quantities. Industrials are still taking only subnormal quantities. The automotive industry is the bright spot in the carbon-brush market, and continued improvement is looked for.

March Construction Largest Reported in Two Years

THE month of March saw the largest volume of construction started in any month since April, 1920, according to figures gathered by the F. W. Dodge Company. The total amount of contracts awarded during March in the twenty-seven Northeastern states of the country amounted to $293,636,000, an increase of 65 per cent over February and of 79 per cent over March, 1921. The first quarter of this year was 68 per cent ahead of the first quarter of 1921.

Practically every class of construction showed a notable increase in March. The amount of residential construction was the largest since the summer months of 1919. March residential contracts amounted to $121,551,000, which was 40 per cent of the month's total. Public works and utilities amounted to $51,997 000, or 18 per cent of the total; business buildings, $49,758,000 (largest figure in this class since May, 1920), or 17 per cent of the month's total; educational buildings, $25,575,000, or 8 per cent, and industrial buildings, $24,270,000, or 8 per cent. The amount of contemplated new work reported in March was $613,000,000, more than double the amount of contracts awarded and the largest amount of contemplated work reported for any month since March, 1920.

The contracts awarded in New York State and northern New Jersey amounted to $88,506,000, only a quarter of a million dollars under the highest monthly total on record for this district. The total was 49 per cent ahead of February and triple the figure for March of last year. The volume of construction started since Jan. 1 has been two and one-half times as large as that started during the first quarter of 1921. New England contracts increased 78 per cent over February and 100 per cent over March, 1921, while in the Middle Atlantic States the increase amounted to 62 per cent over the previous month and 66 per cent over March, 1921. Contracts placed in the Pittsburgh district increased 52 per cent over February, but were 10 per cent under March, 1921. In the Central West contracts reached the highest total since April, 1920, the figure being 88 per cent ahead of February and 75 per cent ahead of the previous March. Construction started during March in the Northwest was double that of February and one-third greater than in March, 1921.

In connection with this widespread building activity it may be noted that wholesale prices of building materials continue to drop. According to the latest figures from the Division of Building and Housing, United States Department of Commerce, the February index figure for building materials is 158.7, against 159.9 in January and 160.8 in December, 1921. The peak in April, 1920, was 304.6. In the two years since April, 1920, structural steel has shown the greatest drop, the present index being 99.3 against a peak of 331.0. Copper wire, sheet copper, lead pipe and sheet zinc have just been added to the group making up the composite index.

Radio Popularity Has Caused Large Increase in Battery Demand

THE sudden popularity of the radio telephone has largely speeded up the demand for dry cells, according to a manufacturer, and thus has thrown business to an industry which a year ago little suspected to what an extent it would soon be benefited by a caprice of the public's favor. The market for dry cells remained remarkably good even through the dullest period of 1921, for the business is concerned with a product which must be replaced at frequent intervals. Sales did fall off last spring, but not in proportion to other commodities, and from then to the first of the year they continued on the increase. However, it remained for the radio demand to bring dry-cell business back to a normal basis.

Sales of batteries to the automotive field are reported to be increasing, with prospects brightening still further as new cars are announced and old plants put back into production. In addition, gasoline tractors and other agricultural apparatus are now being put back into use, and this calls for large numbers of batteries. Building of rural telephone lines, which use large numbers of dry cells, is going ahead rapidly, and the demand from this source will be heavy for several months. Railroad buying is continuing at a satisfactory rate.

Orders for Automatic Stokers Running Much Ahead of Last Year

SALES of automatic stokers to central-station companies and large industrial plants are running from 40 to 50 per cent ahead of sales at this time last year and have kept this pace up steadily since the first of the year. This is the outstanding fact in this industry, according to several manufacturers interviewed by the ELECTRICAL WORLD. As a result the manufacturers are very optimistic and not only have increased production considerably since the first of the year but are looking forward to running at full capacity before many months are gone.

This cheerfulness, it seems, is predicated on good grounds. Central stations form the most important class of buyers of this equipment, and it is accepted that they are in a financial condition which will permit them to make extensions and improvements whenever they decide to do so. At this time last year central stations were making many inquiries but evidently were not in a mood to buy, and a large percentage of these prospective orders failed to materialize. This year an inquiry for automatic stoking equipment has generally meant an order. These orders are coming from practically all sections of the country.

Deliveries can be made immediately as a rule on standard equipment and in normal time on special apparatus. What effect the coal strike will have is uncertain as pig iron is the prime raw material used and a shortage of fuel would mean an almost immediate shortage of pig. This might have a temporary effect on prices also. Quotations now are down to about 15 per cent below the highest point reached in 1920. There seems to be little chance of their receding further, for iron and steel prices had started upward even before the coal strike was taken seriously.

Export demand is holding up well, with activity particularly noticeable in England, some of the British possessions and France. An official of an American company having a British subsidiary reports orders there double the present manufacturing capacity of the British plant.

Volume of Wiring-Device Trade Better

A GRADUAL improvement in the demand for wiring devices is reported by a number of representative manufacturers. Plants are running close to full time each week, although it has not been necessary to force production by enlarging the personnel to any material extent. The expansion of the building industry is a helpful factor in the situation, and some production of sockets and switches for stock is in progress. Wage liquidation has been under way to some extent in the factories. Raw material is plentiful and buying is well distributed from different parts of the country. Foreign trade is running to very low volumes at present, the exchange situation continuing a bar to expansion.

Jobbers are still buying largely from hand to mouth, but the development of the building industry is tending to create either more frequent orders or larger single orders. Acute competition exists in jobbing circles, notably in connection with the distribution of sockets, but here and there a vigorous effort is being made to sustain the going price and to raise the margin somewhat above the figures lately quoted to contractor-dealers by distributers. It is argued that the ultimate consumer pays the wiring concern an exceedingly liberal profit upon sockets for example, and that the contractor-dealer has been getting his supply from the jobber at a price range below or barely meeting the over-all costs of the distributer. Hence, some jobbers feel, a somewhat stiffer price to the wiring house handling these supplies to the consumer is just fiable.

The small wiring specialties required in radio work are in great demand owing to the nation-wide appetite for this class of electrical equipment, but so far no complaints of poor delivery conditions have become generally current.

German Electric Flatirons on Sale Here Found Defective

A COMMUNICATION sent out by Thomas Henry Day, president of the Western New England Association of Electrical Inspectors, states that a recent test of electric flatirons made in Germany and sold in New York showed every sample to be more or less defective and considerably below the standard set by American manufacturers of these appliances. The open letter sent out by Mr. Day asserted that he was advised of the receipt of 15,000 dozen of these flatirons by a dealer in New York at a cost considerably less than $10 per dozen and that efforts have been made to interest the trade in other sections of the country, especially New England.

Four of these irons were purchased from dealers who did not usually handle electric appliances at a cost of $1 each, complete with attachment plug and four feet of flexible cord. The voltage to which the irons should be connected is not shown on the irons, but tests indicated a wattage of 950. None of the samples, said Mr. Day, continued in circuit long enough to permit the intended tests to be completed, the heating element breaking down in from three to thirty-five minutes. As there are no replacement parts available, such irons would prove expensive at any price. When taken apart the device proved to consist of a wooden attachment plug, a flexible cord considerably below standard and a heating element of sheet-mica matrix wound about with iron wire and very poorly insulated. No stands are provided, though this has been a requirement in this country for a number of years. These and various other defects, Mr. Day reports, make these irons not only worthless but dangerous.

Metal Market Situation

THE copper market the last week has shown a very sharp upturn, and the price of electrolytic has risen from 12⅝ cents per pound to 12⅞ to 13 cents. At the beginning of last week the market had gone practically stagnant and some buyers were expecting still further drops from the 12⅝ cents price. In view of the later development it must be admitted that the depression was more psychological than otherwise and that the present buying movement is the logical result of natural economic causes.

In the first place the statistical situation of the market has been growing better each month since last September. In March this improvement continued at a hitherto unprecedented rate, revised estimates of sales into domestic and foreign consumption putting the total at 185,000,000 lb. as against 100,000,000 lb. in February and 65,000,000 lb. in January. Stocks held by the Copper Export Association have been reduced to less than 200,000,000 lb., and stocks of refined for the country are placed at about 450,000,000 lb. The production of refined during March was only 80,000,000 lb., a much smaller total than that of sales. Deliveries into both foreign and domestic consumption during March are put at 150,000,000 lb. From these figures it will be seen that at the present rate of consumption and production there would be a copper shortage within six months, provided of course that producers failed to take the necessary steps to ward it off. Of course they will, but at all events the supply of copper will be well under their control. Demand, too, is increasing rapidly with new electrical developments daily, increased sales by brass makers, the return of copper to most of the uses from which it had been ousted by substitutes during the war, and the pushing of new uses by producers. With stocks low and demand increasing, there is little doubt that the market will be firm from now on with occasional quiet periods.

The steel industry, which was just getting into its stride, has received a setback in the shape of the coal strike. March output gained almost three quarters of a million tons and April orders promised to better that figure.

NEW YORK METAL MARKET PRICES

Copper	April 4, 1922	April 11, 1921
London, standard spot	£ s d. 57 2 6	£ s. d. 57 2 6
	Cents per Pound	Cents per Pound
Prime Lake	12 75	12 87½-13.00
Electrolytic	12 75	12.75
Casting	12 50	12.50
Wire base	13.87½-14.12½	14.00 -14.25
Lead Am S. & R price	4 90	5 00
Antimony	4 50	4 87½
Nickel, ingot	[illegible]1 00	36 00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.05	5.22½-5.27½
Tin, straits	29.37½	30.50
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11 00 -11.37½	11.00 -11.25
Brass, heavy	5 00 - 5 37½	5.00 - 5.50
Brass, light	4 75 - 4.87½	4.75 - 4.87½
Lead, heavy	3 75 - 3 87½	4 00 - 4 12½
Zinc, old scrap	2.25 - 2 50	2.50 - 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE improvement in the electrical industry was sustained by last week's business, and April bids fair to be a successful month. One of the important developments of the week was the proposing of an ordinance in St. Louis to make the use of conduit and safety switches necessary in certain electrical construction. The passage of such a bill would create a heavy demand for those items in that city. St. Louis jobbers report sales generally good, with considerable interest manifested in industrial heating equipment. Business in Chicago is satisfactory, with especial activity noted in motors, one manufacturer reporting his March sales as the best in many months. Boston trade is spotty, but improving in wiring materials, small motors and lamps.

Electrical jobbing is still slow in Atlanta and the Southeast, mainly on account of the long-continued bad weather. Florida, however, with a good citrus crop sold, is enjoying more business than the rest of the section. On the Pacific Coast from Los Angeles up to Seattle range-selling campaigns are being planned or put under way, and a great deal of business is expected to develop during the summer.

NEW YORK

Business in the electrical trade is showing a decided improvement. Jobbers generally state that figures for their March sales show a very healthy increase over those for the previous month, and at least one jobber reported that March had been his best month in the last year and a half. April sales so far have held up well and indications point to a continued gradual improvement. There has been no spectacular development along any particular lines as the movement has been very evenly distributed.

Another good sign is the number of contracts which have been placed for wiring supplies to be used in commercial buildings and large apartment houses now under construction. Contractors seem to feel that present quotations on conduit, wire, armored cable, etc., are sufficiently attractive for them to buy for future requirements.

No important price changes were recorded this week. Several manufacturers of switches, receptacles, sockets and related items have issued new discount schedules. The changes, however, are slight and for the most part amount to a general revision of quotations.

Rigid Conduit.—Sales of this material are showing some improvement and several car-lot orders have been placed. Prices remain unchanged. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50; ¾-in., $58.10, and 1-in., $82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities remains at $50, $64.50 and $92.20 per 1,000 ft.

Rubber-Covered Wire.—Demand for wire is a little better than formerly although no change in prices has been made. The increase in building activity of course accounts for this improvement. No. 14 rubber-covered is quoted at $6.35 per 1,000 ft. in 5,000-ft. lots. In lots of 10,000 ft. sales have been made at $6.25 per 1,000 ft.

Flexible Armored Conductor.—Armored cable continues in active demand and a number of sales in fair-sized quantities have been made. Quotations of No. 14, two-wire, single-strip, range from $43 to $45 per 1,000 ft. for that quantity. Double-strip sells for $45 to $47 per 1,000 ft. Jobbers' stocks are in fairly good shape.

Wiring Supplies.—Several manufacturers of so-called schedule material have issued new discount sheets calling for some slight reductions on certain items. The changes, however, are virtually only a revision of price lists.

Lamp Cord.—Sales are fair and jobbers' stocks are fair to large. No. 18, cotton, twisted, sells from $11.65 to $12.75 per 1,000 ft. Parallel is quoted at $14.50 to $15.45 per 1,000 ft.

Dry Cells.—A steady demand for standard cells is reported. In barrel lots igniters are quoted at $30 per 100.

Fans.—Buying for stock has been very good this year, and two exceptionally warm days early this week have acted as a remarkable stimulus to sales.

Appliances.—Heating devices continue to move at about their usual pace. A special combination offer by one manufacturer whereby a reduced price is made on toasters has materially increased sales on this article.

CHICAGO

Although the electrical business for the past week has equaled the average activity of the month, few important changes occurred. Price variations still exist, but the movement of wiring materials has been steady. A large order for outdoor substations was reported by one manufacturer of high-tension apparatus. The motor market has awakened from the winter sluggishness and nearly all manufacturers report that conditions are improving. Radio still continues to be the center of attraction of the electrical industry, but stocks are low on both head telephones and vacuum tubes.

Building permits for March numbered 1,327, with a valuation of $19,333,900 and a frontage of 45,684 ft. This is an increase of 693 over February's permits. The month of March had 686 permits for residences, 409 for apartment buildings, 176 for industrial structures and 56 for others. Twelve months of building at this rate would give Chicago 32,988 new homes costing $228,000,000. This compares favorably with the total valuation in 1910 of $123,000,000.

Flexible Armored Conductor.—Jobbers report a good movement, but prices vary from $41 to $42.50 per 1,000 ft. in 5,000-ft. lots. Stocks are fair but not large.

Wire.—The call for No. 14 rubber-covered wire has been steady, but the majority of sales have been for small amounts. In 5,000-ft. lots, this material sells for $6.25 per 1,000 ft. and stocks are in good condition. The demand for weatherproof wire has been fair and it is available for 16 cents a pound. Bare wire has been moving steadily, but the price is unchanged.

High-Tension Equipment.—Orders for a 33,000-volt and a 66,000-volt outdoor substation, each rated at 10,000 kva., were received during the week by one manufacturer. Manufacturers also report some good sales on 66,000-volt pole-top switches for the coast.

Motors.—An improved market for motors during the month of March was reported by a number of manufacturers. One company said that its March sales had not been duplicated within the last eight months. The demand for both large and small sizes has been equally distributed since the industrial companies are reported buying again. The call for motors up to 10 hp. has been steady.

Poles.—Dealers tell of a sustained market, and the only price changes have been on the small-sized poles. A reduction of about 15 per cent on the 16-ft. and 20-ft. Northern white-cedar pole went into effect March 23, but dealers report very little action on this material.

Wiring Material.—An increased call has been noted, and trade has been steadily improving. A reduction of about 5 per cent on the single-pole push-button switch has been reported. No price changes on the regular equipment have been noted and stocks are ample.

Radio.—The interest in this equipment is still sustained and appears to be increasing daily. All dealers report shortage of stocks, especially in head telephones and vacuum tubes. Orders are being placed for future deliveries without time guarantees.

BOSTON

Trade is rather spotty this week in New England, but the demand for wiring materials, small motors and lamps show some improvement. Prices are fairly steady, but competition is extremely acute and price cutting is frequent. Little buying for jobbers' stocks is apparent beyond thirty-day requirements. Conditions in the textile field continue bad owing to labor troubles, although some mills report increasing outputs as striking employees return to work in small numbers. No early settlement is expected in this field. Trade is fairly good in the paper industry, dull in the leather field and improving in the metal lines. Building is increasing by leaps and bounds, and this constitutes the brightest aspect of New England industry at the moment.

Building and engineering contracts for New England for the week ended April 4 totaled $9,279,100 against $1,995,500 for the same week last year. This is the best record for this week in twenty years. Contracts for March in these states amounted to $27,795,000, an increase of 78 per cent over February and over 100 per cent better than March, 1921. Forty-five per cent of the March, 1922, total was for residential work. Financial conditions continue favorable.

Ranges.—Orders for sample ranges for jobbers' and retailers' stocks are being placed with manufacturers and installations for new apartment-house service are picking up somewhat. Manufacturing for stock is proceeding steadily. Prices are firm and a good season is anticipated.

Heaters.—Trade is sluggish, but the demand for summer camp service will soon begin to be felt. Mild weather resulted in a rather poor season in portable heaters, although prices were well maintained.

Electric Refrigerators.—Sales are picking up decidedly and the outlook is for an excellent season. Development of smaller sizes of apparatus is attracting trade, and one dealer reported Monday having sold six machines within the past month, this total representing about a year's previous business.

Wire.—Prices are open on rubber-covered wire on 5,000-ft. lots and over. No. 14 sells around $7 per 1,000 ft. in 1,000-ft. lots. Weatherproof wire is moving quietly at 15½ cents base. Bare copper price is stiffer, Boston base being 15⅛ cents Monday. Inquiries are active from central-station companies for both bare and weatherproof wire, and some trolley wire is being sold.

Motors.—A better demand is noted for sizes of 5 hp. and below, and fractional horsepower motors are moving a little better. Stocks are still too large to warrant much increase in manufacturing activity.

Rigid Conduit—The demand for small-order lots is improving. Prices are steady, the following being representative: Black, ½-in., $48.32 per 1,000 ft.; galvanized, $53.42; black, 1-in., $88.15; galvanized, $98.35, per 1,000 ft., all in 5,000-ft. lots.

Appliances.—Vacuum-cleaner sales are improving and a better tone is apparent in washers. Hollow ware is not moving very fast at present. Price conditions are being weighed carefully before purchases are made, but the public is being converted to the service idea better than formerly.

ATLANTA

The outlook for business in general continues to brighten, and there is an undertone of increased activity apparent in nearly all lines. Electrical jobbers, however, report that as yet this improvement is not making itself felt in their line, which continues very slow. This is due to the fact that building is still delayed, while the buying public is not investing in electric appliances as freely as has been the case heretofore. Business in the smaller towns is very dull, owing to the fact that planting operations are already two to five weeks behind, which has served to handicap truck farmers in all parts of the state. As the farmer was anxious to be ready for early planting of cotton in order to avoid the damage of the boll weevil, the delay is causing a little pessimism regarding the outlook for the ready-money crop next fall. Florida continues in good shape, the movement of the citrus crop this year having been quite satisfactory. The sale of this was stimulated by the freezing temperature in California which damaged the orange crop in that section. The slight trend upward of farm prices in January is lending a little more strength to the business outlook in the rural districts.

Building permits are being granted in considerable volume, 471 having been issued in Atlanta during the month of March with a valuation of $2,110,818, while reports from the section for February show a total number of 2,035 permits in twenty-three cities with a valuation of $10,565,955. The increase in the section's building activities is approximately 100 per cent over that of the same month last year.

Industrial Motors.—Sales have been somewhat spotty for the past ten days, but there are a number of inquiries on hand, with the prospect that sales will show a sharp improvement in the near future. Local stocks and shipments are reported in good shape with prices steady.

Oil Switches.—Like industrial motors, the demand in this line is weak. Jobbers' stocks have been allowed to run very low, though manufacturers have reasonably good stocks on hand.

Rigid Conduit.—The delay in building operations caused by inclement weather is making itself felt in the movement of conduit, which has slowed down considerably in the past thirty days. There is still a fair movement in the more popular sizes, but it is not up to expectations. Ample stocks in all sizes are reported on hand.

Vacuum Cleaners.—This line should be active at this time, but only a very small volume of sales is reported. One of the largest manufacturers, however, is preparing to start a brisk campaign on May 1 and expects to get good results. Local stocks are in good condition.

Interphones.—Sales are reported only fair, while signal and call systems are very slow. Some pick-up is expected as school and hospital construction now proposed gets under way. Stocks of interphones are good, while the shipments on signal and call systems are quite satisfactory.

Insulators.—The glass type is in fair demand, independent telephone companies taking a fair quantity. The porcelain type is somewhat slow, though slightly improved over recent months.

Farm-Light Outfits.—Campaigns by manufacturers have resulted in a fairly satisfactory turnover, deferred payments having been of material assistance in accomplishing this result. Local stocks are in good shape with shipments satisfactory.

ST. LOUIS

The carpenters' strike is probably impeding the progress of large construction jobs in St. Louis, but residential structures are being built in increasing numbers. Permits issued for the latter class of work are about 50 per cent greater than they were a year ago. The total value of permits issued in March by the city of St. Louis amounted to $1,799,005, as compared with $974,405 for the same month last year. Industrial construction still lags, as is indicated by the $46,300 in permits for workshops and factories issued in March. The nature of wiring work in St. Louis will be materially altered if a proposed ordinance now before the Board of Aldermen is passed. This provides, in part, that all wiring shall be in conduit and that all entrance switches shall be of the inclosed "safety" type.

Sales for the week were up to the recent average. Inquiries continue to come in much greater volume than orders. The industrial situation in this territory is unquestionably improving, and improved electrical sales are bound to come soon. As an indication of the better buying spirit on the part of the public, a large manufacturer of a comparatively low-priced automobile reports production as great as at any time in 1920, while the April production schedule calls for a 60 per cent increase.

Wiring Material.—A number of price reductions have been announced. Non-indicating porcelain 5-amp. snap switches have been reduced from $21 to $15.40 per 100, in lots of 250, single-pole push-button switches from $19.25 to

$16.70 per 100 in lots of 100, three-way push-button switches from $27.50 to $23.10 per 100 in lots of 100, and single-push switch plates from $7.70 to $6.60 per 100 in lots of 100. Sales are spotty and as a rule for small amounts. The total volume is showing slight improvement, and stocks are conservatively maintained.

Conduit.—A proposed ordinance that seems likely to be passed provides that all wiring in St. Louis shall be in conduit. Stocks and deliveries are in good condition to meet the increased demand that would thereby result. At the present time sales are comparatively quiet. Following are representative prices: ½-in. black, $4.35 per 100 ft.; ½-in. galvanized, $4.95 per 100 ft.; ¾-in. black, $5.50 per 100 ft.; ¾-in. galvanized, $6.30 per 100 ft., in 1,000-ft. lots.

Entrance Switches. — Externally operated entrance switches will be required for all installations in St. Louis if the new wiring ordinance is passed. Stocks now on hand are ample for present requirements, but considerable additional buying will be required to meet the demand should the new rule become effective. One well-known type of switch now sells for $1.30 each in lots of twenty-five or more.

Industrial Heating Equipment.—Increased interest is being manifested in the installation of electric heating equipment, principally for vitreous enamel work, core baking and japan and paint drying. Some comparatively large orders are expected to be closed in the next thirty to sixty days. At a recent meeting of the American Ceramic Society the electric furnace was actively discussed and an installation here was examined and was very favorably reported on.

PORTLAND—SEATTLE

General business conditions apparently are starting once more to improve after a period of quietness. Lumber production for the Northwest for the week ended April 1 was only 10 per cent below normal. Nevertheless, new business for the week exceeded production by 17 per cent and shipments were only 4 per cent below new business, indicating that the lumber industry is picking up very rapidly and that production must increase materially if it is to keep ahead of the demand. Building throughout the Northwest for the month of March was very active, and in the case of Portland the value of permits taken out was the greatest for any month in the history of the city. The employment situation in Seattle is reported as improving slowly, there having been a reduction of 13 per cent in the number of unemployed in the month of March.

From reports of electrical jobbers and dealers it may be concluded that the electrical business is quite generally satisfactory. An extensive advertising and educational campaign undertaken by one of the large Pacific Coast jobbers is producing quite satisfactory results in the way of increased business. Credits are somewhat improved as are also collections. Prices on the whole seem to have reached a pretty stable basis and no important changes have been noted during the past week or two. Inquiries are improving, particularly in regard to high-tension line material. Schedule material is quite active and the demand for electric ranges is good in some sections. The Portland central stations report that approximately fifty electric ranges are being installed each month in the city. Electrical permits taken out in the city of Portland for the month of March were 38 per cent greater than for March, 1921, and exceeded the number for any March in the history of the department.

Wire.—The demand for rubber-covered wire is steady, being sustained by activity in apartment and residence construction. No. 14 is quoted at $6.70 per 1,000 ft. in 5,000-ft. lots and No. 12 is $9.10 in similar quantities. The base price on bare wire is $17.50 per 100 lb. No. 6 weatherproof is quoted at from $19.50 to $21 per 100 lb. in lots of 500 lb.

Sockets.—The movement in sockets is very satisfactory. Prices have remained firm for some weeks. Keyless brass sockets are quoted at from $20.25 to $22.50 per 100, key sockets at from $21.30 to $24.55 per 100, and pull-chain sockets at from $40.50 to $45 per 100, all prices in carton lots.

SAN FRANCISCO

The value of building permits issued in the four principal California cities during March, 1922, was as follows: Los Angeles, $10,964,829; San Francisco, $3,289,251; Oakland, $1,925,577; San Diego, $1,068,700. The value for March, 1921, was: Los Angeles, $6,915,216; San Francisco, $2,941,402; Oakland, $1,314,457; San Diego, $1,241,532. All signs point to even greater increases in building, for more homes are badly needed. Los Angeles has several large hotels contemplated, and San Francisco needs a great deal of school and other municipal construction. However, there has been a certain unrest among some of the building trades unions in San Francisco, the bricklayers being actually out on strike and some of the other crafts considering such action. Electrical contractors generally believe that there will not be a general building strike such as that of last year as both sides have too recent memories of its effects.

Ranges.—Though nothing definite has yet been broached, it is known that committees from all branches of the industry are working out a practicable campaign that will probably be based on sales at list price and on intelligent co-operation between dealers and central stations.

Water Heaters.—A remarkable increase in installations was shown during 1921, running close to 70 per cent, or more than triple the general increase in range installations. The outside circulation type in the 5-kw. size with thermostatic control is now practically standardized. This line too will be covered by the campaign.

Fans.—Nearly all contracts for the present season have been signed, although the ordering in general has been a little lighter than last year. However, experts predict that the unusually cold winter will be followed by a very hot summer, and so it may be that even last year's remarkable fan showing will be surpassed.

Dishwashers.—Sales of dishwashers are steadily increasing, although they fall far short of what they should be or of what they will be under the stimulus of the publicity and attention now being given this device. The number of firms regularly carrying a dishwasher of some type has almost doubled during the past year.

Motors.—The past week has been rather quiet in motor sales. Smaller motors, however, are the subject of considerable inquiry. There have been many calls for electric drills and other tools. The second-hand motor business is very slow, and nearly all shops have been compelled to reduce their organizations. Some of them, however, report many inquiries for pumping plants.

SALT LAKE CITY—DENVER

Interest in radio is growing rapidly in this region, several of the large jobbing houses having already obtained distribution rights and placed orders for equipment. Advertising campaigns tying in with the wide national publicity now in progress are being conducted through the newspapers. That a large demand for radiophone installations will be created seems certain. Shipments to this territory are expected in the very near future and technicians of experience will be employd to supervise the installations.

Latest official reports show that the employment situation is improving slowly but steadily. The coal mines have passed through the big production season of the year and will employ fewer miners for the next few months, but the steel, iron and copper mines are steadily increasing their forces. Skilled and unskilled labor for construction is plentiful. The season is now far enough advanced for cottage building to get under way and ground is being broken for hundreds of new homes. In the larger cities central-station companies are actively on the job of spreading the appliance-outlet propaganda, with the object of increasing the market for power. The emphasis in advertising has now shifted from washing machines to vacuum cleaners, and small payments down and easy terms are counted on to stimulate selling. Many households are availing themselves of the opportunity to such an extent that trade is showing a considerable improvement in these lines.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wakefield Brass Reports Good Business

The F. W. Wakefield Brass Company of Vermilion, Ohio, reports a steady increase of business during the first three months of 1922. Officials of the company state that April started off with an order for 1,800 "Red Spot" hangers for a new office at Dallas, Tex., and that numerous other orders and inquiries are coming in.

Universal Electric Sign Company a New Chicago Manufacturer

The Universal Electric Sign Company, 4854 West Kinzie Street, Chicago, a new corporation with capital stock of $12,000, has leased the plant at that address to manufacture electric signs. The company has purchased the necessary metal-working machinery for this 60-ft. x 90-ft. factory, and according to G. H. Thompson, Jr., secretary and treasurer, is receiving a satisfactory volume of electric sign business. The officers are: R. I. O'Connor, president; S. M. Moses, vice-president, and G. H. Thompson, Jr., secretary and treasurer.

Sorgel Electric Company Takes More Manufacturing Space

The Sorgel Electric Company, 138-140 West Water Street, Milwaukee, electrical jobber and repairer, has acquired two additional floors in the building at 140 West Water Street. This move was made necessary, according to W. R. Sorgel, secretary and treasurer, by recent increases in business and the addition of new lines. A radio department has been added, and the company will do both a jobbing and retailing business in this specialty.

Increasing Business Makes Westinghouse Changes Necessary

Increasing activity in the power and railway divisions of the Pittsburgh office of the Westinghouse Electric & Manufacturing Company has resulted in the separation of the two divisions and some new appointments in personnel of management. Barton Steveson, who has been manager of both divisions, will continue as manager of the power division and will devote his entire time to activities in connection with that unit. F. G. Hickling has been appointed manager of the railway division, the appointment becoming effective immediately. S. R. Shave has been appointed manager of the price section of both the power and railway divisions in the Pittsburgh office. The separation of the two divisions under different heads will facilitate the handling of both power and railway business, according to the company's announcement.

Fire Damages Canada Plant of Packard Electric

A fire at the plant of the Packard Electric Company at St. Catharines, Ontario, Canada, recently caused a loss estimated at about $20,000. A number of large transformers just completed on order had been stored in the basement of the plant; the basement was flooded during the fire, and the total damage cannot be estimated until the transformers are dried out and tested to discover whether they have been harmed.

International General Electric's 1921 Business 17 per Cent Ahead of 1920

In the year 1921, according to the annual report of the International General Electric Company, the company billed sales to the amount of $38,359,000, as against $32,775,000 in 1920, a gain of 17 per cent. The total income of the company during the year was $40,940,661, while net income amounted to $3,226,116. However, of this, there was available only $1,973,072 for dividends on the preferred and common stock, compared with $2,406,957 in 1920. The merchandise on hand, it is stated, has been written down either to cost or market value as of Dec. 31, 1921, depending on which value was lower, and additional depreciation and reserves have been made for excess and slow-moving stock.

In his remarks to stockholders in regard to the outlook, Gerard Swope, president, says:

"Unfilled orders on the books of your company on Jan. 1, 1922, were upward of $12,700,000. The outlook for export business for the current year is not promising, and shipments are expected to be much less than in the year just closed. Despite this, owing to large curtailment in expenses, it is believed that the operations of your company will show a reasonable profit for the year 1922. There is increasing need throughout the world for the construction of hydro-electric and other enterprises, which will require large amounts of electrical apparatus. The investment of adequate capital for the support of such enterprises may be expected to follow an improvement in the economic and financial situation abroad."

Radio Manufacturer Takes Over Machine-Tool Plant

The plant of the Greaves-Klusman Machine Tool Company, Cook and Alfred Streets, Cincinnati, has been bought by the Crossley Manufacturing Company, radio equipment manufacturers of that city. The plant is to be equipped for the manufacture of radio apparatus. The factory will give the Crossley company approximately 25,000 sq.ft. of floor space and is expected to give employment to more than 400 persons when running full capacity. The actual operation of the plant will be undertaken by a subsidiary of the Crossley company, the American Automobile Accessories Company. Powell Crossley, Jr., is president.

Sewickley Company Formed to Manufacture Meters

The formation of the Sewickley Electric Manufacturing Company, Sewickley, Pa., has been announced with the further information that the principal product is to be watt-hour meters. The meter will be marketed under the trade name "Semco." The initial capitalization of the company is given as $500,000.

The company already has secured its factory, which is a reinforced-concrete structure having approximately 40,000 sq.ft. of floor space. The plant is located at Stoops Ferry, Pa., about 12 miles west of Pittsburgh on the New York Central Railroad, giving very good shipping facilities. The offices of the company are at Sewickley. The officers of the company are: Tracy M. Kramer, president; Gilbert Hunter, vice-president; Frank Semple, Jr., secretary and treasurer.

Landers, Frary & Clark Postpone Addition to Plant

The proposed addition to the New Britain (Conn.) plant of Landers, Frary & Clark, manufacturers of various electrical appliances, will be postponed for the present, it is stated. All bids for the construction of the building have been rejected, and when the matter will be taken up again has not been announced. The addition was to have been six stories in height and would have considerably increased the company's manufacturing facilities.

Manufacturers' Agents Announce Merger

The DeVeau-Bartling Company is the name of a newly formed manufacturers' agency at 602 Equity Building, Detroit. Both members of the firm had been established previously as manufacturers' agents in the Detroit territory but had operated separately. Since combining they represent the Stanley & Patterson Company, Lowell Insulated Wire Company, Chase-Shawmut Company, Federal Porcelain Company, Passaic Rubber Company, General Apparatus Company and Horne Manufacturing Company.

Canadian General Electric Seeks More Working Capital

The Canadian General Electric Company has issued $5,000,000 worth of 6 per cent gold debentures, with the announced purpose of reimbursing the company for capital expenditures and providing additional working capital. The Canadian General Electric Company, which owns Canadian Allis-Chalmers, Ltd., is the largest manufacturer and distributer in Canada of electrical apparatus. The company has the right in perpetuity to manufacture and sell in Canada products of the General Electric Company and manufactures a varied line of machinery under a contract with the Allis-Chalmers Manufacturing Company, Milwaukee. The company and its subsidiary own eight manufacturing plants in Canada and maintain eighteen branch houses in principal distributing centers of the Dominion.

In its report for 1921, just issued, the company reports a deficit after dividends of $220,946, compared with a surplus of $342,575 in the previous year. The report shows total assets and liabilities of $34,614,834.

New Quarters for National Stamping Works

The National Stamping & Electrical Works, 424 South Clinton Street, Chicago, having completed the construction of a new one-story building costing $60,000 at 3238-50 West Lake Street, will leave their old quarters to occupy this new plant on about April 10. This new plant, which is 130 ft. x 150 ft., will allow all their manufacturing work to be done under one roof.

New Plant for Newgard & Company

Plans have practically been completed for a new manufacturing plant for Henry Newgard & Company, 947-55 West Washington Boulevard, Chicago. The company manufactures electrical specialties and also operates an electrical contracting business. The plant is to be one story in height, with 21,000 sq.ft. of floor space, and is to be built at 4603-19 Fullerton Avenue, Chicago. The plant with its equipment is to cost about $75,000.

Louisville Company Acquires More Factory Space

The William C. Knauth Electric Company, 113-115 West Market Street, Louisville, Ky., has purchased property adjoining its factory on First Street between Market and Main Streets. The building will be remodeled and will be completely equipped for the manufacture of repair parts for all kinds of motors and electrical power apparatus. The new property will increase the available floor space to 50,000 sq.ft. The move was made, according to officials of the company, to take care of largely increased business. Some of the additional space will be used for display purposes, but the main purpose of the move was to obtain greater facilities for the making of repairs to electric power apparatus.

Company Formed to Manufacture Oil-Burning Equipment

The formation of a company to manufacture fuel-oil-burning equipment under the name of the Combustion Company has been announced. The company will have its headquarters in Chicago and has leased a plant at 4256 North Western Avenue in that city, and production is expected to start in the near future. William T. Dean is president and J. F. Kennedy is secretary and treasurer.

Remy Electric Employs 1,165 Persons

The force of the Remy Electric Company, Anderson, Ind., which has been gradually growing for several weeks, reached 1,165 persons recently. The Remy business continues to improve steadily, and during the past week some of the former workers were taken back. The increase in business is steady, but no unusual pick-up is anticipated.

Business of Gray & Davis Improving

Better times in the market for electrical accessories for automobile service are indicated at the Gray & Davis factory at Cambridge, Mass., affiliated with the American Bosch Magneto Corporation. For the first quarter of 1922 shipments totaled $836,000, against $359,335 for the same period a year ago. As total shipments in 1921, including the now discontinued lamp department, were but $1,688,905, this branch of the organization has reached in three months nearly half of last year's total output. It is expected that 23,000 starting and lighting systems will be shipped during April and 26,000 in May. Releases from various companies have either been declared or will become effective May 1, in addition to present orders for prompt shipment.

Lynn Works of General Electric Now in Two Sections

Announcement has been made of the division of the Lynn (Mass.) Works of the General Electric Company into two sections, to be known as the West Lynn Works and the River Works. F. P. Cox has been appointed manager of the West Lynn plant and Nelson J. Darling manager of the River Works, both succeeding Richard H. Rice, deceased, who formerly exercised control over the entire plant. Mr. Darling was formerly assistant manager of the Erie (Pa.) Works of the General Electric Company, and Mr. Cox had for several years been closely associated with Mr. Rice at West Lynn. Under the jurisdiction of the River Works will come the branch factories located at Everett, Taunton, Hudson, Gloucester, and North Easton, Mass., and Windsor, Conn.

More Space for Radio Manufacturer

Because of the increased interest in radio telephony and the demand for apparatus, the Freed-Eisemann Radio Corporation has found it necessary to double the floor space formerly occupied by its factory. The company will take an additional floor at 255 Fourth Avenue, New York.

The Combustion Engineering Corporation, 43 Broad Street, New York, has opened a new branch office at 1137 Guardian Building, Cleveland. It will be in charge of Frank Henderson, who has been associated with several large stoker manufacturers in that territory for a number of years.

Sandvik Steel, Inc., has announced the consolidation of its general steel and steel-belt conveyor departments, with headquarters at 2001 Woolworth Building, New York. W. D. Thomas, formerly manager of New York export sales for the American Rolling Mill Company, is president and general manager.

The Reynolds Electric Company, 2650 West Congress Street, Chicago, manufacturer of electric motors, has moved its New York office from 1123 Broadway to 120 West Thirty-second Street. The office is in charge of C. W. Ellis.

The Electric Furnace Company has moved its general and sales offices from Alliance, Ohio, to Salem, Ohio. By this action all departments of the company will be consolidated at its works, Wilson Street and Pennsylvania Railroad, Salem.

The McClave-Brooks Company, 210 West Washington Square, Philadelphia, has appointed the Mahler Machinery & Supply Company, Syndicate Trust Building, St. Louis, as sales representative in that district for McClave combustion systems.

The Appleton Electric Company, 1701 Wellington Avenue, Chicago, manufacturer of conduit fittings, lighting and other electrical specialties, has appointed R. P. Tillotson, who has been associated with the company for the past thirteen years as Western sales manager and director, to take charge of the California territory, in which it was formerly represented by the Keeler, White Company, San Francisco. A branch office and warehouse will be maintained in Los Angeles. In addition to a branch office and warehouse in New York City, the Appleton Electric Company also has resident representatives in Atlanta, Boston, Cleveland, Detroit, Oklahoma City, Philadelphia, Pittsburgh, Portland, Ore., and St. Louis.

Philip E. Edelman, consulting electrical engineer, and the staff associated with him have moved their headquarters to 9 Church Street, New York City.

Foreign Trade Notes

THE ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT of Germany, *Engineering* states, has decided to increase its capital stock by 250,000,000 marks, making the total capital 1,100,000,000 marks. Statements were made at the general meeting to the effect that, in spite of the eminently satisfactory year, the dividend was only increased by 2 per cent, although the bank balances had risen from 26,000,000 marks to 658,000,000 marks; also that the reserves had increased 300 per cent, now amounting to 288,000,000 marks, while the percentage of profits had been doubled and the sums set aside for welfare institutions nearly so. It was also argued that the "still reserves" of the company, the raw materials, half-finished and finished goods were booked at about one-quarter of their actual value. The holdings in other concerns represented a further reserve of some 435,000,000 marks above their book figures. It was pointed out by the board of directors that this was in perfect harmony with the policy of the company, also that machines, tools, models, etc., had been written down to 1 mark and that buildings and land figured at reduced sums. The "still reserves" proceeded from exchange transactions which had been undertaken to strengthen the position of the company and obtain an increased number of customers. The business policy of the board was to prepare for the future. The increase in capital was said to be necessary so as to enable the company to make fresh favorable exchange or interchange transactions.

New Apparatus and Publications

MOTORS AND GENERATORS. — The Ideal Electric & Manufacturing Company, Mansfield, Ohio, is distributing bulletin 102, covering its "Ideal" direct-current motors and generators. Bulletin 103 issued by the company describes the "Ideal" squirrel-cage and slip-ring induction motors.

LAMP STANDARDS.—The Electric Railway Equipment Company, Cincinnati, is distributing a circular describing and illustrating its ornamental lamp brackets and "Safety First" lamp standards with General Electric "Novalux" lighting units.

RADIO HEADSET. — The Manhattan Electrical Supply Company, 17 Park Place, New York City, has recently placed on the market the new "Manhattan" radio headset No. 2500.

FUSES.—"Simplicity Fuses" is the title of a folder issued by the Cote Brothers Manufacturing Corporation, 1425 First National Bank Building, Chicago, describing the "Simplicity" refillable fuse recently brought out by the company.

ELECTRICAL PORCELAIN.—The Findlay Electric Porcelain Company, Findlay, Ohio, is distributing a twenty-two page catalog describing its "Standard" electrical porcelain products.

EXHAUST FANS.—"A New Era in Exhaust Ventilation" is the title of the folder just issued by the Centrifugal Fan Company, 9-15 Seventeenth Avenue, Newark, N. J.

CONTROL INDICATORS. — Bulletin 43-A, issued by Payne Dean Limited, 103 Park Avenue, New York City, covers various "Dean products," including the new system for maintaining constant water level.

SAFETY SWITCHBOARDS.—Brown & Pengilly, 607 East Fourth Street, Los Angeles, are expanding their line of dead-front switchboard equipment and adding to it complete all-metal boards suitable for industrial plants.

METER AND SWITCH PANEL.—Brown & Pengilly, 607 East Fourth Street, Los Angeles, electrical manufacturers, have placed on the market a standardized meter and switch panel for special application to pumping and irrigation plants.

ANCHOR.—The Everstick Anchor Company, St. Louis, is putting a new anchor on the market under the name of "Expand-Screw."

GATE VALVES.—The Lunkenheimer Company, Cincinnati, has recently placed on the market the "Lunkenheimer" motor-operated gate valves, equipped with "Dean" control. These valves can be obtained in sizes of 6 in. and larger.

WIRE.—The American Copper Products Corporation, 200 Broadway, New York, is distributing a series of leaflets reprinted from its magazine advertising of the past year and describing its wire products.

SOCKET.—The Tri Novelty Company, Wilson, Pa., has recently placed on the market the new "Neidig" drop socket.

BATTERY AND BULB TESTER.—A battery and bulb tester, known as the "Handy" tester, has recently been developed by Weinberg & Company, 870 Blue Island Avenue, Chicago.

New Companies

THE CHICAGO SUBURBAN POWER & LIGHT COMPANY, Aurora, Ill., has been incorporated by Benjamin F. Alschuler, Ralph C. Putnam and Glenn T. Johnston. The company proposes to supply electricity for lamps, heaters and motors.

THE DUNCAN ELECTRIC COOKER COMPANY, 20 East Jackson Boulevard, Chicago, Ill., has been incorporated by Charles C. Bartlett, First National Bank Building; Wayne A. Duncan and Edward C. Lindsey. The company is capitalized at $125,000 and proposes to manufacture and deal in mechanical electrical devices and equipment.

LAVONIA, GA.—The Shoal Creek Power & Utility Company has been organized with a capital of $200,000, to install a distributing system in Lavonia. W. B. Richardson and T. R. Knox are among the incorporators.

THE MARSHALL ELECTRIC COMPANY, 10 South LaSalle Street, Chicago, has been incorporated for $10,000 to manufacture electrical machinery, including a constant-potential motor-generator battery-charging set. The incorporators are Otto B. Schram, Claude F. Smith and Thomas Marshall.

Record of Electrical Patents

Notes on United States Patents

(Issued March 21, 1922)

1,410,421. Electric Welding; Louis J. Steele, Portsmouth, England. App. filed June 21, 1920. Machine for welding studs of iron, steel or brass onto metal bodies.

1,410,428. Ignition Device for Internal-Combustion Engines; Harry R. Van Deventer, Newark, N. J. App. filed April 7, 1919. Spark plugs placed on incline.

1,410,440. Means for Protecting Third-Rails; Wincenty Woroniecki, Dickson, Pa. App. filed Dec. 12, 1921. Angular shield over rail automatically operated by train.

1,410,443. Lock for Explosion Engines; Robert C. Anderton, San Francisco, Cal. App. filed April 20, 1920. Combined with ignition system.

1,410,482. Cable Fastening; Julius J. Langer, New York, N. Y. App. filed Nov. 23, 1920. Terminal block for armored cable and flexible conduit.

1,410,499. Metal and Its Manufacture; Aladar Pacz, Cleveland, Ohio. App. filed Feb. 20, 1917. Production of tungsten for lamps.

1,410,538. Relay System; Golder P. Wilson, Wilkinsburg, Pa. App. filed Jan. 20, 1921. Prevents stopping of rolling-mill motors until operation is completed.

(Issued March 28, 1922)

15,317 (reissue). Electric Lantern; Charles W. Conger, Portland, Ore. App. filed Sept. 1, 1920. All rays reflected downward.

15,323 (reissue). Controlling Means for Electric Motors; Frank G. Washburton, Manchester, England. App. filed Jan. 18, 1922. For several motors geared to same shaft.

1,410,545. Intercommunicating System; Leon D. Barrows, New York, N. Y. App. filed July 26, 1917. Single-line telephone system for widely separated stations.

1,410,550. Process for the Recovery of the Phosphorous Content of Phosphatic Material; John N. Carothers, Anniston, Ala. App. filed March 11, 1920. Employs electric furnace.

1,410,566. Electric Furnace; William D. Hadaway, Jr., New Rochelle, N. Y. App. filed June 17, 1920. Combined gas and electric furnace.

1,410,595. Separator for Storage Batteries; Charles Pottratz, Philadelphia, Pa. App. filed Dec. 18, 1920. Two sheets separated by ribs.

1,410,606. Electric Vacuum Apparatus; Moritz Schenkel, Charlottenburg, Germany. App. filed Dec. 4, 1920. Means for sealing terminals.

1,410,651. Electric Conductor Connector; Arthur W. Caps, Topeka, Kan. App. filed June 7, 1920. Plug and socket connection.

1,410,654. Refractory Cover for Electric Furnaces; Monroe S. Clawson, Upper Montclair, N. J. App. filed Dec. 1, 1920. Sectional cover to inclose crucible.

1,410,665. Process of Exhausting and Sealing Electrical Glowlamps and the Like; Karl Finckh, Berlin-Tempelhof, Germany. App. filed June 24, 1921.

1,410,671. Railroad Lantern; Paul Genesy, Ogden, Utah. App. filed March 30, 1921. Operates from dry cell.

1,410,700. Sectional Insulator; Samuel S. Matthes, Mansfield, Ohio. App. filed Dec. 8, 1921. For trolley wires used in mines.

1,410,702. Controlling and Regulating Apparatus and System; Friedrich W. Meyer, Milwaukee, Wis. App. filed March 8, 1920. Regulation of electric machine by electronic valve.

1,410,756. Vacuum Tube; Gilles Holst and Ekko Oosterhus, Eindhoven, Netherlands. App. filed March 30, 1921. Device for renewing gas in tube.

1,410,766. Telephone-Exchange System; Alben E. Lundell, Chicago, Ill. App. filed Oct. 16, 1919. Means for increasing speed of selector switch operation.

1,410,793. Crystal Detector for Wireless Telegraphy; Antoine Bonnefont, Paris, France. App. filed Nov. 9, 1920. Inclosing of crystal to prevent deterioration.

1,410,890. Method of and Means for Modulating Carrier Oscillations; John R. Carson, New York, N. Y. App. filed Aug. 8, 1918. Arrangement employing vacuum tubes.

1,410,912. Transmitter for Distant Controlling Apparatus for Ordnance; Riccardo Girardelli, Rome, Italy. App. filed Jan. 16, 1914. Allows for distance between transmitter and gun.

1,410,914. Commutator for Electric Motors; Forest H. Hartzell, Dayton, Ohio. App. filed Oct. 23, 1917. For toy or small motors of low efficiency.

1,410,960. Pantagraph Trolley; William Schaake, Pittsburgh, Pa. App. filed Oct. 16, 1918. Locking device to prevent accident release.

1,410,974. Section Switch; Nils J. A. Wahlberg, Pittsburgh, Pa. App. filed Jan. 5, 1918. For mounting on mine roofs.

1,410,975. Current Regulator for Automobile Headlight Circuits; Harry E. Wallace, Chicago, Ill. App. filed Dec. 10, 1919. Automatic control for lamps supplied by magneto.

1,410,985. Electric Lighting Fixture; Richard M. Beard, New York, N. Y. App. filed Oct. 15, 1917. Reflector made of plaster composition directly on ceiling.

1,411,002. Electric Light Socket; Marvin H. Davis, Douglas, Ark. App. filed Dec. 3, 1919. Switch operated by lamp base sliding up and down.

1,411,023. Regenerative Control for Single-Phase Motors; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 13, 1919. Power factor controlled by relay apparatus.

1,411,040. Control System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed March 8, 1919. Controlling of direction and speed of motors.

1,411,041. Control System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed March 8, 1919. Relay operation on circuits employing motors and generators.

1,411,042. Control System; Edwin S. Lamers, Jr., Wilkinsburg, Pa. App. filed March 8, 1919. Motor and generator inclosed circuit both use same controlling resistors.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

KEENE, N. H. Plans are being prepared for the erection of a power house at the Elliott Community Hospital. Kendall, Taylor & Company, 93 Federal Street, Boston, Mass., are architects.

BOSTON, MASS.—The Edison Electric Illuminating Company has filed plans for the construction of a new power plant on Summer Street, comprising two units, to cost $200,000 and $75,000 respectively.

BOSTON, MASS.—The City Council has applied to the Legislature for an appropriation of $2,000,000 for an electrically operated pumping plant on Stanhope Street for the high-pressure water system.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company contemplates the construction of a new switch house, 90 ft. x 140 ft., for handling distribution, the installation of switching and regulating apparatus and a new garage building for its cars. Welles E. Holmes is treasurer and general manager.

CONCORD, MASS.—The installation of a 500-kva. steam turbine in the municipal electric plant is under consideration and also the rebuilding of distribution lines damaged by sleet storm in November, 1921. Everett E. Pierce is manager.

LOWELL, MASS.—The Lowell Electric Light Corporation has received permission to issue $416,800 in capital stock, part of the proceeds to be used for extensions and improvements.

NORTHAMPTON, MASS.—An addition will be erected to the power house at the Dickinson Hospital.

SPRINGFIELD, MASS. — The United Electric Light Company expects to install ¾ mile of sixteen-duct underground conduit line on Berkshire Avenue, forming part of the transmission line between its No. 2 and No. 4 stations, and about 1¼ miles of overhead wires in Springfield will be placed underground. About 4,500 ft. of underground conduits, four-duct and six-duct, will be installed on Longmeadow and 10,000 ft. of four, six, eight, twelve and sixteen-duct in West Springfield. L. J. Scott is manager.

STOCKBRIDGE, MASS.—The Southern Berkshire Power & Electric Company has completed a 500-kw. hydro-electric plant at Rockdale. It contemplates several extensions and is looking over other possible watersheds with a view of developing, and also plans to install a new switchboard at its Great Barrington plant. Joseph Franz is superintendent.

Middle Atlantic States

ITHACA, N. Y.—Fred T. Ley & Company, Springfield, Mass., has been awarded a contract for the construction of a one-story power house at Cornell University.

MALONE, N. Y.—The Malone Light & Power Company will install in the village of Malone approximately sixty-five one-lamp standards mounted with lamps of 400 cp. each. This will require 26,000 ft. of park cable tested for 3,000 volts. S. G. Hunter is manager.

NEW YORK, N. Y.—The Department of Health, New York City, 505 Pearl Street, will soon take bids for the construction of a one-story power house, 50 ft. x 104 ft., at East Fifteenth Street and the East River. William E. Austin, 46 West Thirty-fourth Street, is architect.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company until April 21 for motors, controls and other equipment for line service. C. S. White, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—The Granby Consolidated Mining, Smelting & Power Company, 25 Broad Street, contemplates the erection of a hydro-electric generating plant at its properties in British Columbia, to cost about $100,000.

SYRACUSE, N. Y.—The Department of Public Works is preparing plans for the construction of an electrically operated pumping plant at the municipal garbage reduction works.

SOUTH AMBOY, N. J.—The Council is considering the establishment of a municipal electric power plant in connection with the present waterworks plant.

ASHLEY, PA.—The Pennsylvania Power & Light Company, Wilkes-Barre, will build a new substation at Ashley Plane for service in this section.

BOOTHWYN, PA.—The Delaware County Electric Company, Chester, will extend its transmission line from Linwood to Boothwyn and install a distributing system here.

HUMMELSTOWN, PA.—The Hummelstown Water & Power Company is planning to rebuild its power house, destroyed by fire April 5. The loss is estimated at $60,000.

NEWTON, PA.—Work will soon commence on the erection of a one-story power house at the Dunwoody Home at Newton. Clarence H. Brazer, Chester, is architect.

NORRISTOWN, PA.—The United Gas Improvement Company, Philadeplhia, Pa., has completed plans for the erection of a new electric power plant at Norristown.

PHILADELPHIA, PA.—Bids will be received by Horace V. MacFadyom, acting purchasing agent, City Hall, until April 20 for a quantity of copper wire. (Contract—Class 180.)

SHARON, PA.—The Pennsylvania-Ohio Electric Company has issued $1,950,000 in bonds, part of the proceeds to be used for extensions and improvements.

YORK HAVEN, PA.—The York Haven Water & Power Company has been acquired by W. S. Barstow & Company, 50 Pine Street, New York, and will be merged with the Metropolitan Edison Company, Reading, and extensions and improvements made in the system. The Edison company has issued $4,550,000 in bonds, part of the proceeds to be used in connection with the consolidation and for extensions at Reading.

BALTIMORE, MD.—The board of directors, Union Memorial Hospital, will build a power house in connection with a new hospital at Thirty-third and Berkeley Streets, to cost about $1,000,000. Joseph E. Sperry, Calvert Building, is architect, and Charles L. Reeder, 916 North Charles Street, engineer.

LEITERSBURG, MD.—The Waynesboro Electric Company, Waynesboro, will extend its transmission line from Ringgold to Leitersburg and install a local distributing system. The company will also build a new line to Smithsburg, Pa.

HUNTINGTON, W. VA. — The Council contemplates extensions to the street-lighting system in different parts of the city, to cost approximately $60,000.

North Central States

BESSEMER, MICH. — The Ironwood & Bessemer Railway & Light Company has been granted permission by the Public Utilities Commission to issue $233,000 in capital stock, the proceeds to be used for extensions and improvements.

GRAND RAPIDS, MICH.—The United Light & Railways Company has issued $7,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

HINSDALE, MICH.—The Village Board is planning to change the municipal electric lighting system from 1,100 volts to 2,300 volts during the coming summer. George H. Williams is village clerk.

LANSING, MICH.—The Board of Electric Light & Water Commissioners has approved plans for the installation of a new street-lighting system on several streets in the city. Extensions will be made in the present system on Warner and Sunset Streets.

MONTGOMERY, MICH.—The Economy Electric Company will erect 3 miles of transmission lines and may possibly build 27 miles more. S. P. Hull is manager.

ASHTABULA, OHIO. — Extensions are being made to the municipal electric light plant, including an addition to power house, the installation of two 5,000-kw. turbines and two 650-hp. boilers. Contracts have all been let and the work is well under way. A. B. C. Palmer is general superintendent.

DAYTON, OHIO.—The Dayton Light & Power Company has completed plans for the erection of a new power plant.

HAMILTON, OHIO.—Surveys are now being made for the purpose of preparing estimates of the cost of a complete new municipal electric light plant, which will include a new water plant. James O'Toole is superintendent of electrical department.

MARSHALLVILLE, OHIO.—The Council will take new bids at once for the construction of a transmission line for local power service. Former bids were rejected. The R. M. Mead Company, Shelby, Ohio, is engineer.

SABINA, OHIO.—The installation of two 150-hp. boilers in the municipal electric light plant is under consideration; also some power transformers. J. C. Phelps is superintendent.

BLOOMFIELD, KY. — The Bloomfield Utilities expects to change its system to alternating current with auto transformer for 110-volt service within the next two months, and will also install all new induction meters in place of the present commutator type now in use. As soon as alternating current is available it expects to erect lines into the farming district. Harry Peet, Jr., is manager.

LIVERMORE, KY.—The Public Service Company is erecting an electric transmission line to Island.

STURGIS, KY.—The Bell Coal & Navigation Company, contemplates the .construction of an electric power plant at its local coal properties. William Herbert is head.

EVANSVILLE, IND.—The Southern Indiana Gas & Electric Company has completed plans for an addition to its power plant, to cost about $500,000, including equipment. Frank J. Haas is general manager.

NEWCASTLE, IND.—The City Council is considering the installation of a new ornamental lighting system in the business district, consisting of 150 single-lamp standards. W. L. Younce is superintendent.

PORTLAND, IND.—The installation of two boilers of 365 hp. each in the municipal electric light plant is under consideration. L. V. Paddock is manager.

ROCHESTER, IND.—The United Public Service Company is considering the purchase of energy or the installation of a 500-kw. engine-driven generator. Charles A. Davis is treasurer.

SOUTH BEND, IND.—The Studebaker Corporation plans the construction of an electric power plant at its works, to cost about $750,000.

CAMBRIA, ILL.—The Cambria Light, Heat & Power Company contemplates extending its transmission line to Blairsville this spring, a distance of about 3 miles. J. J. Thomas is president.

OHICAGO, ILL. — The Commonwealth Edison Company, 72 West Adams Street, is preparing plans for two additional units of 90,000 hp. each at its generating plant at One Hundredth Street and the Calumet River. One of the units will be built at once at a cost of about $7,000,000. Marshall & Fox, 721 North Michigan Avenue, are architects.

EAST ST. LOUIS, ILL.—The East St. Louis & Suburban Railway Company contemplates extensions and improvements to its electric power plant and system, to cost about $500,000, of which $100,000 will be used in the Alton section.

MATTOON, ILL.—The Central Illinois Public Service Company has awarded a contract to the Adams Construction Company, 217 Clarkson Court, Chicago, for the construction of a one-story addition, 83 ft. x 110 ft., to its power plant at Harrisburg, Ill. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

PERU, ILL. — Extensions are contemplated to the municipal electric light plant, including the installation of a 450-kva. General Electric generator and an Ames "Uniflow" engine, to replace a 200-kw. generator and engine. One 90-kw., 230-volt direct-current to 2,300-volt alternating-current motor-generator set will also be purchased. H. J. Mueller is superintendent.

STONINGTON, ILL.—The Council contemplates extending the municipal electric system to mine No. 21 of the Peabody Coal Company to furnish electricity for lighting and power. O. W. Culbertson is manager.

WHITEHALL, ILL. — Plans are being prepared for extensions and improvements to the municipal light plant, to cost about $75,000. The Caldwell Engineering Company, Jacksonville, is engineer.

WINNETKA, ILL.—The installation of two 400-hp. water-tube boilers, and chain-grate stokers in the municipal electric light plant is under consideration. H. L. Woolhiser is manager.

APPLETON, WIS.—The White Rapids Paper Company, recently organized with a capital stock of $200,000, plans to develop a water-power site on the Wolf River at White Rapids and erect a paper and pulp mill. T. Eugene Orbison, consulting engineer, and J. C. Lymer, both of Appleton, are interested in the project.

COLBY, WIS.—The Midland Public Service Company contemplates three-phasing about 20 miles of transmission lines and extensions in the farming district. F. A. Vaughn is president and manager.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company will construct a hydro-electric plant on the Chippewa River, to cost $1,900,000.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has appropriated $6,000,000 for extensions and improvements in its power plant and lines during the present year.

CLARKFIELD, MINN.—The Council will take bids at once, it is understood, for the construction of an electric distributing system, to cost about $25,000. The C. L. Pillsbury Company, 1,200 Second Avenue, South, Minneapolis, Minn., is engineer.

ST. PAUL, MINN.—The Council will install an ornamental street-lighting system on Wabasha Street and Central Avenue.

BETTENDORF, IOWA.—The Bettendorf Improvement Company contemplates extensions to its transmission lines, to cost about $2,000. W. Z. Schneider is manager.

CANTRIL, IOWA.—The Cantril Telephone & Electric Light Company will erect a high-tension line, 6 miles long, to connect with the system at Bloomfield. Material for the proposed line has been ordered. George W. Irvin is manager.

DUBUQUE, IOWA.—The Globe Portland Cement Company, 416 McKnight Building, Minneapolis, will build a power plant in connection with its new local cement mill. The entire works will cost about $1,500,000. The C. L. Pillsbury Company, 1,200 Second Avenue, South, Minneapolis, is engineer.

DUNKERTON, IOWA.—The Dunkerton Light & Power Company contemplates small extension on town line and may erect a few miles of farm lines. H. L. Bellmer is owner.

NORA SPRINGS, IOWA.—The Nora Springs Light & Power Company is erecting electric lines into the farming district and may possibly extend its lines into other rural sections. C. A. Coon is president.

PRESTON, IOWA.—The Rural Power Company is planning to connect 40 miles of its lines on three-phase current and erecting 50 miles of single-phase farm lines. The company also contemplates extending its lines into Andover, Almont, Teeds, Grove, Green Island and other towns.

STOCKPORT, IOWA.—Plans are under consideration by the Van Buren Light & Power Company for extending its transmission line south of Donnellson into northeastern Missouri to furnish electrical service to eleven towns and one northwest from Donnellson into southeastern Iowa to serve about twenty towns in that section. Wherever possible it will supply service to farmers along the lines. Dan Roods, Kansas City, Mo., is treasurer and manager.

CLINTON, MO.—The Green Light & Power Company plans the construction of a new power plant in Clinton, to cost about $125,000. A distributing system will be installed for service in this district.

NEW FRANKLIN, MO.—The Home Electric & Ice Company is planning to build a new power house at once and installing new equipment. Its present equipment was recently damaged by fire. G. Y. Prigmore is secretary and manager.

ST. CHARLES, MO.—The special election called to vote on the proposal to issue $175,000 in bonds for a municipal power plant has been postponed.

SARCOXIE, MO.—The Southwest Electric Light & Mill Company contemplates some line repairs and lightning protection and possibly the installation of a larger engine. Art. Adams is manager.

STE. GENEVIEVE, MO.—The Home Light & Water Company is installing a 240-kva. General Electric, three-phase, 2,200-volt generating unit and two 300-hp. water-tube boilers. Guy E. Paxton is manager.

VERSAILLES, MO.—W. R. Banks, Lamar, Mo., and associates have been granted permission by the Federal Power Commission to construct a hydro-electric plant on the Osage River at Devil's Elbow, near Versailles. The cost of the project complete is estimated at $3,500,000.

PANAMA, NEB.—The Council is having plans prepared for an electric distributing system, to cost about $10,000. The Hollister Engineering Company, 517 Bankers' Life Building, Lincoln, is engineer.

ABILENE, KAN.—The Rocky Ford Milling & Power Company contemplates the installation of a 1,000-hp. Stirling boiler, the erection of a smokestack, 200 ft. x 13 ft., remodeling part of the power station, and will probably erect about 100 miles of transmission lines. Arthur Groesbeck is division superintendent.

CHANUTE, KAN.—Extensions are contemplated to the municipal electric light plant, which may possibly include the installation of a 100-kw. oil-engine driven generating unit and a water-softening plant. D. A. Steiner is superintendent.

HUMBOLDT, KAN.—The Humboldt Light & Power Company is building a dam at Neosho Falls and is installing two 200-hp. water turbines with generators. I. C. Bushong is vice-president.

HURON, KAN.—Extensions are contemplated to the municipal lighting system, including the erection of 1½ miles of 2,200-volt transmission line equipped with one step-up transformer, 220/2,200 volts, and three or four 2,200/110-volt step-down transformers. W. E. English is superintendent.

LARNED, KAN.—The Pawnee Power & Water Company contemplates the erection of 40 miles of 33,000-volt transmission line. H. W. Mogruder is manager.

OLPE, KAN.—Plans are being prepared for the construction of a transmission line to Emporia, Kan., for service at Olpe.

Southern States

OLD FORT, N. C.—The White Coal Power Company is planning to build a 200-hp. hydro-electric plant in Old Fort. Contract for generator and turbine has been placed. D. W. Adams is president.

PLYMOUTH, N. C.—The installation of an additional generating unit in the municipal electric plant in the near future is under consideration. R. L. Owens is manager.

POLLOCKSVILLE, N. C.—The Town Commission contemplates the installation of an electric lighting system on the principal streets.

LAURENS, S. C.—The Reedy River Power Company, which operates two plants on the Reedy River, is building a power house in Laurens, to be used as an emergency plant.

ATLANTA, GA.—The L. W. Rogers Realty & Trust Company contemplates the installation of an electric lighting system on a tract of land near the city to be developed. B. R. Padgett is general manager.

DALTON, GA.—The Georgia Railway & Power Company contemplates the construction of a new substation, to cost about $25,000.

SPARTA, GA.—The Council is considering equipping the municipal pumping station for electrical operation. R. J. Wilson is superintendent.

GAINESVILLE, FLA.—Improvements are contemplated to the municipal electric light plant, including the installation of a 500-kw. turbine, for which contract has already been awarded. G. H. Cairns is city manager.

HOMESTEAD, FLA.—Plans are under consideration to double the output of the municipal electric light plant within the next eight months. George T. E. Fuller is chief engineer.

ORLANDO, FLA.—The Orlando Water & Light Company contemplates construction of a new generating plant near Orlando, to cost about $1,000,000. Transmission lines will be erected to Winter Park, Oakland and other points. D. A. Cheney is general manager.

ST. PETERSBURG, FLA.—The City Commission contemplates extensions to the ornamental street-lighting system.

DOTHAN, ALA.—Extensions are contemplated to the municipal electric light plant within the next three months, including the installation of a 1,000-kw., 2,300-volt, three-phase, 60-cycle turbo-generator and stokers for boilers of the overfeed type. Actual work on the proposed municipal hydro-electric plant will begin late in the summer or early in the fall. R. J. Goodwin is superintendent.

FLORENCE, ALA.—The Council has authorized plans to be prepared for a municipal electric plant. Thomas Hallman is engineer.

THORSBY, ALA.—The Council has granted a franchise to P. G. Ault, Birmingham, and associates, to install and operate an electric light and power system in Thorsby.

VALLEY HEAD, ALA.—The Fort Payne Light & Power Company, Fort Payne, Ala., contemplates the construction of a transmission line from Fort Payne to Valley Head.

UTICA, MISS.—The Council has authorized plans to be prepared for an electric light and power system, for which bonds have been voted.

ARKADELPHIA, ARK.—The Arkansas Light & Power Company has contracted with the Aluminum Company of America for electricity for its plant at Bauxite, and will construct a 60,000-volt transmission line to the site, a distance of about 55 miles.

LITTLE ROCK, ARK.—The Caddo River Power & Irrigation Company has surveys under way for the construction of a hydro-electric power plant on the Ouachita River, to develop an ultimate capacity of about 60,000 hp.

MENA, ARK.—The Commonwealth Public Service Company will install new equipment at its local plant to replace apparatus recently destroyed by fire.

MORRILLTON, ARK.—The Council contemplates the installation of an ornamental street-lighting system in the business section, comprising about seventy lamps.

HOUMA, LA.—At an election held recently bonds to the amount of $200,000 were voted for a municipal electric plant and waterworks.

WELEETKA, OKLA.—Bids will be received by the Council until April 18 for the construction of a municipal power plant and distributing system, and also an electrically operated pumping station and filter plant, to cost about $215,000. V. V. Long & Company, 1,300 Colcord Building, Oklahoma City, are engineers.

AUSTIN, TEX.—The Texas Power & Light Company has made a proposition to the City Council for the purchase of the municipal power plant and system. If acquired, the company will make extensions and improvements.

LONGVIEW, TEX.—The City Council has engaged an engineer to prepare estimates of cost of the installation of a municipal electric light plant.

MILFORD, TEX.—The board of directors of the Texas Presbyterian College for Women plans to rebuild the power house at the institution which was damaged by fire March 22.

Pacific and Mountain States

HERMOSA BEACH, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental street-lighting system on Pier Avenue.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission, City Hall, until May 2 for furnishing synchronous condenser equipment for the municipal power system. James P. Vroman is secretary.

ORLAND, CAL.—The Chamber of Commerce is negotiating with the Pacific Gas & Electric Company for the installation of an ornamental street-lighting system in the business district. E. A. Kirk is secretary.

REDDING, CAL.—The Pit River Power Company has preliminary plans in progress for the construction of a new hydro-electric plant in this section.

SACRAMENTO, CAL.—The Carmichael Colony Lighting District, recently organized, has issued $45,000 in bonds for the installation of an ornamental lighting system.

SAN BERNARDINO, CAL.—The Council has authorized the city engineer to secure estimates of cost for the installation of an ornamental lighting system on E Street from Mill Street to Highland Avenue. The plans call for about 300 lamps.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 2, for 102,000 ft. of portable electric cord, for use at the Mare Island Navy Yard. (Schedule 9578.)

SIERRA MADRE, CAL.—The Council will install a street-lighting system on West Central Avenue. G. T. Farman is chairman of the lighting committee.

FLORENCE, ARIZ.—The Salt River Valley Water Users' Association contemplates the construction of dams and hydro-electric plants at Morman Flat, Indian Bend and at other points, to develop a total of 40,000 hp., to supplement the present 25,000-hp. plant at the Roosevelt dam. The electric transmission system will be extended to Florence, Hayden, Ray, Tucson, Cass, Grande and other points.

PHOENIX, ARIZ.—The Auxiliary Eastern Canal Irrigation District will build a large electrically operated pumping plant to include four pumping units, for its proposed irrigation project in the Salt River district. A series of smaller motor-driven pumping plants will also be erected. Howard S. Reed and Sheldon K. Baker, 419-20 Fleming Building, Phoenix, are engineers.

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Broadcasting Over the Wires!

GREAT interest has been created by the recent announcement from General Squier of a new device to broadcast entertainment over the electric light wires. Electrical men are eagerly discussing it. To the public it comes as a new manifestation of the wonders which the future seems to promise in the field of communication. It suggests a startling innovation in the service of the central station and possibly, also, of the telephone company.

Naturally our minds turn first to the technical aspects of the situation. But, looking beyond all the debatable engineering obstacles and possibilities, there is one fundamental fact that we must keep prominently in mind.

THE world has gone wild over wireless. True. But when you come to analyze it, it is not radio that so interests everybody, but broadcasting. Wireless telegraphy and wireless telephony, through the years of their development, have ever appealed to the popular imagination as scientific marvels. But this meant nothing to the ordinary life until the idea of broadcasting was conceived. Radio was a science. Broadcasting is human. It is something to play with, something to enjoy, and it has swept the country in a wave of growing popularity.

So the people want broadcasting and they are getting it. Everybody has been wondering how the ether is to be policed with all these concert, lecture and news programs floating through space, to say nothing of the deluge of wireless political eloquence that is beginning to radiate from Washington. Nobody knows just how all this free entertainment and advice is to be paid for. But nevertheless the demand for more is clamorous, and radio receiving sets cannot be manufactured fast enough to fill the orders that pour in from town and country.

Now comes the next step—wired wireless—and the recognition that the power and telephone lines themselves will distribute entertainment broadcast. And, realizing that after all it is not radio that the people want but merely broadcasting, this thought logically follows: Why not enter this new field with a new service over the existing wire systems and develop broadcasting as an additional source of profit for the public utility?

HERE are our great existing utility systems—already capitalized, already organized, already in physical contact with millions of homes. If these households want broadcasting, why not make this a great appealing service from the public utility, winning friends for every central station? Let this entertainment travel to connected homes along the wires, and to the rest by wireless. There is market enough for all. And the bigness of the opportunity will pay the cost of all the engineering effort needed to prepare the way.

John Edward Jennings

Engineer and manufacturing executive, a pioneer and specialist on transmission-line structures.

FROM the early days of high-tension transmission, when steel structures first came into prominence for this character of service, to the present time years of study, experiment and development have elapsed. Specialists have come forward, men who not only were engineers but who had a proper appreciation of the necessity for continuity of electric service. Prominent among those who have contributed to the development of the industry in the economical adaptation of structural steel to high-tension systems is J. E. Jennings, vice-president and chief engineer of the Milliken Brothers Manufacturing Company of New York. In 1907 the Great Western Power Company adopted his design for a double-circuit steel tower for a portion of its system. This marked the entrance of Mr. Jennings and his company into the electric power transmission field.

Born in Brooklyn, N. Y., in 1875, young Jennings went to public school until fifteen years old, when he started work in the construction department of a large Eastern railroad. At the same time he continued his studies at Cooper Union, from which he was graduated in 1896. With his railroad structural experience for a background, he then began a career of more than twenty-five years devoted to technical structural steel work, during the last fifteen of which he has specialized in transmission-tower development. In this time he has personally supervised the design and manufacture of steel towers for use on thousands of miles of high-tension transmission systems operating now in almost every quarter of the globe.

The strictly technical phases of Mr. Jennings' activities have brought about many economies and practical advances in tower design. His original method of arriving at a safety factor by increasing by a suitable percentage the calculated actual field forces arising from climatic and mechanical conditions of service has become the general practice of many large power companies for obtaining the test loads to which a full-size tower must be subjected. His design work has embodied many original features concerning the economic relation of sag, wire stress and span.

As an expert in transmission structures, Mr. Jennings has been employed in a consulting capacity by a number of large power companies and syndicates as well as by the government of Norway. His work in connection with tower design for the Norwegian authorities called him from the United States in 1920 and resulted in a trip around the world for transmission-line study, inspection and business in an engineering and contracting capacity for his company. His travels led him as far as Australia, where his skill as a designer will soon be evident in a 100-mile line extending from Melbourne to the Morwell brown-coal fields, which are to play a large part in electrical development.

Mr. Jennings has been active in the technical branch of electrical and engineering development closely affiliated with transmission structures. He designed the radio towers in use at important wireless stations in many parts of the world. Here as in his transmission-tower work he has striven to reduce his designs to a general standard permitting recognition of the peculiarities of each system.

Editorial Comment

Electrical World, April 22, 1922
Volume 79 Number 16

No Alarm Over the Coal Situation

ONE aspect of the present coal strike which stands out most prominently is the public's lack of interest. For three weeks production has been at a standstill in union and non-union mines. Even the output of those non-union mines whose men have not gone out has fallen far behind the estimate because of lack of orders. Thus the surplus stocks will dwindle faster than anticipated and the price of coal will rise if the strike doesn't terminate within a reasonable time. Electric public utilities need not become alarmed on that account, however. If the strife is permitted to run its course unhampered, their storage bins will probably still have coal in them when the end comes. What must be avoided are feverish assaults on limited coal reserves. Clamorous buying offers too much of an inducement to gougers, who, being opportunists, may be relied on to ply their trade. The records show that electric public utilities have greater stocks of coal on hand now than they had during the trying periods of 1917 and 1920. Naturally we deplore the losses and waste due to industrial strife. All thinking men do. Yet so long as these cannot be checked lawfully we must of necessity bear them patiently. When the public refuses to be stampeded strikes have a habit of terminating themselves very rapidly. Let the miners and operators fight this out alone, and drill, pick and shovel will soon be at work again.

Attempt to Limit Jurisdiction of Federal Courts

THE Bacharach bill, now in the hands of the House judiciary committee, demands attention. Its purpose is to limit the jurisdiction of the federal courts over orders made by any state public utility commissions. Although it does not go so far as to permit the determination of rights by bureaucratic fiat, it nevertheless aims to shut the doors of the federal courts to public utility corporations notwithstanding that all other corporations have free access to those august tribunals. The Bacharach bill is particularly objectionable to those men who command capital and are willing to invest it for public use where conditions are such that they can see safety for their investment. These men look to the federal courts, and rightly so, to protect inalienable personal and property rights, guaranteed to them by the Constitution of the United States. Our federal judicial system has been in existence now for one hundred and thirty years, and it is a truism that reverence for civil institutions and confidence in their effectiveness, protection and security depend, among the people at large, in greatest measure, on their antiquity or past duration.

Federal judges are appointed for life and are thus removed from temptation and wrong influences. Great care is exercised in their selection, so that none but scholarly, competent, industrious, impartial and incorruptible men are chosen. To deny public utilities access to federal courts, presided over by judges not easily swayed by popular prejudice and clamor and with an eye single only to do justice, is a great wrong. The industry holds public utility commissions in high esteem and is the last to wish to shake public confidence in them. It seeks to strengthen, not to weaken, commission regulation. Nevertheless, however much commissions may be inspired by commendable impulses, they are subject to the possibility of erroneous judgment. An appeal to the federal courts from such decisions makes for efficiency and expedition in the administration of justice, certainty and security to litigants and satisfaction and confidence on the part of the public. Such procedure should therefore be encouraged and not discouraged, and any measure which has not that end in view should be defeated.

The Trade Association and the Hoover Plan

REPRESENTATIVES of the trade associations—those of the electrical industry included—met with Secretary Hoover last week to consider the invitation of the Department of Commerce that their statistics be cleared through the department and made public to remove all possible suspicion that these industrial groups are conspiring against their customers—the people. The meetings were for discussion. No effort was made to pledge the associations to the plan then and there. Two questions, formulating implied objections, were asked by the association men both in the hall and about the hotels: "What advantage will the association member have over the non-member, if statistics are made public?" and "What will happen when Hoover goes?"

The answers to both are easy. Out of about two thousand trade associations operating today in the United States only seventy to eighty are open-price associations. As Secretary Hoover says, the legality or illegality of all forms of such price comparisons has never been definitely established, but it is clearly not in the public interest for competitors to fix their prices in secret. It is in effect a conspiracy against their customers—the public. It is this practice by the few that has cast suspicion upon all. The trade association can and should be lifted out of this "twilight zone" by the publication of all the cost and production statistics which it gathers. And its membership need not feel aggrieved. For if 1,900 associations find good and profitable work of other kinds to do, surely it will not require a great deal of imagination to find ways to make membership in any group worth while. The real function of such a body is to act as a virtual high school to the smaller business units of its industry.

Big companies can take care of themselves, but the small concern needs education in trade practice and aid in the development of the common opportunity. Here is the place for the trade association to render service.

As to what will happen when a new administration installs a new secretary in the Department of Commerce —there is no menace in that. If the trade associations do not like the tone of his voice or the color of his hair, they are quite free to withdraw from the arrangement. Mr. Hoover is not demanding the submission of trade statistics to his department. He is expressing a willingness to act as a clearing house and raise the trade associations above suspicion. If they voluntarily take advantage of this offer, they can likewise voluntarily cut off this relationship with the government whenever they desire.

Why Crack Nuts with a Trip Hammer?

THE manager of the small plant often listens with weary doubts to the story of methods used for organizing the operation of a big central station or conducting its business affairs. He feels, and there is some reason, that he cannot possibly undertake the systematic refinements about which he is hearing and is altogether discouraged at the possibility of trying. Now, it is perfectly true that there are many details in operation and management practicable in the case of a large plant which are utterly out of the question for the man who is operating in a small city. It is, after all, merely a matter of business. A company with a small yearly output cannot afford to spend the time and money which would be entirely justified by and adequate for an output ten times as great. In fact, we have little doubt that some fairly large plants are spending more on inconsequential details than their value justifies. To return to the small station, there is need, on the whole, for more careful watching of the power plant than exists in the case of a big plant, simply because the size of the small plant stands intrinsically against the highest economies, while it can perfectly well make a greater percentage of improvement than its big brother.

Take, for example, the matter of thermal efficiency in the generating station. The plant of a few thousand horsepower does not justify the array of automatic apparatus and records which would be worth while for a very much larger output. It can, however, do substantially the same things in simpler ways which would not be easy on a large scale. It can watch its coal and water consumption, its flue-gas temperatures and its hourly output without putting unreasonable burdens upon anybody, and from these it can very quickly find out where, if anywhere, the plant is failing to do its duty. It does not need a card catalog of every conceivable operation which goes on in its distribution department, but it is perfectly able to keep simple and straightforward records of output and of services, of lines run and lines discontinued, without extra clerical help or loss of valuable time. It can conduct its business in a manner just as orderly as the biggest of central stations, but by methods of inherent simplicity. There is no need of installing a pressure oil system for lubricating a sewing machine, and this homely example typifies the difference between things which should be done by large methods on a large scale and those for which the simplest means are not only adequate but reasonable.

If the manager of a small plant will take the system used by a big one and ask himself not how these things are done but what are they really designed to accomplish, he will find his puzzles gradually disappearing. Thermal efficiency, electrical efficiency, systematic and well-ordered distribution can be and should be found in every plant, big or little; but each must work out its salvation in its own way, suiting the most easily attainable means to the common end.

Correlation of Resistance and Breakdown Strength Would Be Welcomed

OF THE principal constituents of electrical machinery the greatest improvements of the future are to be looked for in the insulating materials. The problem, however, is one of the most baffling with which the manufacturer and investigator have ever had to contend. It appears safe to say that more time and effort have been expended on the study of insulation than on that of either iron or copper, yet our knowledge and our ability to control the former are far less definite than is the case with either of the latter. However, with increasing appreciation of the importance of the problem and recognition that its extreme complexity demands time, patience and careful study for its proper understanding, there is already beginning to appear from recent investigations a semblance of orderly relation between the physical properties of insulation and its behavior under electric stress.

For many years it has been generally accepted as an approximate truth that the insulation resistance as measured in megohms has little relation to the electric strength or breakdown voltage. The former test is used practically not at all for machinery, and the latter is used rather for the purpose of detecting weak points unavoidable even in the most careful manufacture than as an indication of the real electric strength of the perfect material. As is well known, the voltage test really lowers the initial electric strength of the insulation by the excess stress imposed. If reliable conclusions as to electric strength could be drawn from the value of the insulation resistance, the latter measurement would then undoubtedly rapidly supplant the former.

Several recent researches have brought out clearly certain parallels between these two properties. As regards the influence of both moisture and temperature, there is now substantial evidence that resistance and breakdown strength go more or less hand in hand for many types of manufactured insulation. The importance of the elimination of moisture has long been recognized, but its study and pursuit to the smallest quantities, as exemplified in the work of Evershed of a few years ago, has led to a far more exact knowledge as to the nature and laws of the conducting paths through the material. These laws, although as yet vague, already lead to conclusions on breakdown that are in good agreement with observation.

Similarly as regards temperature. Failure to realize the importance of an initial heat treatment for expelling moisture has often prevented proper recognition of the influence of temperature. Carried beyond this point, however, there is good evidence that a definite relation between insulation resistance and electric strength may be expected. A recent contribution in this field is the paper by W. S. Flight in the *Journal* of the (British) Institution of Electrical Engineers, in which is shown the influence of temperature in lowering the electric strength of those materials in which it is most difficult to eliminate moisture. The way is still long, and the difficulties are many and discouraging, to complete knowledge and control of the fibrous and flexible materials necessary in manufacture; but the work goes on and progress and improvement continue always.

Open-Delta Operation Has Its Advantages in Serving Growing Loads

WITHOUT going into the relative merits in regard to general operating conditions of closed-delta and open-delta transformer banks, which are dependent on many outside factors such as switches and throwover, it must be recognized that savings in energy losses are possible by open-delta operation. The applications of such operation are innumerable and the possibilities of accomplishing it are many. Wherever single-phase transformers handle three-phase load possibilities of such saving are present. Its magnitude will depend on the load factor and on the peak load carried. In this issue Merrill De Merit gives two examples of what can be expected from open-delta operation and points out the value of investigating all cases where open-delta application is possible. Although it is evident that the cost of energy saved is relatively small, as it is off-peak energy, the amount of energy saved will probably be large in many systems. Moreover, an improvement in power factor is possible at low load which would result in reducing losses at other points on the system, particularly in the overhead and underground lines, where, because of very bad power factor, large losses often occur at low-load periods.

Developing Purchasing Power in Customer-Ownership Campaigns

THE Central Maine Power Company's vigorous customer-ownership campaign during the past three years is noteworthy in several respects. Some three million dollars' worth of preferred stock has been absorbed in the territory served since intensive sales methods were adopted, and a potent stabilizing influence upon public sentiment has been created. Not through "propaganda" advertising but by an appeal to the people of Maine to unite with the company in building up the state has come a surprising amount of help in establishing private ownership upon a rock-bottom foundation. The soil of the Pine Tree State is, therefore, at the present time about as poor a seeding ground for state development of electric utilities as can be found in this country.

Only through intensive selling plans has the Central Maine company been able to accomplish so much. These plans have been developed along somewhat different lines from those ordinarily followed by banking houses seeking to place securities in the smaller cities and towns. With the utmost care the purchasing possibilities of the entire field, including remote hamlets, isolated farms and cities, were analyzed, and then the local newspapers were utilized with admirable advertising skill.

Instead of looking upon small towns and rural districts as potentially capable of absorbing only a comparatively few shares of company stock each, the Central Maine staff, through competitive selling and by persistent occupational marketing of the company's stock, has gone literally into the highways and byways, convinced the shrewd Yankee population of the desirability of sharing in the electrical development of the state in competition with outside investments, and achieved a truly enviable record. That people of small and moderate means can be sold securities of this sort when the proper methods are used signifies much to the believer in future good relations between the money-saving public and the companies supplying the essential services of which electricity, whether for light or for power, is the carrier and developer.

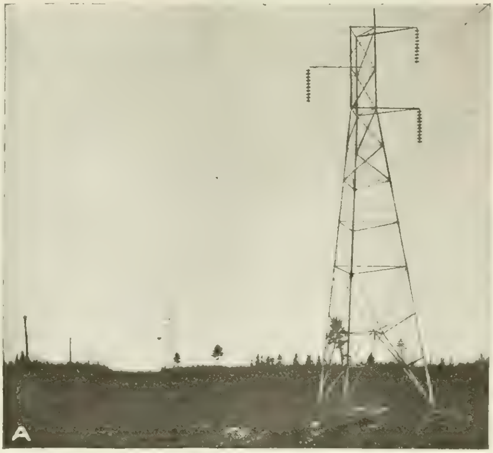
The man who has conducted this campaign presents in this issue a well-rounded, clear-cut program for the organization and operation of such a security-selling campaign to customers. Predicated on this three years' experience in Maine, it offers a practical guidance that may well be followed in the planning and promotion of similar public utility security campaigns in other communities, particularly where the population is small.

The Engineer and the Human-Relations Problem

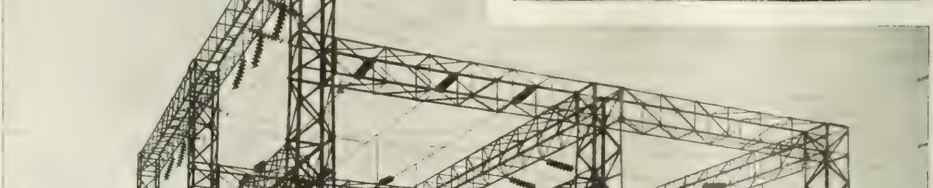
A FIRM belief in the unlimited possibilities of science and the ability of the engineer to produce food, shelter and clothing for the race was recently voiced by Dexter S. Kimball, president of the American Society of Mechanical Engineers and dean of the Engineering School at Cornell University. He was not so sanguine of the ability of the engineer to see and appreciate the human-relations problem which has arisen as a result of the extension of mechanical developments into every phase of industry and home life—an extension that has produced an intense specialization of labor and because of which the worker no longer owns the tools of industry. Although engineering has become synonymous with ability to do things and industry is becoming to be largely administered by engineers, Dean Kimball said that the effort of the engineer seems to have stopped at the point where the accomplishment of physical results is complete.

Written into our national charter is the declaration that every individual is entitled to life, liberty and the pursuit of happiness. Nine-tenths of happiness lies in the establishment of proper relations with others. Without such relations all the mechanical progress imaginable cannot make for development of the human race. With such relations established the greater the mechanical progress the greater the happiness of the human family. If, as Dean Kimball has said, the engineer has been extraordinarily blind to this phase of his problem, it is perhaps due to the tremendous pace in mechanical development that has been maintained for several decades past. However, the time has arrived when he can no longer afford to be blind. In no field is this thought more applicable than in the electrical, and particularly in the public utility portion of that field. It is gratifying to note that in the various conventions, through all the discussions, runs a note that puts the wellbeing of the public at the forefront in solving engineering and business problems. There is little need to worry about the ultimate awakening of the engineer. He is already yawning and stretching, at least; but it is desirable for him to hasten the awakening process a little.

Michigan System Comprises 1,300 Miles of Transmission Line, of Which 526 Miles Is 140 Kv.



STARTING operation of its 110,000-volt lines in 1907 and now having 526 miles of 140,000-volt line joining thirty-one steam and hydro-electric generating stations, the Consumers' Power Company of Jackson, Mich., ranks as a leader in high-tension interconnection. The nature of the country over which the lines are run and the construction of the towers are indicated in illustrations A and B. C is an outdoor switching station at Muskegon.



Thirty-one Hydro and Steam Plants Joined by 140-Kv. Lines in Michigan

Thirteen Hundred Miles of Transmission Line Involved, of Which 526 Miles Is of the Above Voltage—Eleven Years' Experience Has Justified the Line Construction Employed

By **HARRY J. BURTON*** and **WILLIAM W. TEFFT**†
Consumers' Power Company, Jackson, Mich.

AN EXCELLENT test of the value of interconnection in assuring continuity of service was afforded on the Michigan system during the sleet storms of the winter just past. These storms proved to be the most severe in the history of the State. Railroad schedules were canceled for two or three days, telephone and telegraph traffic was disrupted, trees were stripped of branches, and rain froze on wires to a diameter of 2.5 in. (6.3 cm.) and formed as many as five 7-in. (17.1-cm.) icicles to the foot on conductors. Although even the rugged steel transmission towers crumpled in some places and conductors broke in others, more than 99 per cent of the service was maintained uninterrupted. No interruption that did occur exceeded fifty-seven minutes. The authors feel that this record is one deservedly to be proud of, considering the fact that more than 1,300 miles (2,090 km.) of transmission lines was involved, joining thirty-one widely scattered generating stations‡ and about fifty substations. Of this mileage 526 miles (846 km.) consisted of 140-kv. lines. Furthermore, nearly half of the energy consumed in the system is generated by water-power plants situated chiefly at points remote from the market.

More Than 500 Miles of 140-Kv. Transmission System

The transmission system is divided into two parts by reason of the use of 30 cycles in the western portion of the peninsula and 60 cycles in the southern and eastern portions. The two parts each have main transmission at 140 kv., and they are tied together through a 15,000-kva. frequency changer at the Elm Street plant in Battle Creek. A 5,000-kva. frequency changer tying the two frequencies together on the lower-voltage transmission lines has been in operation since 1915 at the Kalamazoo plant. The section of the 140-kv. transmission line from Owosso to Lansing and Battle Creek has been changed from 70-kv. to 140-kv. operation in the past year, and a new section of 140-kv. line from Battle Creek to Argenta has been built to bring the 30-cycle system into Battle Creek for tying the two frequencies together. The transmission distances range from 40 miles to 250 miles (64 km. to 400 km.) and the power transmitted per circuit amounts in some cases to as much as 25,000 kw.

Previous to 1907 the transmission voltages did not exceed 70 kv. In that year the Croton-Grand Rapids line, about 40 miles long, was designed and built for 110-kv. operation. The distance from the Au Sable and Manistee River power sites to the power market was such that this voltage would not economically transmit the power available. In 1910 the first 140-kv. lines were designed and the construction undertaken, the circuits being put in service in 1912.

The present standard construction consists of single-circuit and double-circuit towers in standard and corner types and medium, heavy or tripod anchors as required. The single-circuit tower heights are such as to give either 40, 50 or 60 ft. (12, 15 or 18 m.) from the lowest wire to the ground, while the double-circuit towers give a clearance of 40 ft. (12 m.) from the conductor to the ground and 10, 20 and 30-ft. (3, 6 and 9-m.) extensions for either the standard or corner tower are provided. All construction that cannot be handled with this assortment of towers is treated as special, and designs are worked out in each case to fit conditions.

Steel-Tower Difficulties Encountered and Overcome

The single-circuit tower is a three-post type with triangular conductor arrangement. For the Croton-Grand Rapids line, which was only a step toward the design of the 140-kv. lines, the tower was modeled after an older pin-type tower. The three legs ran to a peak at the top of the tower and a ground-wire connection was provided. In passing it is interesting to note that, owing to adverse experience with ground wires on other lines, this ground wire was never installed. In the later designs the tower was modified to bring the legs within 4 ft. (1.2 m.) of each other at the bottom crossarm, providing the stiffer design needed when subjected to torsion and to stresses caused by conductor breakage.

The vertical spacing which was allowed between adjacent wires was 8 ft. (2.4 m.) and the horizontal spacing between wires on the opposite sides of the tower slightly more than 13 ft. (3.9 m.). Under certain conditions, when snow or sleet melted off the conductors, trouble due to the lower wire swinging up and short-circuiting the conductor above it was experienced. This occurred when the sleet fell off a single span, leaving the adjacent spans loaded. The vertical spacing for the 140-kv. towers was increased to 12 ft. (4.2 m.). The horizontal spacing was increased to 16 ft. (4.8 m.) to increase the clearance between the conductor and the tower leg from 5 ft. to 6 ft. (1.5 m. to 1.8 m.).

The older pin-type line towers were equipped with a tripod-type anchor. The designs for the Croton-Grand Rapids line provided for anchors constructed of a single galvanized-steel angle about 8 ft. (2.4 m.) long riveted about 1 ft. (0.3 m.) from the lower end of the leg. This was then covered with concrete molded in the form of a mushroom. The expectation that this form of construction would prove cheaper than the tripod anchors previously used was not realized as the difficulty in forming the concrete was greater than anticipated. Later experience indicated that the protection against corrosion given by the concrete was not needed, and the tripod type of anchor was retained in later designs. In the earlier lines no distinction was made between corner and straight-line towers, nor was there any attempt made to accommodate tower locations to the topography of the country. A uniform spacing of ten towers per mile was used. It was found that the use of one type of tower was not satisfactory. Two were then developed, one for use for straight lines and for deflections not in excess of 11 deg. The other was designed for angles up to 45 deg. and at railroad crossings. The design of the standard tower is based on the assumption that the tower need be no stronger than the conductor. The tower stresses are allowed to reach the assumed elastic limit of 32,500 lb. per square inch (2,275-kg. per sq.cm.) at the same time the conductor stresses reach that point. For the copper used this value is assumed at 35,000 lb. per square inch

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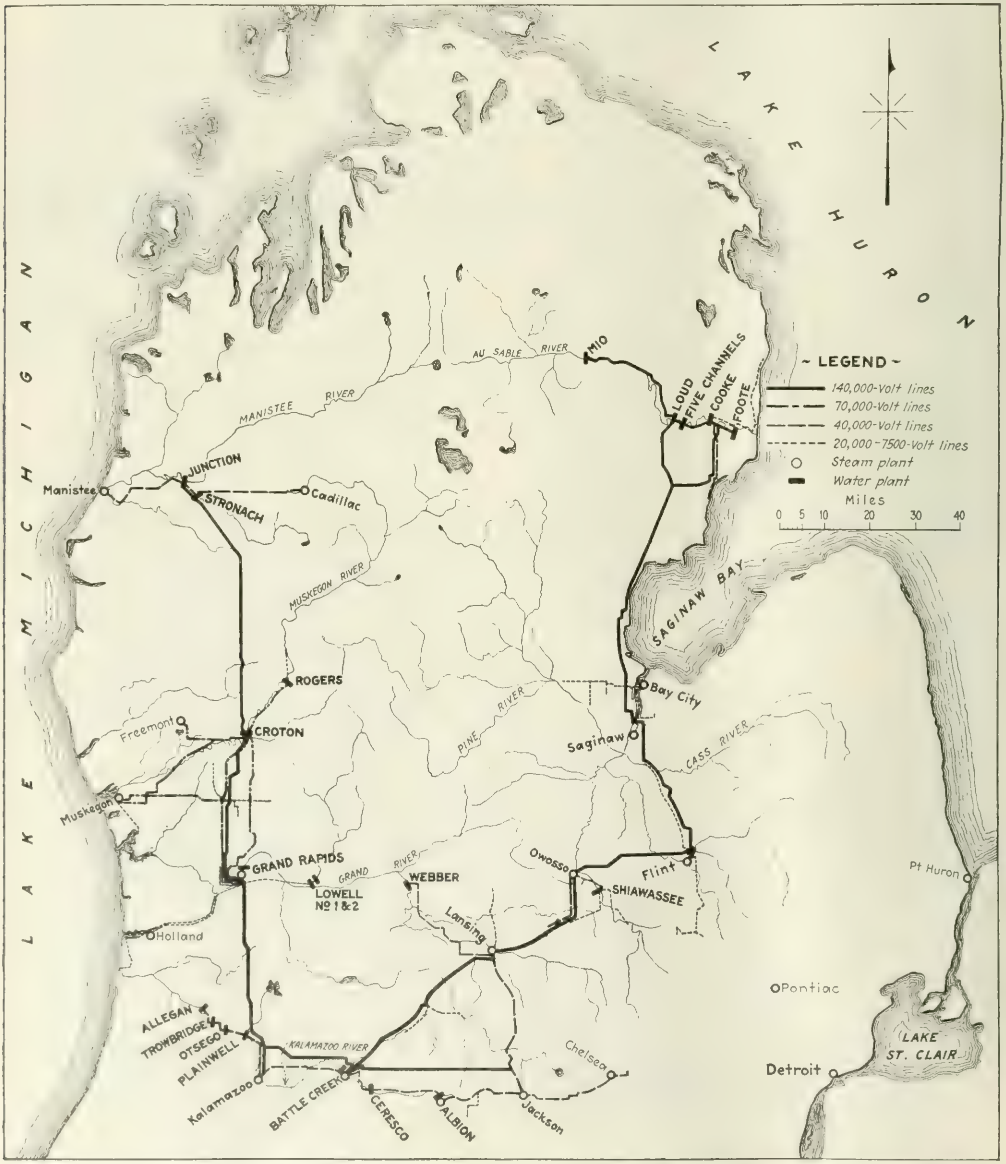
*Director of educational department.

†Consulting hydraulic and civil engineer.

‡Features of some of these plants were presented on page 329 of the Feb. 18, 1922, issue.



TWENTY HYDRO-ELECTRIC AND ELEVEN STEAM GENERATING STATIONS ARE INTERCONNECTED BY THESE TRANSMISSION LINES

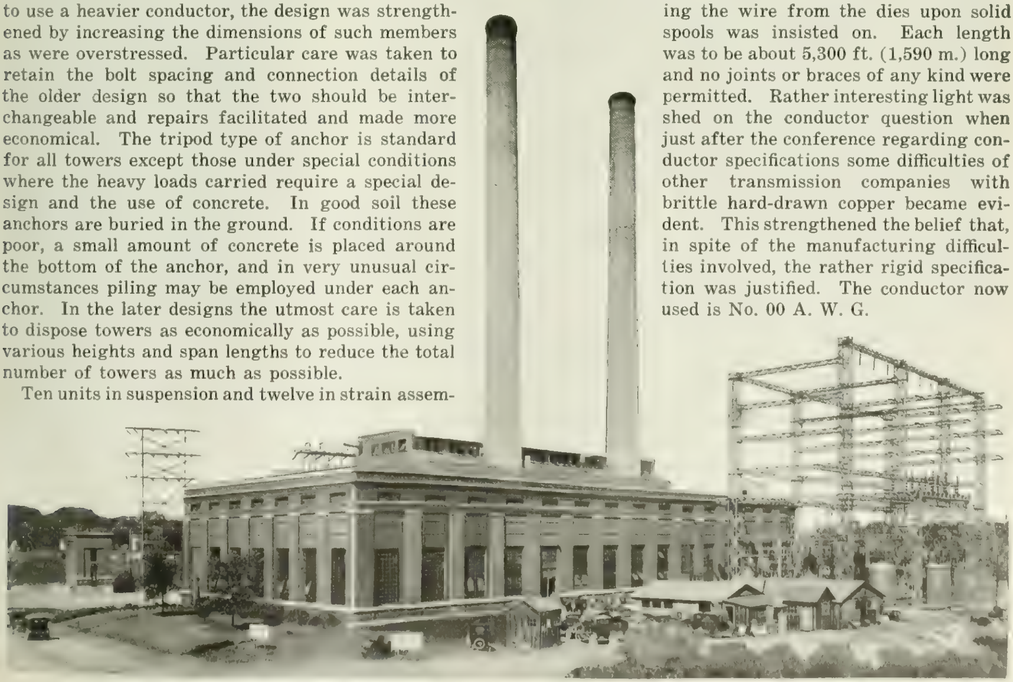
(2,450 kg. per sq.cm.). Eleven years of experience has shown few failures except those caused by conditions against which the designer is helpless, and the assumptions may therefore be considered justified, since they produce a most economical tower design. The corner tower is designed for greater assumed conductor stresses and the stress in the steel is limited to 25,000 lb. per square inch (1,750 kg. per sq.cm.). The three-post single-circuit tower has shown decided advantages due to economy in anchor settings, perfect anchor alignment and economy in total weight.

Tower Changes Required for Double Circuits

The necessity for double-circuit towers brought a design using a four-post tower with two cross-arms one above the other. Each cross-arm supported one circuit with three wires in a horizontal phone. Trouble on the upper circuit interfered with the operation of the lower one and at best made repairs on the upper one hazardous. A second design reverted to the three-post type with cross-arms and one circuit on each side of the tower. It was soon found that the advantages of the three-post tower for single circuits did not hold for the double-circuit type, because the combination of increased height and load produced an uneconomical design in that portion of the tower immediately below the lower cross-arms and imposed too great a duty on the anchors. A four-post tower was then designed for use on the 140-kv. transmission line from Grand Rapids to Kalamazoo. Three cross-arms were provided for the location of a circuit on each side of the tower with a vertical spacing of 12 ft. (4.2 m.) and a horizontal spacing of 16 ft. (4.8 m.). Later, when it became necessary to use a heavier conductor, the design was strengthened by increasing the dimensions of such members as were overstressed. Particular care was taken to retain the bolt spacing and connection details of the older design so that the two should be interchangeable and repairs facilitated and made more economical. The tripod type of anchor is standard for all towers except those under special conditions where the heavy loads carried require a special design and the use of concrete. In good soil these anchors are buried in the ground. If conditions are poor, a small amount of concrete is placed around the bottom of the anchor, and in very unusual circumstances piling may be employed under each anchor. In the later designs the utmost care is taken to dispose towers as economically as possible, using various heights and span lengths to reduce the total number of towers as much as possible.

Ten units in suspension and twelve in strain assemblies are used on all the 140-kv. lines. The Hewlett-type suspension insulator was used on the first 110-kv. lines. At that time no regular hardware was available, and the deficiency was supplied by using an annealed piece of line wire connected with Crosby clips. This arrangement has proved satisfactory for a good many years of service, though now a good many breaks are beginning to develop. The system has probably experienced about the same difficulties that have been met elsewhere.

The conductors employed on the Croton-Grand Rapids line consist of six strands of No. 10 medium hard-drawn copper, making a conductor a little less than No. 2 in copper content, but an over-all diameter slightly less than No. 1. The combination was selected for purely manufacturing reasons. A hemp center was put in the conductor and caused considerable localized corona, so that it is probable that the increased diameter of the conductor did not greatly reduce the corona loss. In the fall of 1908 the General Electric Company made some corona tests on this line. When the 140-kv. lines were designed in 1910 there were hardly any other data available on this subject. On the strength of the tests it was decided that No. 0 stranded conductors would be the smallest it was advisable to use. These were made up of seven strands of copper instead of the six strands of copper and one of hemp in the conductors on the older line. Because of the high stress to which the wire was to be worked to obtain the largest possible ground clearance and the longest possible spans with 40-ft. (12-m.) towers, the specifications were very rigid. Particular care was taken to specify a tensile value that will give maximum strength with a minimum of brittleness. The avoidance of small kinks by drawing the wire from the dies upon solid spools was insisted on. Each length was to be about 5,300 ft. (1,590 m.) long and no joints or braces of any kind were permitted. Rather interesting light was shed on the conductor question when just after the conference regarding conductor specifications some difficulties of other transmission companies with brittle hard-drawn copper became evident. This strengthened the belief that, in spite of the manufacturing difficulties involved, the rather rigid specification was justified. The conductor now used is No. 00 A. W. G.



EASTERN AND WESTERN HALVES OF 140-KV. SYSTEM JOINED BY FREQUENCY CHANGER IN THIS STATION

This steam generating station, which is situated at Battle Creek, Mich., is thoroughly modern, having been completely remodeled recently. It is rated at 27,000 kw. and contains a 15,000-kva. 60/30-cycle frequency changer.

Economy of Open-Delta Operation

In Growing Industries Two Transformers May Serve Load for Some Time, Thus Postponing Purchase of One Transformer—Condition When Third Unit Is Necessary

By **MERRILL DE MERIT***
West Penn Power Company, Pittsburgh, Pa.

STATEMENTS from different sources have indicated a prejudice, in some places at least, against open-delta operation. It cannot be denied that in many cases the open-delta arrangement of transformers is very unsatisfactory, both as to economy and to service. However, the conditions which govern different cases vary widely and economical considerations indicate that the open-delta bank for transforming three-phase power has some applications. Frequently the conditions of operation on power transformers are such that a three-phase bank is underloaded for a great period of time. This is especially true of transformers which accommodate growing industrial loads where the customer takes primary current, because the open-delta arrangement reduces his original investment about one-third, and he can increase his transformer capacity by inserting the third transformer.

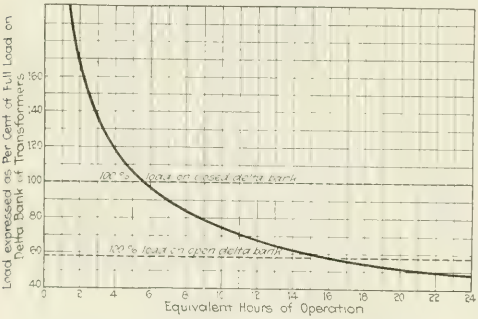


FIG. 1—LOAD OF EQUAL ECONOMY FOR OPEN-DELTA AND CLOSED-DELTA BANKS OF TRANSFORMERS

If, for instance, the equivalent hours of full load operation are ten and the load is 50 per cent open-delta operation is economical.

The third transformer should be inserted when the load becomes too great for the original two, or, possibly sooner, when the load reaches some other amount determined by economy. Naturally the economical determination would take into account the cost of transformers and the cost of energy. Each case in practice would therefore require a special solution. The more general problem will be handled here; that is, only the economy with respect to energy losses will be considered. When the open delta arrangement is being used the exciting current on the third transformer is being saved. The copper losses are greater than with the closed delta for the same load, and so at higher loads would offset the advantages of lower excitation loss. The daily copper losses are a function of the equivalent hours of operation at maximum load, so that in determining the load at which it would be economical to cut in the third transformer it is essential to take these into consideration. This load for any number of equivalent hours may be readily computed from the data ordinarily furnished with each transformer, *i.e.*, the quarter-load efficiency and the full-load efficiency.

The derivation of the general equation for determining the point at which economy changes from closed-delta to open-delta operation follows. It is assumed that the load is balanced.

I_f = transformer current at full load.
I_l = line current at full rated load of closed delta bank.
I_c = line current of equal economy for closed and open delta connections.
R = equivalent resistance of one transformer.
C = core loss in watts for one transformer.
I = line current at any time.
t_e = equivalent hours of operation per day.

DAILY LOSSES IN WATT-HOURS

Transformer Connection	Copper Losses	Core Losses
Delta	$3\left(\frac{I}{\sqrt{3}}\right)^2 R \times t_e$	$3\,C \times 24$
Open-delta	$2\,I^2 \times R \times t_e$	$2\,C \times 24$

Equal economy will occur when core lossesΔ + copper lossesΔ = core lossesΛ + copper lossesΛ, hence

$$3\left(\frac{I}{\sqrt{3}}\right)^2 R \times t_e + 3\,C \times 24 = 2I^2R \times t_e + 2\,C \times 24$$

Then the critical line current $I_c = \sqrt{\frac{24\,C}{R t_e}}$, $I_l = I_f\sqrt{3}$ and

$$\frac{I_c}{I_l} = \sqrt{\frac{8}{t_e} \times \frac{C}{I_f^2 R}}$$

where $\frac{C}{I_f^2 R}$ = ratio of core loss to copper loss at full load on one transformer.

This equation, in terms of the known full-load current and the equivalent hours of maximum load operation, gives an easy method of solving for the current that will give equal economy on both methods of operation, open-delta or closed-delta. It is evident that the constant $\frac{8\,C}{I_f^2 R}$ will vary with transformers of different sizes and characteristics.

As an illustration of the application of the equation the problem is worked out for a bank of three single-phase, 200-kw., 6,600/220-volt transformers of known characteristics as follows:

If the efficiency of each transformer is 96.5 per cent at quarter load and 98 per cent at full load, then

At full load

(1) Input = 200,000 + I_f^2R + C watts
Output = 200,000

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*Formerly with distribution engineering department, Detroit Edison Company.

$$(1)\ \text{Efficiency} = 98/100 = \frac{200{,}000}{I_{f_2}R + C + 200{,}000}$$

At quarter load

$$\text{Input} = 50{,}000 + \left(\frac{I_f}{4}\right)^2 R + C \text{ watts}$$

$$\text{Output} = 50{,}000$$

$$(2)\ \text{Efficiency} = 96.5/100 = \frac{50{,}000}{\left(\frac{I_f}{4}\right)^2 R + C + 50{,}000}$$

Solving (1) and (2) simultaneously, $C = 1660$, $I_f^2R = 2420$ and $\frac{I_f^2R}{C} = .686$

and the equation for the economy curve becomes

$$\frac{I_c}{I_t} = \sqrt{\frac{5.48}{t_e}}$$

The curve in Fig. 1 is drawn by taking various values of t_e and substituting them in this equation. The curve indicates that with the transformers assumed it would be economical for ordinary types of load to use the open-delta connection at least up to its full capacity. The equivalent hours on most power loads do not run over ten and are usually considerably less—down to four or six for smaller loads. Within this range the curve lies considerably above the full load point of the open-delta bank. However, another point must be taken into consideration here. The regulation of the three phases of an open-delta bank is not the same, even if the load is a balanced three-phase load. That is, at full load the voltage between any two wires on the secondary side is different from the voltage between any other two wires. This difference may be relatively high, depending on the design of the transformer. In cases where it is relatively high it would decrease the efficiency of some of the three-phase machinery contained in the load. Naturally it would not be good policy to fully load the transformers unless the equivalent hours of operation were fairly low. If the load contains no machinery which would be affected by this inequality of voltage this consideration would of course be unnecessary.

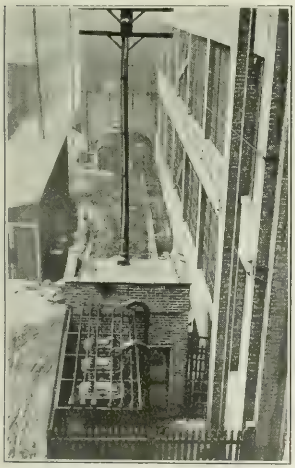


FIG. 2—OPEN-DELTA TRANSFORMER BANKS HAVE PLACE IN SERVING GROWING LOADS

Two 200-kva. transformers in open delta were originally installed to care for this load, which had prospects of growing rapidly. After the load had increased sufficiently the third transformer was added, making the installation shown.

Thus far the discussion has been from the viewpoint of determining the economy of open-delta operation in cases where the load is low and is expected to increase. The object has been to bring out the fact that if there exist advantages of another nature in favor of open-delta operation, then the economy of operation of the transformers so arranged will usually add further advantages. However, the great variety of conditions of load which are shown to be economical by the curve in Fig. 1 may cause one to ask whether it might not be good policy to operate in open delta even in some cases where the other favorable conditions do not exist. Some of these other cases would be where the load on a certain bank of three transformers is cut down temporarily for a considerable period of time. Such conditions of load might be brought about by a dull business period, a curtailment of load by the central station company, or some similar cause. In order to determine whether it would be good policy to disconnect one of the three transformers in a case of this nature it would be necessary to determine the amount that could be saved by the economy thus effected. This would enable one to say just how much trouble or expense would be justified to cut out the third transformer. In order to give a general idea of how much the saving might be under the proper conditions, a curve has been drawn (Fig. 3) between size of transformer and kilowatt-hour of core loss per month. This curve is only for transformers of certain voltages and of a certain design, but, generally speaking, this curve will very closely represent the conditions for any line of transformers designed for general purposes and which are for voltages ordinarily used on power distribution. To facilitate interpretation of this curve in terms of dollars a second scale has been added at the right of the sheet, showing the monthly cost of power loss in dollars for various transformers. The cost of energy used is $0.025 per kilowatt-hour.

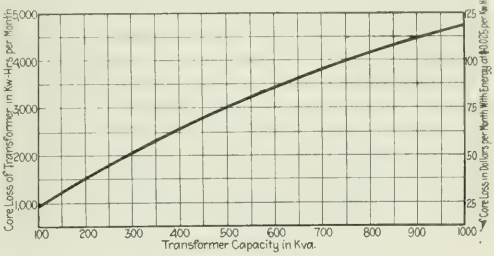


FIG. 3—CORE LOSS PER MONTH AND EXPENSE THEREOF FOR A GIVEN GROUP OF TRANSFORMERS

Refers to 6,600-volt, 60-cycle, single-phase power transformers. Curve shows cost of core loss in dollars per month if energy costs $0.025 per kilowatt-hour.

If the load is well below the critical point the cost of core loss on one transformer represents very closely the saving that would be effected by disconnecting one transformer of a three-phase bank and operating the other two in open delta. The actual saving would be less than the core loss saving for a given period by an amount equal to the increase in copper loss cost on the two transformers during that period. However, since the copper loss varies as the square of the load, and since it is usually about 1 per cent at full loads, it becomes almost negligible at low loads. This is more nearly true since the copper loss endures for only a portion of each day. From the curve in Fig. 3 it is evident that this saving is appreciable, especially with transformers of large capacity. It seems possible that, for the transformers considered, a sufficient saving would be accomplished to warrant the disconnection of transformers as small as 100 kw. for a period of a month. It is also evident that the longer the period of low load the greater the amount which will be saved.

The cost of disconnecting and connecting would not vary, of course, with the length of time the load is low and so, generally speaking, the longer the period of low load is to exist, the smaller will be the lowest size of transformer that can be economically disconnected. Conversely, it might be economical to disconnect one transformer in a large bank for a short period of low load. It is quite conceivable that with the proper equipment available, it might be quite profitable to switch out one transformer for a period of a few hours.

It is not meant to imply that other considerations besides those of strict energy economy should not be made. For instance it would, of course, be folly to install expensive switching equipment to cut out a transformer once or twice. Nor would it be good policy to cut out an out-door transformer located in some position where it would be liable to rapid deterioration, unless the economy gained would justify special means for preventing such injury. The number of conditions which might prevent the disconnecting of one transformer are too numerous to be given here. There are, however, in every electrical problem a similar large number of facts and special conditions which must be taken into consideration in the solution of that problem.

It is meant to emphasize here that the fact which should be taken into consideration in many cases is that the superior economy of open-delta operation over closed-delta operation justifies its use. Briefly, it may be stated that frequently:

1. Where other advantages exist for open delta operation, usually the economy of energy consumption in the transformers adds another advantage.
2. Where the load on a bank of three single-phase transformers is to be low for a considerable period of time, considerable saving can be accomplished by disconnecting one of the transformers and operating the other two in open delta.
3. That where conditions are favorable on banks of three large single-phase transformers it is good policy to disconnect the third transformer and operate the other two in open delta for very short periods of low load.
4. That each problem should be considered with reference to all facts and conditions which affect that problem, and that in all problems due importance should be given to the economy of open-delta operation.

Census of Electrical Manufactures for 1919 Analyzed

Even After Consideration Is Taken of Underlying Economic Conditions, It Is Apparent that Electrical Production Has Made Tremendous Strides, Especially in Energy-Consumption Devices

DETAILED figures of the sales in 1919 of electrical machinery, apparatus and supplies, as compiled by the Bureau of the Census, are now available and are here published for the first time. For comparative purposes corresponding data are given for the census years 1914 and 1919. In this respect, however, a word of caution should be given. Due consideration must be given to the economic conditions that existed in the years taken before making any comparisons. Otherwise one is apt to arrive at unwarranted conclusions.

It must not be forgotten, for instance, that the first seven months of 1914 were pre-war months and consequently more or less normal. During the last five months of that year business, both domestic and foreign, fell off and was almost at a standstill. Prices reflected this condition and as a result were lower toward the close of the year. All told, therefore, the year 1914 was decidedly subnormal and was below those immediately preceding it.

After 1914 a great change occurred in business, particularly in prices. At the opening of 1919 the war had been over only a little more than a month and already there was a depression, with falling prices, due to the cessation of business in munitions. In this fashion the first quarter passed. Then the pent-up desire to spend asserted itself and the entire country was before long engulfed in a wave of unbridled extravagance. Not even at the height of the war were factories so hard pushed to meet demands. Prices soared to record levels in most lines, and the year closed on the crest of the flood of prosperity. Thus the year 1919 was decidedly above normal both in volume of merchandise produced and in the price secured. This was true of the foreign as well as the domestic market.

In order, therefore, to get a true picture of the growth of the electrical manufacturing industry one should really allow a little for 1914 and temper somewhat the 1919 figures.

The tables tell the story better than words. Table I gives the picture as a whole, while the important subdivisions are given in more detail in the smaller tables. There are, however, certain features to which attention should be directed.

The growth in the battery business seems almost unbelievable. This is another indication of the extent to which electric starting and lighting have replaced hand cranking and acetylene for automobiles. The figures also show to what proportions the flashlight trade has developed, as it were, almost overnight.

It is impossible to help noticing the rapid gains made by Pennsylvania manufacturers of switchboards and similar equipment.

The greatest surprise, however, is in the transformer figures. The increase in kilowatts was from 2,644,794 to 14,484,179, while the value increased from $13,120,065 to $25,560,901. The market for large transformers was very active, this being brought about by the great number of interconnections.

Illinois took first place from New York in the production of insulated wire and cable, while New Jersey retained her position in second place. Not only did

TABLE I—ELECTRICAL MACHINERY, APPARATUS AND SUPPLIES—SUMMARY

	1919	1914	1909	1904
PRODUCTS, TOTAL VALUE:	$1,019,060,879	$359,432,155	$240,037,479	$159,551,402
Electrical industry—electrical machinery and apparatus	$997,968,119	$335,170,194	$221,308,563	$140,809,369
Subsidiary electrical products of other industries	21,092,760	24,261,961	18,728,916	18,742,033
PRINCIPAL GROUPS:				
Generating apparatus and parts	$86,266,114	$17,865,542	$14,077,071	$11,084,234
Transformers and feeder potential regulators	53,495,570	28,276,338	14,630,715	7,142,026
Motors (not including starters or controllers)	116,893,638	44,176,235	32,087,482	22,370,626
Electric locomotives, mining, industrial and railway	8,159,825	3,720,914	(1)	(1)
Batteries, storage	60,036,152	13,080,964	4,678,209	2,645,749
Batteries, primary	32,427,043	10,321,491	5,934,261	1,598,144
Carbons—furnace, lighting and welding; brushes, battery and miscellaneous	13,291,615	3,602,741	1,934,864	2,710,935
Arc lamps	606,771	742,142	1,706,959	1,574,422
Searchlights, projectors and focusing lamps	4,342,246	2,081,545	935,874	114,795
Incandescent lamps	57,646,900	17,350,385	15,714,809	6,953,205
Rectifying apparatus, including rotating commutators, electric valves, mercury rectifiers and vibrating commutators	1,964,876	147,965	*	*
Telegraph apparatus	12,816,341	2,248,375	1,957,432	1,111,194
Telephone apparatus	46,214,342	22,815,640	14,259,357	15,863,698
Household and industrial apparatus and devices	54,793,195	4,048,915	1,954,112	395,827
Electric measuring instruments	19,322,164	8,786,506	7,800,010	5,004,763
Magneto-ignition apparatus	51,286,793	22,260,847	6,092,343	678,077
MISCELLANEOUS ELECTRICAL MACHINERY, APPARATUS AND SUPPLIES:				
Switchboards, panelboards and cut-out cabinets for light and power	17,735,780	8,989,111	5,971,804	3,766,044
Railway switches, signals and attachments	4,466,611	†6,393,551	†5,377,843	†1,451,337
Circuit breakers, oil	2,733,535	‡	‡	‡
Circuit breakers, air and carbon	1,391,911	‡	‡	‡
Fuses, cutouts, and fuse plugs	7,895,098	1,757,430	1,001,719	868,079
Insulators	6,504,147	‡	‡	‡
Sockets, receptacles, bases and attachment plugs	15,008,365	5,512,609	4,521,729	2,010,860
Wiring supplies (current carrier)	6,857,819	‡	‡	‡
Lightning arresters, choke coils, reactors and other protective devices	2,353,416	1,188,773	940,171	587,124
Insulated wire	53,302,821	69,505,573	51,624,737	34,519,699
Insulated cables, rubber insulation	15,576,247			
Insulated cables, paper insulation	15,337,853			
Pole-line hardware	9,379,145	‡	‡	‡
Circuit fittings not elsewhere provided for	5,052,994	2,067,683	1,080,287	352,544
Underground conduits	890,749	4,874,709	5,098,264	2,416,245
Interior conduits	18,375,880			
Electric lighting fixtures of all kinds§	2,703,266	3,383,955	2,200,668	3,294,606
Annunciators and push-buttons	709,941	263,806	235,567	185,870
Electric clocks and time mechanisms	1,797,909	410,774	352,513	373,926
Bells, buzzers and signal gongs	3,616,281	‡	‡	‡
Therapeutic apparatus, including X-ray tubes	8,895,402	2,653,098	1,107,858	1,036,962
All other electrical machinery, apparatus and supplies	95,232,300	27,276,294	18,995,176	26,267,509
All other products	76,573,808	17,951,652	17,765,645	
Amount received for custom work and repairing	27,106,016	5,676,592		

* Figures not available. † Reported as "electric switches, signals and attachments." ‡ Not reported separately. § Not including fixtures made by establishments engaged primarily in the manufacture of "gas and electric fixtures."

TABLE II—GENERATING APPARATUS AND PARTS, 1919 AND 1914

	1919	1914
Total value	$86,266,114	$17,865,542
Generators (other than small dynamos under 10 kw.):		
Alternating current—		
Steam-turbine driven, under 2,000 kva.:		
Number	532	375
Kilowatts	665,971	600,185
Value	*	$3,895,291
Steam-turbine driven, 2,000 kva. or over:		
Number	144	......
Kilowatts	1,236,827	†
Value	$8,262,802	......
Other, including waterwheel-driven:		
Number	3,123	2,137
Kilowatts	821,597	587,820
Value	$4,403,290	$3,542,154
Direct current—		
Steam-turbine driven:		
Number	2,262	264
Kilowatts	408,866	14,916
Value	$2,704,563	$398,379
Other, including waterwheel-driven:		
Number	4,345	9,369
Kilowatts	485,266	206,305
Value	$3,937,080	$2,569,086
Small dynamos (under 10 kw.), starting motors and automotive generators, not including control equipment-value	$36,662,797	$5,933,273
Self-contained lighting outfits (as farm-lighting outfits):		
Number	61,357	. .
Value	$24,078,536	†
Parts and supplies, value	$6,217,046	$1,527,359

* Value included with that of generators of 2,000 kva. or over, to avoid disclosure of individual operations. † No segregation reported in 1914.

TABLE III—TELEGRAPH APPARATUS, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$12,816,341	$2,248,375	$1,957,432
Intelligence (key, sounder, etc.), all kinds	$2,649,365	$201,956	$197,669
Police, fire, district and miscellaneous	2,092,340	1,253,954	1,126,658
Radio and wireless	7,834,698	672,575	448,262
Switchboards, parts and supplies	239,938	119,890	184,843

TABLE IV—TRANSFORMERS AND FEEDER POTENTIAL REGULATORS, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$53,495,570	$28,276,338	$14,630,715
Transformers:			
Number	382,929	115,843	76,729
Kilowatts	14,484,179	2,644,794	1,635,429
Value	$25,560,901	$13,120,065	$8,801,019
Under 50 kw.:			
Number	331,099	110,177	72,776
Value	$10,613,234	$7,316,615	$4,184,832
50 kw. to 500 kw.:			
Number	50,661	4,857	3,953
Value	$9,199,762	$2,625,414	$4,616,187
500 kw. or over:			
Number	1,169	809	
Value	$5,747,905	$3,178,036	
Rheostats, resistances, controllers, motor starters, speed-controlling devices, reactances, regulators, etc	$23,083,265	$9,788,378	*$2,674,963
Converting apparatus—synchronous condensers, motor-generator sets, double-current generators, dynamotors, frequency changers and rotary phase converters	$4,851,404	$5,367,895	$3,154,733

* Rheostats and resistances only.

TABLE V—BATTERIES, PARTS AND SUPPLIES, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$92,463,195	$23,402,455	$10,612,470
Storage:			
Batteries, value	$56,648,347	$10,615,150	$4,243,984
Weight of plates, pounds	138,438,540	41,079,047	23,119,331
Parts and supplies, value	$3,387,805	$2,465,814	$434,225
Primary:			
Dry—			
Number	79,300,082	71,092,438	33,988,881
Value	$17,805,611	$8,719,164	$4,583,082
Dry, small for flashlights—			
Number	94,483,894		
Value	$7,514,833		
Liquid, including testing—			
Number	2,050,946	306,351	344,650
Value	$3,508,624	$802,525	$729,513
Parts and supplies, value	$3,597,975	$799,802	$621,666

New York fall to third place, but she actually produced less than in 1914.

Lamp production figures are available each year, but still it is interesting to note the tremendous strides that were made in this market in five years. With carbon-lamp production standing almost still, tungsten-lamp production progressed from 74,434,059 lamps in 1914 to 211,383,193 lamps in 1919.

To get an idea of the market for radio supplies one has but to look at the 1919 figures, which were for a period antedating the opening up of the great broadcasting market. From sales in 1914 of $672,575 the market grew in 1919 to $7,834,698.

The household and domestic device market is another that has grown by leaps and bounds. Even where the difference in price is taken into consideration, the 1919 demand will be found to have been many times that in 1914.

The extent of the domestic-appliance market is further shown in the table giving details of motor production. Less than 1 per cent of the 1919 production was of motors rated at over 200 hp. If further analyses were possible, it would probably be found that most of the motors were fractional-horsepower motors.

Another interesting development is the farm-lighting-plant market. The value of this market in 1919 exceeded the value of the total generator market five years earlier.

TABLE VI—MOTORS, PARTS AND SUPPLIES, 1919 AND 1914

	1919	1914
Total value	$116,893,638	$44,176,235
Stationary motors:		
Number	1,533,407	*417,992
Horsepower	3,791,062	*2,882,795
Value	$76,171,558	*$32,286,149
Direct-current—		
Number	380,182	133,492
Horsepower	734,691	980,820
Value	$20,200,313	$13,316,489
Alternating current—		
Under 200 hp.:		
Number	1,151,286	284,500
Horsepower	2,559,526	1,901,975
Value	$52,430,381	$18,969,660
200 hp. or over:		
Number	1,939	
Horsepower	496,845	
Value	$3,540,864	
Marine motors:		
Number	2,630	†
Horsepower	8,428	†
Value	$816,371	†
For vehicles and railways:		
Number	49,256	‡11,880
Horsepower	351,286	‡36,858
Value	$6,355,102	‡$1,351,442
For fans:		
Number	709,350	‖
Horsepower	66,915	‖
Value	$9,908,001	$4,835,850
For miscellaneous uses:		
Number	198,305	‖
Horsepower	141,610	‖
Value	$4,920,311	$1,190,564
Parts and supplies	$18,722,295	$4,512,230

* Includes railway motors. † Not reported separately. ‡ Vehicle motors only. ‖ Figures not available.

TABLE VII—INCANDESCENT LAMPS, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$57,646,900	$17,350,385	$15,714,809
Tungsten:			
Number	211,383,193	74,434,059	11,738,619
Value	$46,628,343	$11,886,354	$6,241,133
Carbon filament:			
Number	13,330,273	14,092,055	55,038,378
Value	$1,830,644	$1,397,572	$6,157,066
Decorative and miniature lamps, X-ray bulbs, vacuum tubes, etc.	$5,892,211	$1,702,729	$600,619
Gem and vacuum and vapor lamps	$2,512,435	$2,363,730	$2,715,991
Other types	$783,267		

TABLE VIII—MAGNETO-IGNITION APPARATUS—GENERATORS, SPARK PLUGS AND COILS, 1919, 1914 AND 1909

	1919	1914	1909
United States, total value	$51,286,793	$22,260,847	$6,092,343
Ohio	$11,262,431	$7,472,268	$131,055
New Jersey	7,780,531	2,922,684	469,952
New York	6,000,612	1,205,494	1,483,735
Pennsylvania	3,509,392	538,762	*
Indiana	2,404,530	2,950,792	2,223,221
Illinois	1,842,045	413,986	253,451
Wisconsin	1,330,480	202,130	63,606
Minnesota	56,678	....	....
All other states	17,100,094	6,554,731	1,467,323

* Included in "All other states."

TABLE IX—HOUSEHOLD AND INDUSTRIAL APPARATUS AND DEVICES, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$54,793,195	$4,048,915	$1,954,112
Welding apparatus (not including motor-generator sets)	2,701,378	231,082	83,505
Electric furnaces (for iron and steel and brass industries)	1,040,337	*	*
Heaters (industrial heaters; air heaters, including those for cars; water heaters)	2,889,734	352,617	919,533
Stoves and ranges	3,444,170	671,413	
Miscellaneous cooking devices (griddles, grills, toasters, percolators, etc.)	7,815,212	1,327,183	951,074
Flatirons	5,646,421	1,466,620	
Vacuum cleaners, vibrators, clippers, cutters, etc.	21,842,439	*	*
Other portable motor-driven devices (motor built in)	6,985,809	*	*
Other stationary motor-driven apparatus (motor built in)	2,427,695	*	*

* Not reported separately.

TABLE X—ELECTRIC MEASURING INSTRUMENTS, 1919, 1914 AND 1909

	1919	1914	1909
Total value	$19,322,164	$8,786,506	$7,800,010
Station meters and apparatus	$7,084,983	$1,585,500	$1,639,202
Testing and scientific instruments	3,336,172	1,073,060	546,970
Meters for consumers' circuits	8,901,009	6,127,946	5,613,838

TABLE XI—SWITCHBOARDS, PANELBOARDS AND CUT-OUT CABINETS FOR LIGHT AND POWER, 1919, 1914 AND 1909

	1919	1914	1909
United States, total value	$17,735,780	$8,989,111	$5,971,804
New York	$7,483,106	$5,505,685	$2,789,297
Pennsylvania	5,197,725	1,566,433	1,243,356
Ohio	772,683	237,916	236,930
Illinois	444,605	419,931	448,185
Massachusetts	375,699	157,961	304,502
Connecticut	356,104	224,481	151,385
Wisconsin	317,097	*	†
Indiana	248,784	229,989	117,877
California	183,541	130,162	90,594
Washington	169,928	*	†
Minnesota	158,454	71,971	48,385
All other states	2,028,054	444,582	541,293

* Included in "All other states." † Figures not available.

TABLE XII—INSULATED WIRE AND CABLES, 1919, 1914, AND 1909

	1919	1914	1909
United States, total value	$84,216,921	$69,505,573	$51,624,737
Wire	$53,302,821	*	*
Cables	30,914,100	*	*
Illinois	$18,660,109	$9,626,775	$9,487,006
New Jersey	16,715,538	15,038,971	13,945,425
New York	14,257,277	19,178,327	9,485,282
Connecticut	11,456,468	6,206,803	4,205,509
Rhode Island	6,006,526	6,045,876	7,741,411
Massachusetts	5,832,663	6,799,411	2,194,474
Pennsylvania	5,367,492	3,299,485	2,796,825
Michigan	3,160,516	†	†
All other states	2,760,332	3,309,925	1,768,805

* Not reported separately. † Included in "All other states."

How to Put on a Stock Campaign

Preliminary Steps Necessary in Laying Out Campaign—Unexpected Obstacles to Be Met—Advertising and Follow-Up Methods—Keeping Employee Interest Aroused

By PERCY H. WHITING
Manager Securities Department, Central Maine Power Company

THIS article has been written for the man who believes in the sale of utility securities to customers and wants to know in intimate detail how to go about it. It is straight-from-the-shoulder advice on the organizing of a stock campaign. It analyzes carefully the necessary steps which must be taken to carry out such a program. It warns against possible pitfalls. It draws largely upon the author's personal experience in customer-ownership campaigns, and his deductions are based upon first-hand information. It concerns itself chiefly with methods which can readily be employed for a selling campaign in territory where stock has never been sold before. Mr. Whiting has agreed to write two more articles to follow, one to deal with the problems to be met in carrying on a campaign after the cream has been skimmed off, and the other with the development of a permanent securities department manned by salesmen who give their time exclusively to stock selling.

FOUR years ago the writer of this article was dropped unceremoniously beside a bale of stock certificates—the first he had ever seen—with brief but explicit orders, "Sell 'em!" He did—and it was an experience calculated to teach any one a great deal in a comparatively short space of time. What was learned in that hectic four years of stock selling will now be set down for the benefit of those who wish to sell their securities to customers through their employees by a series of selling campaigns.

The selling of stock to customers is an easy matter after you have, first, made your customers want the stock and, second, made your employees believe they can sell it.

You accomplish the first step—"making them want it"—by two processes, first, setting limits on the amount of stock you will sell and the people to whom you will sell it, and, second, advertising the stock.

The gentle art of making an article desirable by limiting the amount that will be sold was discovered hundreds of years ago. "We have only fifty of these beautiful coats at $25" is enough to start a riot in a department store, while the familiar "Only one to a customer" has stimulated sales since advertising started. One of the first power companies that used this device of selling a limited number of shares in a customer-ownership campaign was, I believe, the Narragansett Electric Lighting Company. It offered a "limited number of shares of its stock, not over five shares to a customer," and sold its issue in a few hours. Others have tried it with success.

So now most of us stimulate the demand for our securities, when we can, by limiting the sale ordinarily (a) to so many shares in all, (b) to customers and employees only, and (c) to not over ten shares to a customer. Combine these limits with the advertising which will be discussed later, and assuming that the local standing of your company is even "fair" and the price not too far out of line, your preferred stock will be attractive to your customers.

Surprisingly enough, it is generally more difficult to convince your employees that they can sell than it is to make your customers want to buy. The attitude of the average employee is: "I'm a [for instance] lineman, what do I know about stock selling?" To meet this situation I have used successfully what I call the "ten-point" plan. I admit to employees that they cannot sell. But I get them to admit that they can write, read and walk. After they admit that much they must admit further that they "can call on ten customers in ten days and tell them ten points about the stock." If they will do this simple task, they will get the orders. The rest of employee stock selling is a matter of detail.

The necessary details, carefully explained, are given at some length in a "Standard of Practice" which the writer has prepared for the National Electric Light Association and which will soon be ready for the use of member companies. A brief summary of the steps of a sale follow:

The preliminary step is the same as for rabbit stew: "First catch the hare." The precaution of being sure you have stock to sell before starting to sell it is fervently advised by a man who once carefully arranged the set-up of a campaign and then watched it slowly disintegrate while a public utility commission pondered interminably over the simple question of an inevitable issue. So be sure your stockholders, directors and public service commission have passed on the stock; that if necessary, it has been offered to stockholders, and that you have the stock on hand to sell. I know one man who started a campaign with fewer than fifty certificates on hand—with resulting complications.

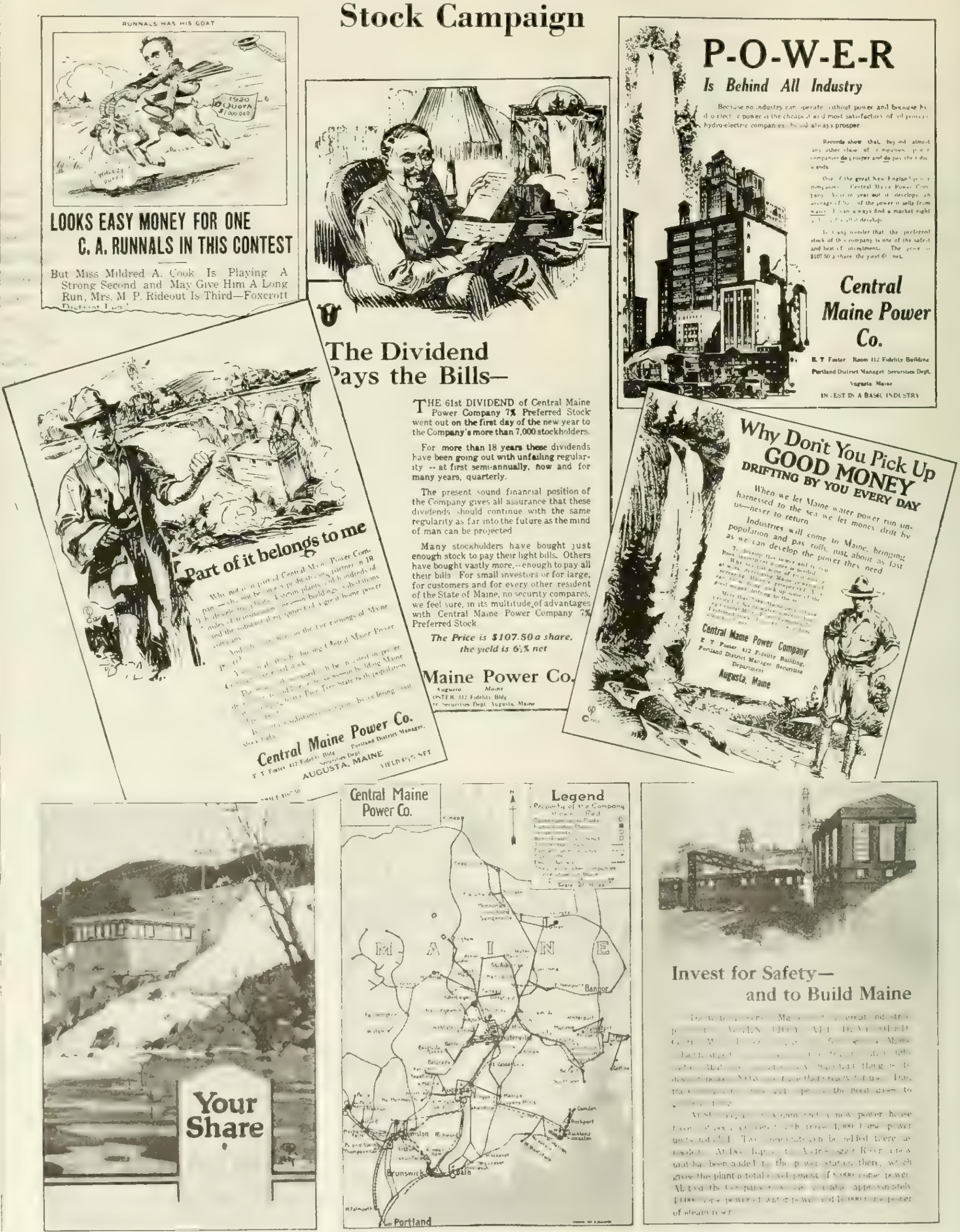
POSSIBLE STUMBLING BLOCKS

Now for a few important points:

Warning No. 1. Don't try to sell too much stock in any one campaign. It is not easy to say just how much "too much" is. Some companies set their quota at a share per month per employee. This is about right for the first few sales, but the writer doubts if that selling pace can be kept up over a period of years. Experience indicates that in an opening campaign (it comes harder the longer you do it) for every ten customers the company has you can sell approximately one share of stock, or, figuring it another way, each employee will sell on an average six shares in one campaign.

Take the advice of one who has known grief: If you have 25,000 customers, keep your quota down to

Publicity Used in Central Maine Power Company's Stock Campaign


RUNNALS HAS HIS GOAT
1920 QUOTA
Central Maine Power Co.
Legend
M A I N E
Bangor
Portland
Brunswick
Rockport
Camden
Your Share

LOOKS EASY MONEY FOR ONE C. A. RUNNALS IN THIS CONTEST

But Miss Mildred A. Cook Is Playing A Strong Second and May Give Him A Long Run, Mrs. M. P. Rideout Is Third—Foxcroft

The Dividend Pays the Bills—

THE 61st DIVIDEND of Central Maine Power Company 7% Preferred Stock went out on the first day of the new year to the Company's more than 7,000 stockholders.

For more than 18 years these dividends have been going out with unfailing regularity -- at first semi-annually, now and for many years, quarterly.

The present sound financial position of the Company gives all assurance that these dividends should continue with the same regularity as far into the future as the mind of man can be projected

Many stockholders have bought just enough stock to pay their light bills. Others have bought vastly more,--enough to pay all their bills For small investors or for large, for customers and for every other resident of the State of Maine, no security compares, we feel sure, in its multitude of advantages with Central Maine Power Company 7% Preferred Stock

The Price is $107.50 a share, the yield is 6½% net

Maine Power Co.

P-O-W-E-R

Is Behind All Industry

Central Maine Power Co.

E. T. Foster Room 412 Fidelity Building
Portland District Manager Securities Dept.
Augusta, Maine
INVEST IN A BASIC INDUSTRY

Part of it belongs to me

Central Maine Power Co.

AUGUSTA, MAINE

Why Don't You Pick Up GOOD MONEY DRIFTING BY YOU EVERY DAY

When we let Maine water power run unharnessed to the sea we let money drift by us—never to return

Industries will come to Maine, bringing population and pay rolls, just about as fast as we can develop the power they need

Central Maine Power Company

E. T. Foster 412 Fidelity Building, Portland District Manager Securities Department

Augusta, Maine

Invest for Safety— and to Build Maine

THE advertising matter shown here is typical of the publicity which proved its value and brought tangible results in stock sales. In the upper left-hand corner is a cartoon which appeared in the company's house organ, the "Exciter," during an employees' contest. At the bottom are shown the cover and two pages of an interesting booklet telling of the company's property that was given to prospective stockholders. Four newspaper advertisements are also reproduced.

2,000 shares, or a little below. You might sell 3,000 easily, but you would be more likely to wreck your campaign, saturate your market and discourage your employees. These figures apply to employee selling. If you use regular salesmen, you can sell more. A moderate campaign can be repeated at six-month intervals for several years, although with growing difficulty as time passes and the cream is skimmed off.

Warning No. 2. Arrange for the prompt issuing of the stock. Have it signed in advance so that, from the home office at least, it can be delivered over the counter with no more formality than accompanies the selling of a vacuum cleaner.

Your next move will be to arrange the terms of sale. Decide the price at which you are going to sell the stock for cash, then add $2 to arrive at the divided payment price. Decide also on the commission you will pay employees for selling the stock. This commission varies from 25 cents to $3 per share.

Warning No. 3. Do not pay too high commissions. It tends to cause employees to neglect regular work in favor of stock selling. From $1 to $2 per share is about right.

Warning No. 4. Decide what you will do to protect your stockholders who wish to resell their stock. The standard resale proposition is: "The company will at any time attempt to resell your stock at the prevailing price and will charge you $2 per share for this resale service."

Advertising Preparations

Next, have your order blanks, receipts and all necessary forms printed. Have them uniform in size, simple, untechnical in language, and well printed on good stock. Don't let your legal or treasury department write them. Your order or subscription blank need say little more than "Please enter my order for ...... shares of stock." Your receipt form can be equally simple. Remember that you are dealing with your customers, with people unused to making investments, with people who abhor legal documents, with people whom you will never sue, even if they do not live up to their agreement to buy.

With your order blanks in the printer's hands you are ready to figure on your advertising. Your first job will be a letter to your customers. Write a human, informal sort of document. Tell your customers why you are offering stock, why customer ownership helps both company and customers, why the stock is a good investment. Bear down heavily on the limits you have placed on the sale: "Only so many shares to sell, to be sold to employees and customers only, and not more than ten shares to any one customer."

Then write a series of advertisements to run, before the sale begins, in the newspapers of your territory. The writer believes that these advertisements should say nothing about the stock but should tell the story of the company, when and why it was organized, how it has grown, the physical property it owns, its willingness and ability to give service—points likely to build up the feeling that your company is a good company. In the closing advertisements, by way of working up interest in the letter to customers, I generally say, in effect: "We shall soon write our customers a letter about our plan of mutualizing the company, which we believe they will find of interest." If they read that advertisement, they will read the letter.

You will need also cards to go in all windows reading after this formula: "Central Maine Power Company 7 per cent preferred stock for sale here." If your window-display man has any ingenuity, he can readily get up attractive windows.

If you serve a city of less than 200,000, you are now due to "sell" your proposition to every bank in your territory. Why?

Because banks in towns and smaller cities are constantly advising their depositors about investments and can make endless troubles unless you convince them that customer ownership is a good thing not only for the company but also for the community. Get the banks to admit (1) that the city can grow no faster than its power company and (2) that the stock is a good investment; then (3) get them to say what they will allow on the stock as collateral. Ordinarily this is 70 per cent to 80 per cent in Eastern states.

Employee Meetings

The advertising campaign just discussed will sell your plan to your customers. Your next move is to prepare for the employee meetings that are to sell the proposition to your employees. You will need a little book on stock selling to explain matters to them. Such a book is being prepared by Fred H. Scheel for the N. E. L. A. and will soon be available for members. Get one for every employee. If you publish an employee house organ, use that also to tell the story to employees.

Next, get up the "ten points" that you are going to ask your employees to repeat to the ten people on whom they will call. They are easily prepared. Just list the strongest points in favor of the stock and the company, select the best ten, boil them down and have them printed or mimeographed. Touch on points like "safety of investment," "freedom from care," "customer ownership." You will find samples in the coming N. E. L. A. "Standard of Practice for Stock Selling."

Your next task is to prepare the talk that you will make at the employee meetings. This talk should touch on customer ownership; it should dwell on the fact that employees will not be asked to *sell* stock; it should tell what employees will be paid if they do happen to sell, and it should explain how to fill out order blanks and receipts for payments. The most important part of the talk is to get every person present to pledge himself to call on ten people within ten days and give them the "ten points" about the company's stock.

Explain in your talk the kind of people you want your employees to call on, not the rich men and the professional investors, but the good, solid, substantial middle-class people, preferably those with money in the savings banks. Explain why the people will buy the stock without the need for long argument—that the newspaper advertising and the letter and the good standing of the company have combined to "sell" customers, and that about all the employees have to do is to call on the people and gather in the orders.

The rest of the talk will occur to you, but be very sure that you emphasize strongly the most important point that you don't expect employees to sell—that you only ask them to call. And be very sure also that you pledge them to make the calls. The big reason for this pledge to make calls is that no superintendent can put pressure on employees to "sell stock," since that is not their business. But after employees have agreed to call on ten people and tell them ten points, then a superintendent or department head can justly put pressure on to get them to do what they have agreed.

With all these preliminaries arranged, start your advertising, send out your letters to customers and hold your employee meetings. Much depends on your sales meetings. They should last not over an hour.

The first man to talk should be some high company executive. To have him there shows that the big men of the company stand behind the stock selling. He should not say much but should make one point very clear, and that is that he personally believes that the stock which is being sold is a good, safe investment. Then should follow the talk by the man in charge of the sale. What he is to say has already been indicated.

At the close of his talk it is a good idea to put on a demonstration sale. Have some employee sell stock to some other employee. The salesman ordinarily comes in, introduces himself, "opens," goes through the "ten points," answers questions and "closes." It is a good plan to rehearse this demonstration sale carefully in advance, because it ought to run off smoothly in order to impress employees with the fact that a sale is really a simple matter.

The next step is to offer employees a chance to subscribe to the issue. This is something else that can be worked up in advance. Have your department heads circulate around in advance of the meeting and let employees know that they are going to have this chance to buy stock. If you can work one district against another, you can accomplish wonders. I have seen almost a whole room full of people rise when we asked those who were going to buy stock to stand up.

Then close your meeting with a talk by the local district manager or department head. The point he must make is this: "You have all agreed to see ten people and tell them the ten points. I am going to see that you do it."

After that, if your set-up has been well fabricated, you can go away on a vacation. You will, however, leave a few jobs for somebody to do.

MAINTAINING EMPLOYEES' INTEREST

Daily sales meetings are helpful. They should be informal affairs which occupy perhaps the last twenty minutes before the whistle blows in the afternoon—just to discuss sales, sales plans and to supply enthusiasm. Daily bulletins are a necessity. Get them out in newspaper style on your mimeograph. They should contain the news of the sale, number of shares sold, number still unsold, number sold by individuals and by districts. Tell briefly of any interesting sales made, of any interesting happenings. Make each superintendent and each department head report daily on the number of calls made by each employee. Here is where you can put your pressure on executives. They can't require employees to sell, but they can require them to make the calls they have agreed to make.

If you have a few executives or salesmen who can be used as field managers, put them at the disposal of your employees. They can help out on difficult sales and act as "closers" for inexperienced but willing salesmen. When employees report on their ten "prospects" give them new lists selected by somebody who knows the territory. The secret of success is to keep calling.

A campaign rightly run ought not to slow down, but then, sometimes it will. If it does, have a few reserves you can call on.

The best resource is additional newspaper advertising. You can set forth the merits of the stock in brief, vigorous advertising which will help your employees to make sales. Special prizes are helpful. Some possibilities are a prize for a sale by those who have not previously made one, a prize for the most sales, for the most ten-share sales, for the most divided-payment sales, etc. One good form of stimulation is to pick out your best salesmen, form them into teams and offer a prize for the winning team. If conditions continue bad, it may be desirable to send out a folder or circular to a new list of prospective buyers.

As a last resort it might pay to hire a few men as stock salesmen, but do not get regular security salesmen as they are never fitted for this work. The best men for the job are insurance salesmen, correspondence-course salesmen and the like—people used to selling a service. These measures should never be needed in a preliminary sale. If executives will get the calls made, the sales will take care of themselves.

LAST MINUTE SALES

The final step is to arrange for "over-the-top day." When you have two or three days' supply of stock left, arrange to sell it in one last whirlwind drive. Pass the word around that only so many shares remain for sale and notify everybody to close in on all "prospects." Tell them to call on or telephone every likely purchaser: "Only so many shares left—buy today or it will be too late." Call on every department head and district manager and urge on him the necessity of getting every man to make his calls. Keep in touch with every district and department by wire, and when the stock is about gone set a definite time when the issue is to close, as nine o'clock Monday morning.

When only a few hours remain put some good talkers at work on the telephone. Give them sections of the customer list and have them call up customers at random and tell them that unless they buy by such a time it will be too late. It is wonderful how many sales can be closed by this method. In a sale in Connecticut I saw an employee continue making calls until nearly midnight. At least two people who were dragged out of bed agreed to come around the next morning and buy stock—which they did.

Any public service company which will follow this plan will without doubt sell stock successfully. For this plan has worked through eleven campaigns in three different Eastern states and should, with reasonable modifications, be good for a "first" sale anywhere.

The means that have to be employed when the cream has been skimmed off and your selling hits the long down slant of "diminishing returns" is another story, as is also the method of selling through regular security salesmen. Any manager, however, can be sure of this much: The first few sales campaigns are easy and can be successfully accomplished by almost any wide-awake company. Such sales produce money at a low cost and, through customer ownership, build good will and provide immunity from unjust political attack.

Entire Electrical Bay of El Paso Station Built Outdoors

SEVERAL views of the outdoor electrical bay of the El Paso (Tex.) Electric Company's recent plant extension, emphasizing certain improvements in layout, were featured on page 670 of the April 8 issue of the ELECTRICAL WORLD. It may be of interest to readers to know that the designers and builders of the plant and extension were Stone & Webster, Inc., Boston, Mass.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Cost of Outdoor Metering Equipment

To the Editors of the Electrical World:

With the increase in the use of outdoor metering equipment that is now being experienced a closer scrutiny of the cost of such apparatus should be made. In general the apparatus used for this purpose is satisfactory in design, but the cost is very high. In the case of many companies it has been necessary to reduce the installation cost by using indoor-type apparatus protected from the weather by wooden boxes or houses. This is not entirely satisfactory. Particularly is it undesirable to build on a pole a house sufficiently large to inclose the equipment necessary for metering at 11,000 volts or higher.

H. R. Wakeman,
Superintendent of Distribution.
Portland Railway, Light & Power Company,
Portland, Ore.

Delayed-Time Low-Voltage Release Is Required

To the Editors of the Electrical World:

Thus far we have seen no delayed-time low-voltage release for application to the control apparatus of industrial motors which meets the requirements of reliability, accuracy and cost essential in such a device. The lack of a device of this character presents a rather serious problem to many consumers and to the electric companies which serve them. In general the low-voltage releases are practically instantaneous in operation. No leeway in time is allowed to take care of the cases in which a short circuit occurs followed by a momentary dip in the voltage. Such short circuits cannot be prevented on extensive transmission and distribution systems, although their duration is being steadily decreased through the application of more elaborate systems of protective relays and automatic switches. If these short circuits cause the operation of many low-voltage releases, it may in many cases be useless to try further to decrease the extent of interruption. But if the low-voltage releases were designed to be delayed in operation for a period of but a few seconds, the further installation of expensive protective equipment could be justified.

One example of the need of such a device may be given. In California there are thousands of small pumping plants used for irrigation. These are often in a remote part of the ranch, and their continuous operation during the pumping periods must be made most reliable. If a short circuit occurs, either on a distant transmission line or a nearby distribution line, the low-voltage release operates and the pump stops. The farmer must then go to the motor to start it again. Needless to say, he is irritated, especially if the trouble occurs in the middle of the night.

A satisfactory delayed-time low-voltage release must be rugged, foolproof, dust-proof, moist-proof, cheap and reliable. It is a small thing, but one of the greatest importance.

G. E. A.
San Francisco, Cal.

Against Government Interference

To the Editors of the Electrical World:

I have read with interest your recent editorial setting forth your views of the coal-mining problem. The ideas of a central-station man closely allied with the coal industry should certainly be worthy of comparison with your own. I operate a mine-mouth power plant serving fifty-five non-union mines. The miners and operators are my neighbors, and I am in close touch with all conditions in the field.

To begin with, the price of coal to the consumer at the mine tipple is no longer a matter of much concern, as competition has reduced this price to a point where none but the best-equipped mines can market their coal. In this field there are any number of coal operators who will sell today good steam coal suitable for stokers for $1.35 to $1.50 per ton at the mines. No union-operated mine can at present produce and sell coal with any margin of profit at these figures. The result has been that the union mines have run very intermittently in the past year, while the non-union mines have operated almost continuously. Consequently the non-union miners, who have taken wage cuts, have profited by this steady production. Many of them made over $5,000 and few under $2,000 last year in this field, while the average wage of union miners in 1921, as stated by Ellis Searles, editor *United Mine Workers' Journal,* was from $700 to $937.50 in various districts.

The whole question will finally solve itself if left alone. Those mines that can produce cheap coal and those miners who are more interested in what they have at the end of the year than in the amount they receive for mining a ton of coal will survive. During and immediately after the war the poorest unequipped mines with high production costs set the price, but now the best-equipped mines are setting the price. Those mine operators who cannot follow have already shut down or will soon be forced out of the running, and those mine workers who still insist on war prices for their labor will be forced, by natural laws of competition, to follow suit. Government interference, with its consequent demoralization, can only raise the price to the consumer.

W. F. Ficklen, District Manager.
Kentucky & West Virginia Power Company, Inc.,
Hazard, Ky.

German Electrical Exports

To the Editors of the Electrical World:

May I draw your attention to the fact that the report you print on page 306 of your Feb. 11 issue from the United States Department of Commerce is not exact? The exportation of electrical goods from Germany is not increasing but decreasing. The amount in marks cannot be taken as a base of comparison as the mark has constantly decreased in value during the last three years. A comparison can be had only by comparing the quantity of electrical goods exported, not the price. An article appearing in the *Elektrotechnische Zeitschrift* (1922, No. 3) gives the value of the exports in gold marks, this being to a certain extent a fair index of their amount. The article shows a steady decrease.

Berlin, Germany. Axel Schmidt.

Electrolysis Research Under Way in the South

To the Editors of the ELECTRICAL WORLD:

The following abstract of a letter which has been sent to members of the research sub-committee on electrolysis may possibly be of interest to readers of the ELECTRICAL WORLD:

With the completion and distribution of the 1921 report of the American Committee on Electrolysis, together with the attention directed to it by the technical press, considerable interest in the subject of electrolysis has been aroused, resulting in a renewed demand for the solution of some of the outstanding questions pointed out in that report which, through lack of fundamental data, remain unsettled.

Perhaps the chief value of the 1921 report is to direct attention to the urgent necessity of acquiring additional information of a fundamental nature before the general engineering solution of the electrolysis problem can be obtained, and to stimulate the activity necessary to procure this information. Chapter 5 of the 1921 report, entitled "Electrolysis Research—Further Work Necessary to Arrive at an Engineering Solution of the Problem," points out the nature of the information needed. The purpose of this memorandum is to direct attention to the plans, so far as they have been developed, for procuring some of that information.

The 1921 report points out that the question of measures for preventing injury by electrolysis from stray railway currents comes up as an engineering problem after, and not until after, the railway system has been placed in proper economic condition from its own standpoint. Furthermore, means applied to the railway for the purpose of placing it in economic condition cannot logically be viewed as measures of electrolysis mitigation, despite the fact that fortunately many of the same measures which tend to economy of railway operation also tend to reduce stray currents.

This conception of the problem has led the research sub-committee to request the aid of the American Electric Railway Association in conducting a study of the railway power distribution problem, to determine, among other things, the economic limits of track voltage drop. You may be gratified to know that the association has acceded to this request, and it is understood that it will appoint a committee to confer with the research sub-committee in the near future.

The determination of the economic limits of track voltage drop is, of course, primarily a problem in railway engineering; but this committee is concerned in it because its solution is necessary to the general engineering solution of the electrolysis problem. When the railways are placed in the condition of maximum economy from their own standpoint, the result will be that a large part of the problem arising from stray currents will have disappeared. It is, however, our duty to determine (1) what the effect of the remaining stray currents will be and, if found to be a source of substantial injury or hazard to underground structures, (2) how this effect can best be overcome.

Since we require quantitative information in order to answer both of the above questions, it has been recognized that suitable measuring devices are necessary, and that, if possible, these devices should be capable of measuring that to which damage by electrolysis is directly attributable—namely, current from the surface of the structure to earth.

The Bureau of Standards, as you know, undertook the development of apparatus to accomplish this purpose, and it has succeeded in such degree that we believe the mean value of current at any given point, as at the surface of an underground structure, can now be determined with reasonable facility and precision by means of the earth current meter. It takes but limited observation, however, to realize that current does not leave the surface of an underground structure with even approximate uniformity of distribution, and it is of the greatest importance to determine a factor which will suitably allow for the non-uniformity with which current leaves the surface of a structure in practice. Direct experimental determination of this factor offers considerable difficulty, but a suggestion has been made looking to a statistical method of attack, and an investigation of this proposal is under way at the present time.

Prior to the determination of this factor, however, the earth-current meter can still advantageously be used for our purposes, as at present it enables us to determine (1) the mean current density at any point at the surface of an underground structure, (2) the true polarity of that structure to earth at that point, and (3) the resistivity of the earth at any point in the region surrounding the structure. We should not fail to note that all of these quantities are of the greatest importance as factors in the solution of our problem, and that we have previously had no field apparatus that would enable us to determine them. It is felt for these reasons that the apparatus provides us with a powerful instrument for research.

In connection with formulating a program of field work, E. R. Shepard of the Bureau of Standards and Elam Miller of the research sub-committee went South on Jan. 5 and visited Atlanta, Savannah, Jacksonville, Mobile, New Orleans and Birmingham. They interviewed railway, gas, water and telephone officials in these Southern cities for the purpose of determining in which of them the conditions were best suited for the field investigations which it had been determined to hold during the winter, and in which of them and to what extent the support of the local interests could be obtained for these investigations. Their reports showed that we might count upon the enthusiastic support, to any reasonable extent, of the local utilities in all of the cities named.

We found that Atlanta and New Orleans were best suited for our purposes, and on Feb. 6 two of the Bureau of Standards engineers were sent to conduct simultaneous investigations in these cities, A. J. Fecht being assigned to Atlanta and E. R. Shepard to New Orleans. A tentative program for the tests was drawn up.

H. S. WARREN,
Chairman Research Sub-committee.
American Committee on Electrolysis.
New York.

Thirty-Year-Old Transformers Still in Service

To the Editors of the ELECTRICAL WORLD:

We observed with interest the note and illustration regarding our early transformers in your issue of March 4, 1922. However, we should like to point out that the rating of these units was 110 kw., not 10 kw., as mentioned in the article.

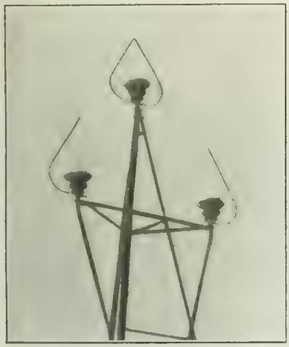
V. Z. DE FERRANTI,
Manager Transformer Department.
Ferranti Limited,
Hollinwood, Lancashire, England.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Lightning Protection on 44,000-Volt Transmission Line

PROTECTION against severe lightning has been given to the 44,000-volt transmission line of the Ray (Ariz.) Consolidated Copper Company by horns surrounding the pin-type insulators. In addition to the horns, a portion of the line is protected by an overhead ground wire supported on a bracket attached to the tower between the cross-arm and the top insulator. The horns are about 2 ft. in height and are fastened to the cross-arm at the base of the insulator and extend to a point directly above the wire as shown in the illustration. They are not intended to prevent static charges gathering on the line, but to provide a path for the arc of short circuits away from the insulator. It has been found that during the seven years of operation with these horns their presence has prevented many cases of insulator breakage. Generally after short circuits service may immediately be resumed. The line is about 17 miles long and extends between Ray and Hayden, Ariz. In this region lightning occurs nearly every summer afternoon.


HORN GAP USED TO BREAK FLASH-OVER ARC ON 44,000-VOLT TRANSMISSION

FIELD EDITOR ELECTRICAL WORLD.

San Francisco, Cal.

Insuring an Exact Brush Fit

IN FITTING brushes for any test where brush contact has an appreciable influence considerable difficulty is encountered in insuring an exact fit. Sandpaper pulled under the brushes will form a curvature on the end of the brush, but when machine is started the brush seldom bears all over its entire surface. If a piece of "commutator stone" is then applied to the commutator while it is in motion, the grinding process thereby produced will cause the stone dust to be carried under the brushes and will make a polished and practically perfect fit of the brushes, such as would be obtained after a week's normal operation.

Care should be exercised in applying the stone to have the rotation "away" from the hand and body, because when the stone begins to "bite" after the glaze is removed from the commutator surface there is a very decided pull as the stone takes hold and grinds and the hand may be drawn under brush stud and severely injured. It is better to have the stone mounted on a piece of wood as a handle. Coarse sandpaper applied before the stone will remove the oil and glaze from the commutator surface. After the stone begins to cut only a few seconds is required to fit the brushes, which have, of course, been previously sandpapered in the usual manner.

EDWARD A. GIBBS.

Boston, Mass.

Adjustment of Turbine Governors

THE satisfactory operation of governors of the "Junggren" inertia type driven direct from the end of vertical turbines depends on securing a proper adjustment between the springs and the weights and reducing the amount of friction between moving parts to a minimum. Springs are adjusted by a threaded sleeve attached to the tops of the spring plug, while weights are adjustable by the insertion of screw plugs. Any excess friction will cause a lag in the regulation.

These governors are fitted with an auxiliary spring actuated by a motor for the purpose of varying the speed while synchronizing. Excessive wear is liable to occur on the balls and raceways if this auxiliary spring is used to regulate the load between units. Its primary purpose is to provide a simple means of synchronizing the unit, and it should be left in mid-position in order to give the best regulation and the minimum load on the transmission bearing, balls and raceways, and also to prevent throwing the main spring out of balance.

If it is desired to change the speed permanently from that at which the governor is set to operate, it should be done with the nut at the top of the governor. This change is only possible, without seriously affecting the regulation, for a very small range either side of the speed for which the spring is designed.

If a governor which has been in operation for a considerable time does not maintain uniform speed, it means that the spring is unable to carry the load imposed upon it. Therefore it is necessary to remove weight from the governor weight. By so doing the load imposed upon the spring is decreased and it will be able to maintain its speed. This change, however, broadens the regulation. If it is necessary to maintain the same regulation as the governor had before the weights were removed, it will be necessary to unscrew the plug from the spring a slight amount in order to bring more coils into action. Sometimes there may be some difficulty in doing this on account of lack of space in the governor. However, by the manipulation of these two methods any desired regulation can be obtained, together with the decrease of load upon the main spring. Particular care should be given to changing the plugs in the spring, and some difficulties may be met in getting the springs to revolve true after disturbing the position of the plugs due to inequalities of the coils in the spring.

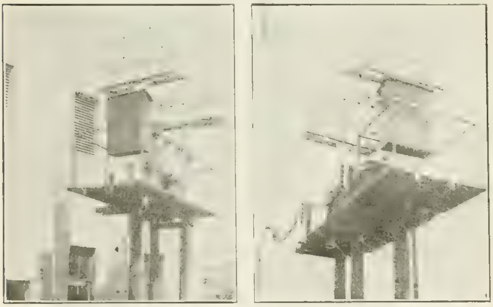
If the governor is too sensitive—that is, gives too close regulation—it is generally shown by the weights being constantly in motion, thereby wearing the knife edges to a greater extent than necessary. The only change necessary in such a case is to remove weight from the governor weights and slacken the spring tension.

In case of broader regulation being desired it can be obtained by screwing the plugs into the spring, thereby reducing the active number of coils. This is quite effective, but the load upon the spring is increased thereby.

Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

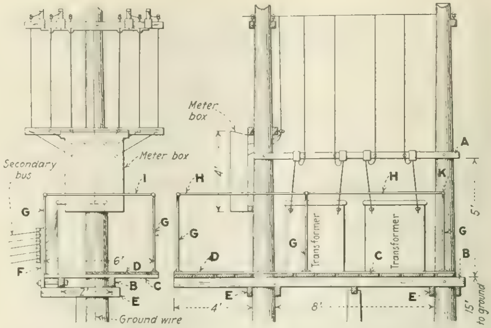
Standardized Transformer Installations Cost $125

SIMPLICITY and stability are the features of a standardized outdoor transformer and metering scheme adopted by the El Paso (Tex.) Electric Railway Company. These installations are generally made to serve loads in excess of 50 hp. and are usually supplied at 220 volts. The cost of the pole structure to carry the transformers and necessary metering equipment was approximately $125 at prices prevailing during May, 1921, exclusive of the transformers and meters. Meter readers are entirely protected from the 2,300-volt primary current, and a sufficient working space is allowed on all sides of the equipment to facilitate inspection and maintenance. The material necessary for the construction of this installation has been so listed that the least time is required in getting the material from the stores and assembling it.


METERS ARE PLACED IN A WOODEN BOX MOUNTED ON ONE OF THE POLES

BILL OF MATERIAL FOR STANDARDIZED TRANSFORMER INSTALLATIONS

Item	No. Required	Material
	2	35-ft. poles
	1	20-ft. stub
	5	Standard cross-arms, bolts and braces
	4	2,200-volt lightning arresters
	26	2,200-volt insulators
	4	100-amp., 2,200-volt cut-outs
	2	Five-point brackets
	1	Standard meter box No. 1
A	1	4-in. x 4-in. x 10-ft. 6-in. lumber
B	2	4-in. x 6-in. x 15-ft. lumber
C	10	2-in. x 12-in. x 6-ft. lumber
D	2	1-in. x 12-in. x 13-ft. 6-in. lumber
E	3	4-in. x 6-in. x 4-ft. lumber
F	2	2-in. x 4-ft. x 3-ft. 6-in. lumber
G	3	1¼-in. x 4-ft. iron pipe
H	2	1¼-in. x 6-ft. iron pipe
I	1	1¼-in. x 4-ft. 6-in. iron pipe
J	1	1¼-in. x 5-ft. 6-in. iron pipe
K	1	1¼-in. x 2-ft. 9-in. iron pipe
	6	1¼-in. floor flanges
	1	1¼-in. pipe T
	4	Three-way pipe fittings
	2	20-in. x ⅝-in. bolts
	2	22-in. x ⅝-in. bolts
	2	12-in. x ⅝-in. bolts
	2	14-in. x ⅝-in. bolts



NEATNESS AND SIMPLICITY MARK THIS STANDARDIZED INSTALLATION

P. M. HATCH,
Superintendent of Light and Power.
El Paso Electric Railway Company,
El Paso, Tex.

Boiler-Room Methods that Help Increase Operating Efficiency

THE steps that the boiler-room force must take to meet changing load conditions and to maintain good efficiency in a modern central station were recently presented in a paper by I. E. Moultrop and R. E. Dillon before a combined meeting of the New York Section of the American Institute of Electrical Engineers and the Metropolitan Section of the American Society of Mechanical Engineers.

It was pointed out that the boiler-room foreman is responsible for having a sufficient number of boilers lighted to take care of the daily peak and to have the proper number steaming to give the best efficiency at all times. With this information, which can be determined as described in the ELECTRICAL WORLD for March 25, on page 587, the foreman is in a position to authorize the number of boilers to be brought into steaming or to be taken out of service, depending on the load. This load, in the instance of the Boston Edison Company, is indicated on a load sign in the generating station. At this point the fireman's duty begins. The procedure adopted by the Boston company follows:

With the knowledge of the load to be carried and the number of boilers that must be kept under steam to carry this load, the firemen refer to a curve that indicates how much coal must be burned in each furnace to produce the necessary steam. Since the tachometers attached to the stoker are calibrated in pounds of coal being fed, the stoker feed can be adjusted to the desired rate. On the tachometers are secondary scales which indicate the approximate air pressure to be maintained in order to supply the right amount of excess air to burn the coal. This instrument and others which are required by the firemen to determine the condition under which the boilers are operating are placed on the front of the boiler, as shown in the accompanying illustration.

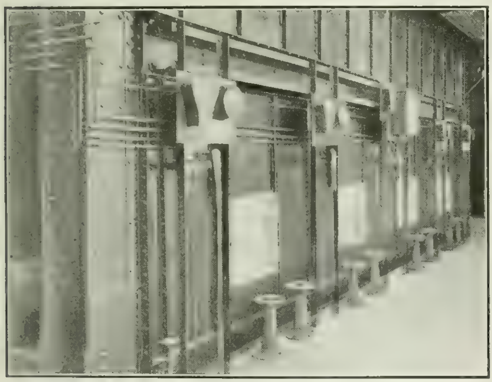
If induced-draft fans are in service, the next step is to regulate this speed so that the draft over the fire is about one-tenth of an inch.

After the boilers are under steam, the steam-flow meters enable the firemen to keep them operating at the proper rating. If the steam flow or pressure indications are unsatisfactory, the firemen take the usual steps to correct the condition, but are instructed to keep in mind the policy of the company, namely, "Service first, efficiency second." The provision of air-flow indicators enables the firemen to maintain the right amount of excess air.

The efficiency in the boiler room alone cannot serve as a criterion for judging the good work of the firemen and the design of the plant, Messrs. Moultrop and Dillon pointed out. It is the combined efficiency of the boiler room and turbine room which is most important. Too often it is believed that the measure of efficiency is the loss to the ashpit and up the stack. However, this loss must be weighed against the loss of heat to the circulating water in the condenser. Feed water can be heated throughout the greater part of the temperature range from either of these two sources of heat. The source of heat to employ is one which will give the best over-all plant efficiency.

Quite apart from boiler-room operating methods but having a decided influence on economy are the conditions under which the men work. Present-day boiler rooms are much more comfortable than formerly. It is now an established practice to spare no expense in making conditions safe and eliminating accident hazards, providing plenty of light everywhere around machinery, allowing plenty of space and keeping the stations clean. The additional expense that has been put into stations to improve conditions has given a high return on investment. This contributes a great deal toward efficiency.

New York. FIELD EDITOR ELECTRICAL WORLD.



METERS AND CONTROL ON BOILERS ENABLE THE FIREMEN TO MAINTAIN THE MOST ECONOMICAL OPERATING CONDITIONS

Water-Barrel Arresters

IN THE article on water-barrel arresters published on page 586 of the ELECTRICAL WORLD of March 25 there is an error in the dimensions of the electrode. It reads, "The electrodes are 3-ft. x 3-ft. x $\frac{1}{8}$-in. copper," etc., but it should read "3-in. x 3-in. x $\frac{1}{8}$-in. copper," etc. This is misleading as it would be difficult to put this size sheet into a barrel.

H. M. KING,
Electrical Supervisor.
Ontario Power Company of Niagara Falls,
Niagara Falls, Ont.

Electric Drive and Push-Button Control Increase Plant Production

WHERE continuity and speed of production are of utmost importance, as is the case in most plants, the layout of individual motors with their starting and protecting equipment should be made with extreme care. The motors and auxiliaries must be kept out of the way of operators, but the control must always be within convenient reach. At the same time the motors must be protected so that an operator cannot overload them for any length of time, with resulting damage. A recent installation that combines these safety and convenience features in a practical manner is the Keystone Spring Works at Philadelphia. The motors, mounted at the ceiling, are controlled at the machine, as may be seen in the illustration, by push-buttons which operate magnetically closed circuit breakers, also mounted at the ceiling. Protection is afforded by thermal relays. The recent change-over in this plant from steam to electric drive has resulted in an increase of production of approximately 20 per cent.

OPERATING CONDITIONS SEVERE

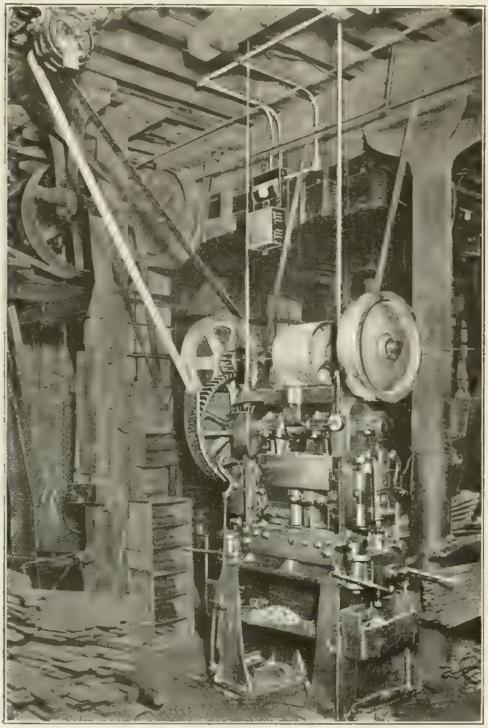
Owing to the fact that a number of the machines, like the rollers and presses, have heavy flywheels and to the abnormally high room temperature caused by hot gases from furnaces and forges, the motors have to start and operate under unusually severe conditions. Thirty Triumph motors ranging in size from 1 hp. to 5 hp. are installed, being mounted on the ceiling beams and belt-connected to the machines. The circuit for each motor passes through a Square-D safety switch installed above the machine on the ceiling beams. These switches are bolted to two strap-iron pieces which are screwed to the sides of the joists or beams. On the same strap-iron supports, immediately below the safety switches, are bolted Monitor "thermaload" starters inclosed in steel boxes. They consist of a small air-break circuit breaker and overload relay, the operation of which will be described later. Start and stop push-buttons are mounted on the machines in the most accessible position, this being possible without interfering with work on the machine because of the small size of the control boxes. The accompanying photograph shows how unobtrusive and convenient the control is.

The starters connect the motors directly to the line. When the starting button is pressed a solenoid is energized, thereby closing the circuit breaker. Only momentary pressure of the button is needed as an auxiliary contact made upon closure of the breakers maintains the circuit through the solenoid. When the "stop" button is pressed the solenoid circuit opens, thus releasing the breaker. On overload a relay opens the solenoid circuit and thus shuts down the motor.

The relay depends for its action on the expansion of a corrugated metal tube when heated by a thermal element in series with the line. The tube has double walls inclosing a liquid which expands on being heated. When the tube expands to a certain length it opens the circuit to the solenoid. Whenever the breaker is open it can be closed only by pressing the control button. An excellent feature of such protection is that momentary overloads do not raise the temperature of the expansion unit sufficiently to open the circuit.

Low voltage will cause the holding solenoid to release the contactor and open the circuit. Failure of one phase will trip the relay provided the current drawn by the motor is sufficient to damage the motor.

The replacement of steam drive by this electrical installation has not only improved conditions of the plant as a whole, eliminating noise, dirt and confusion, but it has also increased the production capacity. Heretofore the capacity was 35 tons of springs per month. It is now more than 42 tons per month. In addition, there has been a considerable saving in time, labor, materials for repairs, etc. Departments are now independent, work can be performed outside of regular business hours without increased cost, and it is no longer necessary to start up the entire plant when a small rush repair job is ordered.



PUSH-BUTTON CONTROL ON FRAME OF MACHINE WITHIN EASY REACH OF OPERATOR

Keystone Spring Works, Inc., Philadelphia, Pa. — THOMAS W. C. HARTMANN, Engineer.

Common Grounded Neutral for Alternating and Direct-Current Systems

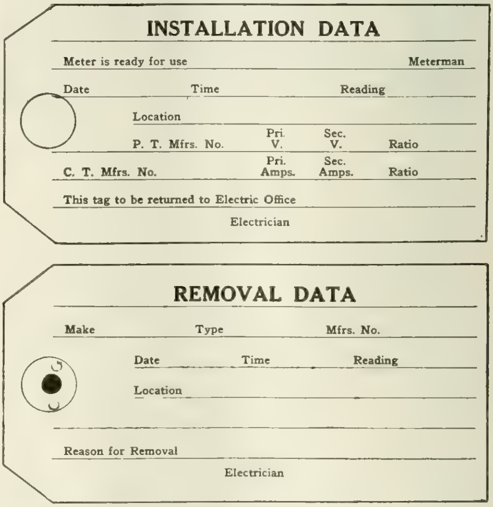
IN CONSOLIDATING the old Dallas Ice Facory, Light & Power Company's three-wire, 110/220-volt alternating-current secondary buses with the Dallas Power & Light Company's buses, it was also decided to combine the neutral of the alternating-current secondary system with that of the existing three-wire, 250/550-volt direct-current commercial power system. The direct-current neutral is continuous throughout the system and is grounded at only one location. This ground is in the substation, and the neutral is connected solidly. This affords a large-capacity, low-resistance ground for both classes of service through only one conductor, resulting in a substantial saving of copper, since the downtown buses are quite heavy owing to the large load. Another advantage gained through eliminating one neutral is that of affording an additional pin space on the pole, which is often badly needed in this congested district. This use of the direct-current neutral also eliminates the necessity of grounding each alternating-current secondary bus separately, as is done in residential sections.

So far no operating difficulties have been experienced with this system, and it is probable that the only objection which could be advanced is a possibility of one of the 500-volt direct-current mains coming into contact with one of the 220-volt alternating-current mains and carrying 250-volt direct current into 110-volt or 220-volt alternating-current apparatus, causing damage by burnouts before the individual fuses of the services would operate—assuming that adequate fuse protection is present, which is not always the case.

Chicago, Ill. — FIELD EDITOR ELECTRICAL WORLD.

Meter Records Checked by Use of Tags

IN ORDER to keep track of all meter sets and removals, when a meter is sent out of the shop to be set at the Lowell mine of the Calumet & Arizona Mining Company, it has tied to it one of the cards shown here. The man who sets the meter fills out the blanks on the side marked "Installation Data" and leaves the tag attached to the meter. When the meter reader comes around at the end of the month he removes the tag and returns it to the office for filing. If a meter is to be removed the card is taken from the file and the reverse side of the card filled out with the "Removal Data." The card is attached to the meter and taken to the shop.



INSTALLATION DATA

Meter is ready for use Meterman

Date Time Reading

Location

P. T. Mfrs. No. Pri. V. Sec. V. Ratio

C. T. Mfrs. No. Pri. Amps. Sec. Amps. Ratio

This tag to be returned to Electric Office

Electrician

REMOVAL DATA

Make Type Mfrs. No.

Date Time Reading

Location

Reason for Removal

Electrician

METERS CANNOT BE LOST TRACK OF WHEN THESE CARDS ARE USED

Calumet & Arizona Mining Co., Warren, Ariz. — W. R. GIBSON, Chief Electrician.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Central-Station Executives Should Visit Appliance Factories

By Cyrus Barnes

General Sales Manager, Charles H. Tenney & Company, Boston

EXECUTIVES of central-station companies who fail to visit appliance factories within reasonable reach of their headquarters miss a real opportunity. Too often in the past the appliance department of the central station has been looked upon more or less as a means to an end, and the magnitude of the business, the capital invested in appliance production and the possibilities of sales development in the company's own organization are still often underestimated. Both for the higher executives of a company and for the department heads, it is worth while to spend time and money in getting into closer contact with the manufacturers in their own establishments.

CYRUS BARNES

It goes without saying that the commercial department executive should welcome the opportunity to visit the appliance factory, and where a number of central stations are operated in group a prearranged visit of commercial department representatives to a factory of this sort can often be arranged with benefit to all concerned. For the past two years visits of this kind have been made by members of our own organization to the number of at least three or four per annum. These visits include a group of sales department executives from various central stations, and at least one day is set apart for factory inspection and for informal discussion with manufacturers' representatives of points of mutual interest. It is almost equally valuable for the executives of a single central station, including the heads of various departments, to join forces in a group trip to an appliance factory, because of the opportunity to study the developments in progress and possibilities of new apparatus and devices for use by central-station customers.

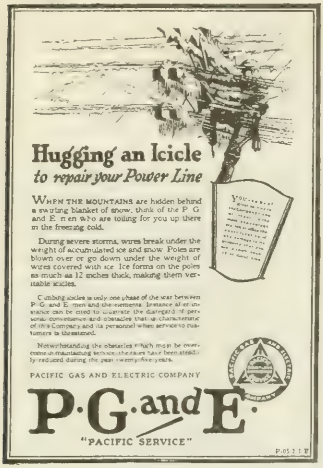
Where the central-station group meets the factory group at close range for mutual discussion and interchange of experience and views, great good may result. The sight of hundreds of toasters, percolators, vacuum cleaners, etc., lined up in the factory in process of manufacture, testing and in preparation for shipment corrects the perspective of many a visitor as to the importance of that branch of the industry. At the factory a real understanding of the quality of workmanship on appliances is given to the receptive visitor, and some inkling of the importance of mass production as a factor in cutting down overhead and operating expenses is pretty sure to be acquired. The trend of new product designing is often in evidence, with advance information as to devices soon to be marketed. Knowledge of how the devices are put together is more quickly acquired here by the group of visitors than would otherwise be probable. Acquaintance with individuals in the manufacturing organization develops favorably under the conditions of the visit.

To the manufacturer such occasions furnish unusually good opportunities to emphasize features of the product and of the methods used in its manufacture, but, perhaps best of all, the contact with outsiders who are all directly or indirectly interested in marketing these devices yields most valuable data on service performance. The reactions of the ultimate consumer to specific methods of selling, his acceptance and his criticisms of designs and service results, interpreted by the merchandising knowledge of the sales staff of the central-station company and the judgment of company executives, all guide the alert manufacturer in the production of his equipment. In ordinary correspondence many points of this kind may, of course, be taken up, but where a group of interested persons concentrate attention upon such matters amid the surroundings of the factory there may well be a stimulus toward constructive criticism and discussion that would be practically unattainable under the restrictions of letter writing. The cost of such trips to a company will be repaid many times in sales results, and the industry and the consuming public will benefit by this group interpretation of service requirements and of the problems of manufacture and distribution.

Pacific Gas & Electric Makes Itself a Personality by Advertising

THE advertisements on the next page are typical of a series by which the Pacific Gas & Electric Company is endeavoring to humanize the company in the mind of the public and to keep its customers "sold" on its service. In these days of open discussion of public utilities and their methods it was deemed important that the people should realize how much of a "home" industry the company is.

By means of this constructive campaign the company aims not only to increase the use of its service, but also to foster and keep alive the good will and esteem of the people of the state. While the bogie of public ownership of the utilities is ever present, the danger is small when patrons generally understand that its great servant is honestly striving to do the best it can. The Pacific Gas & Electric Company believes the small cost of thus selling itself and its service to customers



Hugging an Icicle
to repair your Power Line

When the mountains are hidden behind a swirling blanket of snow, think of the P. G. and E. men who are toiling for you up there in the freezing cold.

During severe storms, wires break under the weight of accumulated ice and snow. Poles are blown over or go down under the weight of wires covered with ice. Ice forms on the poles as much as 12 inches thick, making them veritable icicles.

Climbing icicles is only one phase of the war between P. G. and E. men and the elements. Instance after instance can be cited to illustrate the disregard of personal convenience and obstacles that is characteristic of this Company and its personnel when service to customers is threatened.

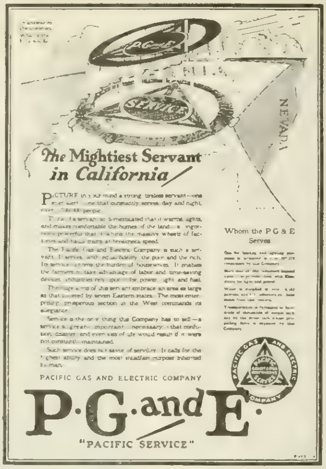
Notwithstanding the obstacles which must be overcome in maintaining service, the rates have been steadily reduced during the past twenty-five years.

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·
"PACIFIC SERVICE"

P-05 2 1 E

SERVICE
PACIFIC GAS AND ELECTRIC COMPANY



The Mightiest Servant in California

Picture in your mind a strong, tireless servant—one never weary—one that constantly serves, day and night, over [illegible] people.

This is a servant so domesticated that it warms, lights, and makes comfortable the homes of the land—so vigorously powerful that it whirls the massive wheels of factories and hauls trains at breakneck speed.

The Pacific Gas and Electric Company is such a servant. It serves, with equal fidelity, the poor and the rich. Its service lightens the burden of housewives. It enables the farmers to take advantage of labor and time-saving devices; industries rely upon it for power, light and fuel.

The huge arms of this servant embrace an area as large as that covered by seven Eastern states. The most enterprising, prosperous section in the West commands its allegiance.

Service is the only thing that Company has to sell—a service so great—important—necessary—that confusion, disaster and even loss of life would result if it were not constantly maintained.

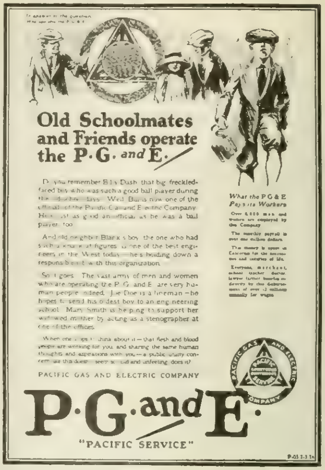
Such service does not savor of servility. It calls for the highest ability and the most steadfast purpose inherent in man.

Whom the P G & E Serves

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·
"PACIFIC SERVICE"

SERVICE
NEVADA
PACIFIC GAS AND ELECTRIC COMPANY



Old Schoolmates and Friends operate the P·G· *and* E·

Do you remember Billy Dash, that big freckled-faced boy who was such a good ball player during the old school days? Well, Bill is now one of the officials of the Pacific Gas and Electric Company. He is just as good an official as he was a ball player, too.

And old neighbor Blank's boy, the one who had such a knack at figures, is one of the best engineers in the West today—he's holding down a responsible job with this organization.

So it goes. The vast army of men and women who are operating the P. G. and E. are very human people indeed. Joe Doe is a lineman—he hopes to send his oldest boy to an engineering school. Mary Smith is helping to support her widowed mother by acting as a stenographer at one of the offices.

When one stops to think about it—that flesh and blood people are working for you and sharing the same human thoughts and aspirations with you—a public utility concern like this doesn't seem so cold and unfeeling, does it?

What the P G & E Pays its Workers

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·
"PACIFIC SERVICE"

P-05 2-3 16

TYPICAL ADVERTISEMENTS WHICH PUT FLESH AND BLOOD INTO "SOULLESS CORPORATIONS"

makes business relations pleasant and profitable and furthermore provides an insurance for the continuation of these two desirable conditions.

Wisconsin Farm-Owned Lines Show a Deficit

An interesting and significant study of the losses in the rural distribution of electrical energy was presented at the recent meeting of the Wisconsin Utilities Association at Milwaukee. The data are for lines that are owned by the farmers and are significant because they are taken from the files of the Railroad Commission. Deficits running all the way from $18 to nearly $68 per consumer are shown. The figures are of particular interest to central-station men who must combat the farmers' idea that the central-station company is making a mint of money out of the service. Not only has the revenue not paid a return on the investment, but depreciation has not been covered in any of the cases, and in some of them the revenue has not covered the current operating expenses. The figures should be valuable to any central-station operator who must handle rural distribution business.

What Other Companies Are Doing

Providence, R. I.—To March 15 of this year the Narragansett Electric Lighting Company has secured 49 per cent more house-wiring contracts than were secured during the same period a year ago. To increase the interest of employees in May and June house-wiring activities, the company is offering a premium of $2 for every new meter application signed as a result of a "lead" furnished by an employee.

St. Louis, Mo.—Through the savings and loan association, formed by employees of the United Railways of St. Louis, 746 employees of the company have been enabled to build their own homes within the past six years, and others are building or buying at the rate of from ten to fifteen every month.

Chicago, Ill.—H. M. Byllesby & Company are distributing a new illustrated circular describing the development and growth of the Northern States Power Company. This circular contains a map of the territory served which illustrates graphically the power sources. The population served by this company has increased 319 per cent in eleven years; the gross earnings have increased in this period 304 per cent.

DATA ON CERTAIN RURAL ELECTRIC LINES IN WISCONSIN OWNED BY THE FARMERS

Company	Average Rate First 50 Kw.-Hr., Cents	Minimum Monthly Charge	Revenues, 1921	Expenses, 1921	Amount Left for Return and Depreciation, 1921	Minimum Depreciation Requirement, 1921	Minimum Return, 1921	Deficit for 1921	Deficit per Consumer, 1921	Average Consumption per Consumer, 1921	Energy Purchased, 1921, Kw.-Hr.	Energy Sold, 1921, Kw.-Hr.	Per Cent Loss
A*	12	$2.00	$4,779.33	$4,774.12	$5.12	$1,633.41	$3,266.88	$4,895.20	$48.95	$46.00	$101,940	55,348	45.7
B	10	1.00	282.70	317.16	– 34.46	140.48	280.96	455.90	56.95	31.00	6,984	2,964	57.4
C	18	2.50	564.91	801.40	-236.49	360.00	720.00	1,316.49	57.40	9.00	9,240	2.518	73.0
D	15	3.50	498.06	464.54	33.52	133.00	266.00	365.48	30.46		5,477	.	
E	10.1‡	1	2,681.54§	2,348.18§	333.36§	653.31§	1,306.69§	1,626.64§	27.11	41.0	30,701	17,182	44.0
F	13.2	3.50	922.65	796.21	126.44	140.00	280.00	293.56	21.00		10,938	.	
G	14	2.00	85.18	151.92	– 66.74	156.46	312.93	262.29	37.60		1,340¶	..	
H	30		1,507.07	1,381.89	125.18	368.00	736.00	978.82	36.50	43.5	49,400	14,140	71.6
I	13					70.00	140.00	510.00°	67.75††				
J	9.8	‡‡	1,638.81	1,195.31	443.50	461.00	922.00	939.50	24.60	21.6	22,260	9,856	56.0
K	11.2	1.50	1,129.09	1,264.99	135.90	261.00	522.00	918.90	23.60	22.6	36,804	10,600	71.0
L			941.06	1,167.78	—226.72	140.92	281.84	649.48	23.20		7,941	......	...•
M	12	1.25	407.24	327.16	80.08	132.80	265.60	318.32	18.70		‡9,171		..

* Company has granted rate to a large user which consumes about 1,000 kw.-hr. annually. † Cost of energy plus meter reading, labor only. ‡ Minus 1 cent discount. ‖ Rural charge, [illegible] $2 [illegible] $2.50 [illegible]. ¶ Seven months sold. • Five months only. ° Yearly requirement for minimum bill, depreciation and return [illegible] per consumer. ‡‡ Demand charge of $1 per month added.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Way that Export Business Must Be Won

By E. W. Droosten
Export Manager, Robbins & Myers Company, Springfield, Ohio

ASK the experienced export manager today what lessons in foreign trade the last few years have taught him and there is only one sure answer that he can give. He will say: "I have learned that I do not know a lot of things that I thought I knew." In other words, so many new conditions have arisen that it has often been a very hard matter to know just what to do in some of these situations. The matter of passing on foreign credits under existing circumstances, and determining how much time we should extend to a foreign buyer, is extremely difficult. Just what to do when asked for extensions on outstanding drafts or where drafts were refused for one reason or another merely to get out of paying them on account of the deterioration in exchange or late shipments or prices made by our competitors is perplexing.

E. W. DROOSTEN

The whole situation has been undergoing a change, so that I do not feel that we can take conditions covering foreign trade in the last four or five years as a precedent for the future. Rather, we have got to begin all over again and couple with our past experience our best judgment as to what we should do in the way of going after foreign business from now on.

The matter of delivery is all-important, as the foreign buyer is a long way from the source of supply. He has to figure, even at best, that when he places an order it will take from two to six months before he can get his goods. And when it is a matter of a year before he receives them—which I have known to be the case frequently—he is without the stock of goods that he has figured on having, and this means a loss to him with his expenses going on just the same. So if we want to build up a foreign trade for America, we should be particular that the export orders which are received by the various manufacturers and producers in the United States get prompt attention and that prompt shipment is made. Moreover, the packing of our goods should be carefully looked into so that they may arrive in the best possible condition and no errors be made, as it takes a long time to rectify mistakes and they are bound to be expensive to some one and cause dissatisfaction.

In many instances the trouble with American manufacturers has been that when business was good in this country they did not give their export orders the proper attention. They have neglected their foreign customers, giving the domestic business the preference. When a slack time comes these manufacturers and producers look anxiously to the foreign countries for business, forgetting that it takes a long time to build up an export business, and that when this has been accomplished it is necessary to do everything that can be thought of to hold it so that it will be there when it is wanted.

My advice to manufacturers and producers in this country would be not to attempt foreign trade unless they intend seriously to make it a part of their business and not to look upon the foreign market as a secondary consideration or as a dumping ground for left-over or imperfect goods. By giving this matter the attention it would have from England, Germany, France or Italy, or in fact any of the European countries that are considered to be our competitors, we can expect to hold and increase our foreign business even if our competitors quote lower prices and make more attractive propositions. The foreign buyer realizes that he is a long distance from the market of supply, and if we are able to give him the service so that he gets what he orders within a reasonable time and his goods arrive in good shape so that he can go on with his business, he appreciates it more than price. By rendering this service, therefore, we can make it very difficult for any one to take the business away from us.

Much, of course, depends upon the men who are employed as salesmen and sent out into the foreign countries to solicit for American firms. An honest representation is vital, and so is the fulfillment of promises in giving full weights, in maintaining the standard of the goods that are shipped so that they are as represented to the foreign buyers, and a "give-and-take" policy. We must always bear in mind that the foreign buyer has his side of the question as well as we ours, and that he appreciates it when we study his interests and welfare.

The Need of Educating the Public on Quality Wiring

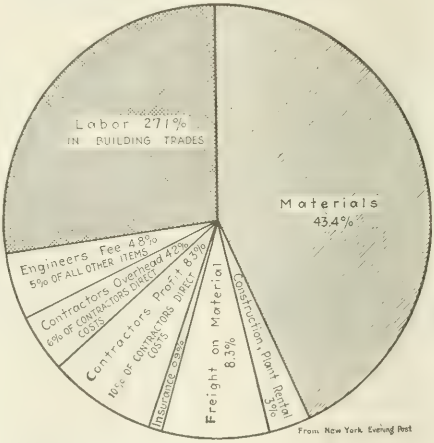
By T. E. Bibbins
President Pacific States Electric Company, San Francisco

AS THE electrical business is now conducted the control of the number of outlets installed on each job is virtually in the hands of the electrical contractor. In the contractor's contact with the owner is determined the sum total of the potential assets of the business—the number of outlets to be installed. Such things as professional and technical standards in the electrical contracting business receive little consideration from the general public.

A citizen who purchases, builds or rents a house wired for the use of electricity is entitled to the complete service which a competent job of wiring implies. As the matter stands today, at least 75 per cent of such buildings are equipped with "stepladder" installations only. In other words, the occupant is compelled to stand on a chair to remove a lamp from its socket or to get any approximation to the use he should have from the energy delivered. It is estimated that 25 per cent of the convenience appliances sold are not in use because of inadequate wiring.

In the past the contractors on the Pacific Coast have divided themselves into two groups, one consisting of well-established contractors, who do business on the basis of good workmanship, standard materials and fair prices, and the other group composed of irresponsible casual contractors, who deal entirely upon the basis of price. A survey of the Los Angeles territory, for instance, shows that qualified contractors during 1920 obtained about 58 per cent of the total number of jobs, installed 60 per cent of the outlets and averaged 14 outlets per job. In 1920 the other group of contractors obtained 42 per cent of the jobs, installed 40 per cent of the outlets and averaged 12.8 outlets per job. In 1921 the qualified contractors obtained only 27 per cent of the jobs, installed only 39 per cent of the outlets, but averaged 15.8 outlets per job. The other group in 1921 averaged 73 per cent of the jobs, installed 61 per cent of the outlets, but averaged only 8.5 outlets per job.

The Distribution of Building Costs



From New York Evening Post

With the increase in building activity this chart is deserving of considerable study by the manufacturer and jobber of wiring material and the electrical contractor. It shows in proportion the elements in the cost of a typical industrial building and offers a basis for comparison in analyzing the cost factors of the electrical installation.

The obvious deduction from these facts is that the irresponsible contractor is definitely reducing the potential market for all electrical products and service by failing to take advantage of the natural demand. What is more important, he is imposing unsatisfactory service upon the public. The difficulty is that the average person knows nothing about contracting service, except in the terms of cost.

The difference between a competent installation made by a qualified contractor and the cut-price kind is only about one-half of 1 per cent of the value of the building—$50 on a $10,000 house. When owners are brought to understand that this small increase in cost carries completeness and permanent satisfaction in the use of electricity and is not merely an additional profit to the contractor, confidence will be established and the business will take a normal course of proper development.

Such public education, I believe, can be accomplished only through broadcast newspaper advertising, and no single company or organization can hope single-handed to accomplish the results completely. It is desirable that all manufacturers, wholesalers and power companies shall join in this educational work and that every effort shall be made to assist contractors in a sound development of that end of the business, because upon it depends the development of the whole industry.

Real Profit in the Elimination of an Excess Variety of Products

The important relation which standardization of products and the discontinuance of unnecessary types of what is virtually one article bear to profit has not been fully appreciated by all manufacturers, jobbers or dealers. A careful survey of the gains which are certain to accrue through an intelligent program of standardization and elimination of excessive variation has been made by the Fabricated Production Department of the Chamber of Commerce of the United States. The gains to be realized by the manufacturer have been listed as follows:

1. Less capital tied up in raw materials, semi-finished stock, finished stock, jigs, dies, templates and special machinery, storage floor space and repair parts.
2. More economical manufacture through larger units of production, reduced number of manufacturing units, longer runs, less frequent changes, higher rates of individual production, accurate and proper estimating for production, more effective stock control, better and more simplified inspection, less idle equipment, reduced amount of equipment, simplified and more accurate costing system, elimination of waste in experimentation and design, and standardized material inventories.
3. More efficient labor due to making the training of employees more simple, better earnings through increased individual production made possible by longer runs, happier and more contented workmen, skill increased by repetitive process, less labor idle from preventable causes.
4. Better service to the trade in better quality of product, more prompt delivery, decreased quantity of sizes of packing required, fewer packages broken in transit, less chance of errors in shipment, and less obsolete material.
5. More efficient sales force.
6. Increased rate of turnover.
7. Intensified sales momentum.
8. Easier financing.
9. Fewer factory shutdowns.
10. Compels attention to individuality in those features where there should be individuality, by preventing attempts at individuality in those features where individuality is superficial and useless and where standardization and quality should prevail.
11. Earlier plans and schedules.
12. Decrease in number of production processes.

The jobber and dealer will profit from these advantages:

1. Increased rate of turnover due to all live numbers (none obsolete), elimination of slow-moving stock, staple line, easy to buy, quick to sell, more effective sales force, greater concentration of sales on fewer items, and standard patterns that are proved best sellers.
2. Decreased capital investment in stock on hand, repair parts on hand and storage space required.
3. Less stock depreciation and obsolescence.
4. Decreased overhead on handling charges and clerical work.
5. Better service through lower prices and quicker and more reliable deliveries.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Propagation of Traveling Waves in Transformers.—H. MASSING.—In this mathematical paper the author tries to determine how the self-induction of a transformer, its capacity between coils and its capacity from coils to case will affect an oncoming current wave with steep or sinusoidal form. A purely mathematical solution, the author admits, is very difficult and in the end uncertain, for which reason only the general form of the calculations is indicated. This suffices to give quantitative results, which can be verified by actual experience.—*Revue Générale de l'Electricité*, Jan. 21, 1922.

Things That Cause Trouble in Reversing-Roll Electric Drives.—A. J. WHITCOMB.—Uninterrupted operation and low maintenance costs of large steel-mill drives depend upon the correct functioning of a large number of individual elements. The failure of any one of them may stop or damage a large part of the mill output. Attention to details is essential. Just what kind of attention is needed and how it can be organized into a definite maintenance schedule are outlined in this article. After a machine is shut down for the week end a detailed investigation should be made of the commutator for high or low spots, and the machine ground down if necessary. Brushes should be closely inspected for binding in the holder, broken ends or edges and ridges. The slip rings should also be examined.—*Electrical Review and Industrial Engineer*, February, 1922.

Generation, Transmission and Distribution

The Blackburn (England) Power Station.—L. C. KEMP.—A very complete description is given of this English plant, recently constructed. It consists of two 10,000-kw., 1,500-r.p.m. turbo-alternator units, designed to operate with steam at a pressure of 200 lb. per square inch and 200 deg. Fahr. superheat. The alternators generate 6,600 volts at 50 cycles and have a two-hour overload rating of 20 per cent. The coal-handling apparatus, cooling towers and circulating water system, switchgear and transformers, protective apparatus and metering equipment are discussed.—*Electric Journal (England)*, January, 1922.

Traction

Transformation of Three-Phase Current Into Direct Current.—FR. KADE and CH. KRÄMER.—The authors attempt by analyzing the characteristics of different rotating machines and rectifiers to decide in which cases one or another of them should be used, but admit that no definite decision can yet be made. In the first part of the article Mr. Kade explains the limitations of rotating machines used chiefly for this transformation. In the second part of the paper Mr. Krämer gives a general explanation of the valve action of a mercury arc and its use for rectifying purposes. A photo of a giant rectifier of 2,000 amp. at 1,200 volts, built by the A. E. G., is shown. With the exceptions that it does not work both ways and that it shows low efficiency for less than 220 volts direct current, there is nothing a rectifier could not do when compared with rotating machines. In addition, its efficiency is virtually independent of the load. The old question of the best current system for main railroad electrification has again been taken up since the rectifier permits of a simple, effective and cheap alternating-current-direct-current transformation, with no more no-load losses than a transformer. This has given a considerable impetus to the direct-current system in Germany, where the alternating-current system is now established as a federal standard.—*Elektrotechnische Zeitschrift*, Jan. 26, 1922.

Lamps and Lighting

The Lighting of Metal-Working Plants.—A. L. POWELL.—Localized lighting was the first method used for shop lighting. It still has advantages for certain operations, but has been commonly superseded by general illumination with more efficient, larger lamps. In metal-working plants where extremely fine work or internal boring is being carried on the high intensity or direction of light necessary may compel the installation of drop lamps, but these should always be supplemented with general illumination. Glare in the workman's eyes due to unshielded lamps should be carefully avoided, for it produces an effect upon the eye which not only reduces its sensitiveness but also tires the entire body. The best means of avoiding glare is the use of proper reflector equipment. Detailed recommendations are made for machine-tool work, sheet-metal work and assembling rooms.—*Bulletin L. D. 134, Edison Lamp Works.*

Installations, Systems and Appliances

Insulating Material for Electric Appliances.—A consideration of the requirements of insulating materials for electrical appliances such as mica, fireclay, porcelain, quartz and refined alundum. The chief requirements are that the materials must be refractory, must be good non-conductors both of heat and electricity and must have a low thermal capacity. They should be of reasonable mechanical strength with a low temperature coefficient of expansion.—*Electrical Times*, Feb. 2, 1922.

Electric Ventilating.—W. T. REACE and G. C. BREIDERT.—Electrically operated ventilating equipment has reached a high state of effectiveness and efficiency and is being used extensively in both industrial and commercial establishments. Methods are described in this article for making stores and restaurants attractive to patrons by providing a constant supply of pure, fresh air and avoiding any possibility of tainted odors. The necessity of promptly removing disagreeable gases, vapors or dust from factories is explained. The increased production resulting from a continuous supply of fresh air to workers throughout the factory is becoming widely recognized.—*Electric Journal*, March, 1922.

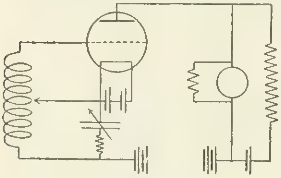
Analysis and Control of Factory Transportation.—F. A. Pope.—Methods by which idle time is checked, performance records of tires and batteries best secured, daily service recorded, and the final analysis of cost and performance made.—*Factory*, January, 1922.

Wires, Wiring and Conduits

***Ferranti System of Automatic Cable Protection.*—P. Testard.**—If a two-phase or three-phase cable is surrounded by a closed magnetic core on which is a single winding, no flux will be created in the core as long as the cable is sound, because the sum of the two or three currents flowing through the cable is zero at any instant. If, however, one of the phases becomes accidentally grounded, this equilibrium will be disturbed, a magnetic flux will be established in the core, and the current induced under such circumstances in the winding upon the core can be used to energize a relay to disconnect the faulty cable. In the case of double-feeder systems a selective cable protection may be established with a proper arrangement of four such special transformers and relays per cable pair, as is shown diagrammatically in the paper. The feeders of the Parisian electric distributing network are equipped with this Ferranti system. The method will not protect cables against short circuits or accidental rupture of one of the phases. As, however, 99 per cent of short circuits or the opening of phases are accompanied with a grounding, the system operates to full satisfaction. A few of its advantages are simplicity, the absence of any pilot wires, sensitiveness, considerable stability and the absence of voltage coils in the relays.—*Revue Générale de l'Electricité*, Feb. 18, 1922.

Electrochemistry and Batteries

Resistance of Electrolytes at High Frequencies.—John J. Dowling and Katherine M. Preston.—Methods of utilizing high-frequency oscillation valve circuits for the measurement of resistance have been devised and are described in this article. These methods are capable of great precision and are suitable both for metallic and electrolytic resistances. Tests indicate that ordinary electrolytes offer the same resistance to high-frequency as to low-frequency currents. The frequency used was about 750,000 cycles.—*Philosophical Magazine* (*London*), March, 1922.



OSCILLATION CIRCUIT USED FOR PRECISION MEASUREMENT OF METALLIC AND ELECTROLYTIC RESISTANCES

Electrophysics and Magnetism

Absorption of Narrow X-Ray Beams.—P. W. Burbridge.—An investigation of X-rays made to ascertain whether at very small angles there was any large scattering effect. — *Philosophical Magazine (London)*, February, 1922.

The Design of Liquid Rheostats.—W. Wilson.—The main object of this paper is to determine more definitely the constants of the liquid rheostat and the more exact prediction of its performance. The phenomena occurring in such a rheostat under a wide variety of circumstances are considered, a distinction being drawn between the behavior of direct and of alternating currents in the apparatus. Tests are described which bear out and amplify the conclusions, many of which are characterized by the employment of current densities many times larger than those generally considered to fall within the limits of safety.—*Journal of (British) Institution of Electrical Engineers*, February, 1922.

Units, Measurements and Instruments

Method of Measuring Coil Capacities and Standardizing Wavemeters.—Gregory Breit.—A method is worked out for the adjustment of two frequencies to have an accurately known ratio. This is based on the fact that an electron tube detector distorts the wave form of the emf. impressed on it and thus produces harmonics in its output. These harmonics are made to give beats with the fundamental of a circuit of fixed frequency and are rectified in an amplifier to give a musical note. The applications of this method to wave-length standardization and to coil capacity measurements are described. —*Radio Review*, February, 1922.

Dielectric Strength of Slate.—D. F. Miner.—In this article the author gives the various mechanical and electrical tests to determine the suitability of slate for switchboards. In the mechanical tests strength against bending stresses is the principal gage. The electrical test includes investigations for leakage and dielectric strength and exploration for metallic veins. The methods explained for determining insulation, resistance and leakage are (a) by a portable testing transformer, (b) by the megger test, (c) by a high-voltage direct current, (d) polarization time with high-voltage direct current, (e) leakage-current measurement with alternating current, (f) power measurement with alternating current.—*Electric Journal*, March 1922.

Telegraphy, Telephony and Signals

Telephone Receiver with Increased Sound Intensity.—G. Seibt.—The author found it possible to increase the sound intensity of a telephone receiver by laminating the pole pieces above the poles of the permanent magnet and by introducing a magnetic shunt just below the coils. The polepiece laminas are made of 4 per cent silicon steel of 0.25 mm. thickness. The magnetic shunt air gap was found to be most effective when set to about 2 mm. The membrane is made of the same steel as the pole-piece laminas, instead of the previously used American ferro-type steel of 0.16 mm. Tests made with such receivers showed an increase of sound intensity of from two to two and four-tenths times that of the old model. This new receiver is already being made on a large scale.—*Elektrotechnische Zeitschrift*, March 2, 1922.

Directional Transmission of Electromagnetic Waves for Navigational Purposes.—J. Erskine-Murray and J. Robinson.—The paper analyzes the differences between directional transmission and reception as used in navigation and describes in particular a number of directional transmission methods which have been developed by the Royal Air Force of England. The methods include several in which the determination of a bearing depends on the timing of the moment of equality of signals as heard in the receiver, and also a new class of directional transmitters in which a characteristic of the radiation, such as a particular wave length, is allotted to each direction in azimuth.—*Electrician* (*London*), March 17, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Improvement in Employment Situation Among Engineers

According to reports from the Employment Bureau of the Federated American Engineering Societies, the records of the first quarter of 1922 indicate a distinct improvement in the employment situation in the engineering profession. There was a 41 per cent increase in the number of men placed by the bureau and over 100 per cent increase in the number of available positions listed with the bureau as compared with the same quarter for the year 1921.

The bureau reports that there is a notable increase in the number of higher-grade openings which are reported, indicating in the mind of the bureau that many companies are actively preparing for a return to more normal business conditions. The bureau also says that the gradually increasing activity does not appear to be confined to any particular line, but is more or less general.

World Power Conference Scheduled for London

The council of the British Electrical and Allied Manufacturers' Association has authorized the director of the association to promote a world power conference, the object of which will be to bring together in London experts from all parts of the world to discuss the important subject of "power" in its many aspects. By permission of the executive council of the British Empire Exhibition the conference will be held at Wembley during the spring or early summer of 1924. Invitations have been extended to technical institutions and trade organizations to co-operate in the enterprise. The free use of a conference hall at the exhibition has been granted by the exhibition authorities, who have also agreed to provide for the entertainment of foreign guests. So far as we have been able to learn invitations have not been received in this country as yet.

Royal Commission Appointed to Investigate Chippawa Project

A royal commission has been appointed by the Ontario government to investigate the Queenston-Chippawa hydro-electric development of the Hydro-Electric Power Commission of Ontario. This investigation has been in the mind of the Drury government for some time. The commission is to consist of Walter D. Gregory, lawyer of Toronto, chairman; Michael J. Haney, civil engineer of Port Credit; Lloyd Harris of the Massey-Harris Company of Brantford; James A. Ross, manufacturer of Toronto, and Dr. Robert A. Ross, consulting engineer of Montreal.

Very wide powers are vested in the commission, including the investigation of all estimates given from time to time in connection with the Chippawa development, the reason for their increase, the total cost of the completed project, its capacity, the method of its construction, supervision and management and the extent to which the price of electricity will be affected by the cost of the work.

In addition, the commission is empowered to investigate the Nipigon and any other power development undertaken by the Hydro-Electric Power Commission. The purpose of Premier Drury is to delve into all matters of expenditure and administration by the Hydro-Electric commission. Attempts were made in the Ontario Legislature last week to have the probe made by a committee of the House, but the government urged a royal commission and was sustained.

Hearing on Bacharach Bill Scheduled for Next Week

The House judiciary committee will hold a hearing on April 25 on the Bacharach bill limiting the jurisdiction of federal courts over the orders of public service commissions. From indications the hearing will be well attended, many mayors, governors, commissioners and other state and city officials having signified their intention of being present.

In addition, representatives of numerous bar associations and public utility corporations are expected to testify against the measure. If enacted into law, public utility companies will lose the right of appeal to the federal courts and must look to state courts for relief from oppressive orders of public service commissions. The passage of such a law is regarded as rather dubious by official Washington.

Would Have Federal Commission to Regulate Trade Associations

After considerable debate the Senate joint resolution creating a committee to study business and recommend to Congress legislation defining rights of trade associations as distinguished from illicit combinations in restraint of trade was referred on Monday to the judiciary committee. Senator Edge, who introduced the resolution, spoke of the recent Hardwood Association decision, and it was pointed out that as a result trade associations do not know what they may and may not do lawfully. A great many associations, it was pointed out, are already considering the advisability of going out of existence.

Senator Edge also proposes in a bill that the Federal Trade Commission or some other body now or to be formed be clothed with authority to advise trade associations on any association activity. The trade associations, if they are to enjoy certain immunities, must report to this commission in much the same way that the railroads report to the Interstate Commerce Commission.

The matter of trade association activity is receiving unusual attention as the result of the Hardwood decision. Secretary Hoover has endeavored to give to industry an idea of what these associations could do, but this expression of opinion has not removed the element of fear of investigation.

Representatives of four or five hundred such bodies were in Washington last week at the invitation of Secretary Hoover. One of the conclusions that may be drawn from the meeting is that the value of so-called open-price statistics has been exaggerated greatly.

While it was brought out clearly at the meeting that the legality of open-price statistics has not been passed upon, and that associations doing such work cannot be denounced as lawbreakers, particularly when their figures are made public, yet it was made perfectly plain that the Department of Commerce will not co-operate with that type of organization. No one will be surprised if the Department of Justice should institute proceedings against such associations. At any rate, the Department of Commerce is not going to jeopardize its usefulness to other trade associations by co-operating with those which are within the twilight zone.

In this general connection those high in authority are impressed particularly with the inhibition against secrecy which runs through the opinion of the Supreme Court in the Hardwood Lumber case. Since the Supreme Court seems to aim particularly at statistics which are available to members only of associations, the Department of Commerce is interested in giving evidence that publicity is taking place. There is no desire on the part of the department, Secretary Hoover points out, to force any association to file its figures with his bureaus. In fact, the department is entirely out of sympathy with legislation giving actual control over any trade association activity. There are a few instances where statistical information as to important basic commodities is refused by manufacturers.

Colorado River Commission to Meet Again in July or August

AT THE conclusion of the series of hearings which have been held in various centers in the Colorado basin Secretary Hoover, chairman of the Colorado River Commission, said that either late in July or early in August the commission would be reassembled and some real conclusions reached as to the best method of procedure, these conclusions to be based on the mass of facts and opinions presented to the commission.

"It appears to me that four or five different principles have been advanced for the formulation of a pact for the development of the river," Mr. Hoover stated, "and out of these we should be able to formulate some agreement. There is a sad lack of understanding of even the most fundamental engineering facts in the relation of the upper and lower basins. In time the relative weight of the rights of the several states, the relative weight of the different engineering principles involved and the relative weight of the legal process that may follow from failure to complete such a pact will all contribute to drive these states together with the national government to some solution."

Middle West Floods Do No Serious Damage to Electrical Systems

THE floods in southern Illinois and the surrounding country during the past ten days, which have damaged so much argricultural and industrial property, have not done any serious damage to central-station installations. According to reports received in Chicago on Wednesday, service has not been abandoned in any community except where limited districts have been flooded and incidental damage done to distribution lines. The crest of the flood seems to have occurred on Sunday and Monday, and central-station operators feel that the probability of serious damage is past.

Hoover to Address N. E. L. A. Convention

SECRETARY OF COMMERCE HOOVER, it was announced this week at the offices of the National Electric Light Association, has accepted the invitation to speak at the opening session of the annual convention at Atlantic City the week of May 15.

The program has been arranged tentatively as it appears on the opposite page. For public policy night a number of speakers of national importance have been invited and announcement of their names is expected shortly.

Radio-Operated Relay Gets Enthusiastic Attention at A. I. E. E. Meeting

ENGINEERING speculation was allowed free rein at the Wednesday afternoon session of the spring convention of the American Institute of Electrical Engineers in Chicago after F. W. Dunmore of the radio laboratory of the Bureau of Standards had described a relay which will operate on radio signals. It is controlled selectively from both the radio and the audio frequency standpoint, and with recording or other devices the combination can also be selectively controlled mechanically. The discussion consisted largely of questions as to the applicability of the relay and developed the possibility that it could be used for a wide variety of remote-control problems in the central-station field. The relay can be made responsive to any predetermined arrangement of signal, according to Mr. Dunmore's statement, and the discussion suggested the possibility of combining a radio transmitter and receiver and some such devices as are used in the automatic telephone field to operate oil switches or any other station or substation devices desired. None of the apparatus for such purposes is developed, but the discussion opened a wide field for research and experimental work.

In opening the convention President McClellan said that the key to industrial expansion is a condition that will make electrical power available everywhere for all industrial, agricultural, transportation and other uses. The supply must be sufficient to meet all demands of industry, and the cost must be low.

The convention continued through Thursday and Friday. Thursday afternoon was devoted to a discussion of energy from coal mines to large centers of distribution, and Friday evening to a discussion of the proposed St. Lawrence waterway. Motor and control equipment of cranes was among the subjects discussed in papers presented on these two days.

N. E. L. A. Atlantic City Convention Program

(Tentative Draft Subject to Revision)

General and Executive Sessions

TUESDAY, MAY 16, 9:30 A. M.

1—Welcome to Atlantic City, Mayor Edward L. Bader.
2—Address of President Bump.
3—Appointment of committee on president's address.
4—Report of Treasurer Abell.
5—Report of finance committee, Joseph B. McCall.
6—Report of Executive Manager Aylesworth.
7—Address of chairman Public Relations Section, Martin J. Insull.
8—Address of chairman Accounting Section, E. J. Fowler.
9—Address of chairman Commercial Section, R. H. Tillman.
10—Address of chairman Technical Section, N. A. Carle.
11—Announcements.
12—Report of committee on rate research, Alex Dow.
13—Report of committee on wiring, R. S. Hale.

WEDNESDAY, MAY 17, 9:30 A. M.

1—Report of committee on company employees' organizations, Robert B. Grove.
2—Election of nominating committee.
3—Symposium on business development: Electric light and power companies, H. L. Doherty; electrical manufacturers, G. E. Tripp; electrical jobbers, W. E. Robertson; electrical contractors and dealers, J. R. Strong; Society for Electrical Development, W. W. Freeman; N. E. L. A., H. A. Lane.
4—Announcements.
5—Address, Herbert Hoover, Secretary of Commerce.
6—Address, "Budget Control," L. F. Musil.
7—Appointment of committee on resolutions.
8—Report of committee on membership, Walter Neumuller.

THURSDAY, MAY 18, 9:30 A. M.

1—Report of insurance committee, S. E. Wolff.
2—Report of committee on relations with savings banks, M. S. Sloan.
3—Report of committee on customer ownership, John F. Gilchrist.
4—Address, Carl D. Jackson, president National Association of Railway and Utility Commissioners.
5—Announcements.
6—Address (subject and speaker to be selected).
7—Address, "Hydro-Electric Power Commission of Ontario Report," W. S. Murray.
8—Address (subject and speaker to be selected).
9—Report of committee on accident prevention, Charles B. Scott.

FRIDAY, MAY 19, 9:30 A. M.

1—Report of committee on Doherty and Billings prizes, A. S. Loizeaux.
2—Report of committee on rural lines, G. C. Neff.
3—Report of committee on water-power development, Franklin T. Griffith.
4—Report (not determined).
5—Report of lamp committee, Frank W. Smith.
6—Report of committee on electrical resources of the nation, M. S. Sloan.
7—Report of technical advisory committee, Charles F. Scott.
8—Report of committee on president's address.
9—Report of resolutions committee.
10—Report of nominating committee.
11—Election and installation of officers.

Technical Sessions

MONDAY, MAY 15, 2:30 P. M.

1—Address of chairman, N. A. Carle.
2—Report of committee on constitutional amendments.
3—Vote on constitutional amendments proposed.
4—Appointment of nominating committee.
5—Report of committee on underground systems, D. W. Roper.
6—Report of committee on safety rules, Thomas Sproule.

PARALLEL SESSION

Report of committee on hydraulic power, Markham Cheever.

TUESDAY, MAY 16, 2:15 P. M.

1—Report of nominating committee.
2—Election of officers.
3—Report of prime movers committee, H. P. Liversidge.

PARALLEL SESSION

Report of committee on inductive interference, A. E. Silver.

WEDNESDAY, MAY 17, 2:30 P. M.

Report of committee on electrical apparatus, A. H. Lawton.

THURSDAY, MAY 18, 2:30 P. M.

Report of committee on overhead systems, L. M. Klauber.

PARALLEL SESSION

1—Report of meter committee, W. L. Wadsworth.
2—Paper, "Analysis of Economic Loss Due to Power Factor — Basic Meterable Factors," R. C. Fryer, J. E. Doran and J. B. Hodium.

Public Relations Sessions

WEDNESDAY, MAY 17, 2:30 P. M.

1—Address of chairman, M. J. Insull.
2—Appointment of nominating committee.
3—Report of committee on women's public information, Olive A. Bursiel.
4—Report of committee on employee relations with the public, H. C. Blackwell.
5—Report of committee on manufacturers' advertising, R. L. Thomson.
6—Report of committee on public speaking, H. C. Couch.
7—Report of committee on relations with bankers, M. S. Sloan.
8—Report of committee on state organization of public information, H. T. Sands.
9—Report of committee on uniformity of state regulatory laws, W. W. Freeman.
10—Announcements.
11—Report of committee on upbuilding the industry, F. R. Coates.
12—Report of nominating committee.
13—Election of officers.

THURSDAY, MAY 18, 8:30 P. M.
(With music)

1—Report of public policy committee, Sidney Z. Mitchell.
2—Addresses (speakers of national prominence invited).

Accounting Sessions

TUESDAY, MAY 16, 2:30 P. M.

1—Address of chairman, E. J. Fowler.
2—Appointment of nominating committee.
3—Report of committee on accounting education, Fred R. Jenkins.
4—Report of committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers.
5—Report of committee on budget, Harry A. Snow.

WEDNESDAY, MAY 17, 2:30 P. M.

1—Report of committee on federal income-tax procedure, F. B. Odlum.
2—Address (subject and speaker to be selected).
3—Report of committee on customers' records and billing methods, J. D. Jacobus.
4—Report of committee on accounts payable records, E. A. Davis.

THURSDAY, MAY 18, 2:30 P. M.

1—Report of nominating committee.
2—Election of officers.
3—Report of committee on fixed capital records, J. H. Lubban.
4—Report of committee on security holders' records, Robert Davey.
5—Report of committee on purchasing and storeroom accounting, W. F. Stevens.

Commercial Sessions

MONDAY, MAY 15, 2:30 P. M.

1—Address of chairman, R. H. Tillman.
2—Appointment of nominating committee.
3—Report of Electric Vehicle Bureau, C. R. Skinner, Jr.
4—Report of committee on garages and garage rates, F. F. Sampson.
5—Report of committee on transportation, F. M. Feiker.
6—Report of committee on publicity, Norman Maul.
7—Report of exhibition committee, H. T. Luscumb.
8—Paper, "Electric Trucks in the Service of the American Railway Express Company," R. F. M. Cowie.
9—General discussion on electric vehicle subjects.
10—Report of committee on commercial service and relations with customers, Harold Wright.

TUESDAY, MAY 16, 2:30 P. M.

1—Report of Lighting Sales Bureau, L. R. Wallis.
2—Report of division on educational exhibits, Clarence L. Law.
3—Report of division on residence lighting, M. Luckiesh.
4—Report of division on industrial lighting, J. Daniels.
5—Report of division on street and highway lighting, A. D. Cameron.
6—Report of division on lighting of large buildings, Arthur S. Ives.
7—Report of division on commercial aspects of lamp equipment, G. H. Stickney.
8—Report of division on sign, display and billboard lighting, P. B. Zimmerman.
9—Report of division on store lighting, W. E. Rolinson.
10—Report of lighting committee (joint committee for business development), P. B. Zimmerman.
11—General discussion on lighting subjects.
12—Address, "Lighting Education," Ward Harrison.
13—Report of committee on wiring, G. E. Miller.
14—Report of committee on wiring (joint committee for business development), A. K. Baylor.

WEDNESDAY, MAY 17, 2:30 P. M.

1—Report of Bureau on Merchandise Sales, C. E. Greenwood.
2—Report of division on central-station merchandising service, Thomas Berger.
3—Report of division on electric cooking and heating, C. O. Dunten.
4—Report of division on standardizing and testing, R. S. Hale.
5—Report of division on relations with manufacturers, F. D. Pembleton.
6—Report of committee on appliances (joint committee for business development), C. E. Greenwood.
7—General discussion on merchandising subjects.
8—Report of committee on electrically equipped furniture, Joseph F. Becker.

THURSDAY, MAY 18, 2:30 P. M.

1—Report of Power Sales Bureau, Charles K. Nichols.
2—Report of division on electric power economics, John W. Meyer.
3—Report of division on industrial heating applications, V. M. F. Tallman.
4—Report of division on material handling, R. H. McLain.
5—General discussion on power subjects.
6—Report of committee on education, Fred R. Jenkins.
7—Report of committee on "Electrical Salesman's Handbook," George H. Jones.
8—Report of nominating committee.
9—Election of officers

Indiana Company Starts Building First of Chain of Water-Power Plants

AWARDING of a general contract for construction of a hydro-electric power plant of 8,500 hp. rating at Norway, White County, Ind., the first unit of a proposed five-million-dollar project of the Indiana Hydro-Electric Power Company, was announced recently by Harry Reid, vice-president of the company. The plant is to be in operation by the end of the year, Mr. Reid said. The company, which is a Middle West utilities property, plans the development of three other power sites, at Tioga, Oakdale and Springboro. The ultimate development will be 29,000 hp.

The hydro-electric developments will be operated by the Interstate Public Service Company, which has large electric light and power and electric railway properties in Indiana, and it, with the Central Illinois Public Service Company, which serves 190 Illinois communities with electric light and power, has entered into a contract for the purchase of the entire electrical output.

New Oklahoma Plant to Be Center of Large Distributing System

THE Oklahoma General Power Company has completed plans for the construction of a two-million-dollar steam station on the Arkansas River near Fort Gibson. Although the details of this plant have not been given out, it was announced that automatic control of all units would be the fundamental idea of construction. This company was recently incorporated as a subsidiary of the Oklahoma Gas & Electric Company.

This 15,000-kw. plant will be constructed by H. M. Byllesby & Company. Realizing that natural gas may not be available a few years hence, coal will be used for fuel. It was with this view in mind that the plant was built in close proximity to the coal mines of eastern Oklahoma. J. F. Owens, vice-president and general manager of the parent company, said that it would be the center of an anticipated large electrical distributing system over the entire eastern half of the state. The program calls for the building of high-tension lines to various cities in Oklahoma. One of these will be a 60-mile, 63,000-volt transmission line to Fort Smith, Ark.

Two New Units for Calumet Plant of Commonwealth System

THE 1922 electrical construction program for the Commonwealth Edison Company, which includes the addition of two generating units at the new Calumet station as well as four new substations, will require an expenditure of $14,000,000. Contracts have been let for the two 30,000-kw. units and the necessary increase in building space. Work has already started on driving a 6-ft. tunnel under the river. This tunnel will be 340 ft. long and will carry the 33,000-volt cables into the Indiana territory, thereby adding another link to the Mississippi Valley superpower system. Two additional cables will be laid to connect the Fisk and Quarry Streets stations with the Calumet station. This will double the lines now connecting the two stations.

Of the four new substations to be built this year, two will serve the "Loop" district. One rotary-converter station, rated at 4,000 kw., will be built on LaSalle Street between Polk and Harrison Streets. A second station is to contain a rotary converter and storage batteries with a total capacity of 8,000 kw. This station will be on Adams Street between Des Plaines and Halsted Streets. The other substations, rated at 6,000 kw., are to be placed at Prairie Avenue and Armitage Avenue, outside the "Loop."

In order to improve the radio broadcasting service, two 125-ft. steel towers will be erected on the roof of the Edison Building. Since this building is 290 ft. high, the aërial will be 415 ft. above the pavement.

Davis Bridge Seven-Million-Dollar Power Development Progressing

EXCELLENT headway is being made by the New England Power Company upon the hydro-electric development on the Deerfield River at Davis Bridge, Vt., which has been under construction for several months. It is estimated that this development will add 105,000,000 kw.-hr. to the output of the system and will also directly increase the output of all the company's generating plants on the river. The work at Davis Bridge will include a reservoir about 12 miles long with an average width of one-third mile; an earth-filled dam 1,200 ft. long and 200 ft. high, impounding 45,000,000,000 gal. of water, and 18,000 kva. in generating machinery. The diversion tunnel required by the hydraulic layout is about one-third completed. The machinery has not yet been purchased, nor has a final decision been reached as to the head to be adopted. It is probable that about two years will be required to complete this development, the estimated cost of which is $7,000,000.

New Orleans Company and City Officials Reach Agreement

THE representatives of the security holders of the New Orleans Railway & Light Company have compromised their differences with the Commission Council of the city, and on April 8 the Council gave its approval to the settlement reached, Mayor McShane alone dissenting. This agreement provides for carrying out every point in that of last fall, which was held up by court order, except the provision about the rate of return on new money needed for improvements and extensions. This provision was waived at the solicitation of the 4½ per cent security holders, and with the obstacle out of the way the conferees lost no time in reaching an agreement. The rate of return on both new and old money (the valuation being fixed at $44,700,000) is now 7½ per cent.

Commissioner Paul Maloney of the Department of Public Utilities, summarizing some of the advantages which will accrue to New Orleans as the result of the compromise, mentioned these among others: Local control is assured; securities cannot be sold without the approval of the Commission Council, which is to have access to the books and supervise the operations of the company; real estate owned by the company and not needed is to be sold and the proceeds put into equipment; the city is to have a perpetual option to purchase the properties, one-half of a reserve fund of $300,000, set up yearly, to be reinvested in the property and the other half in liquidating the bonds; all dividends in common stock at the time of reorganization are to be reinvested in the property; no stock dividends are to be declared, and the rate of cash dividends is to be limited, as is the return.

Time must still elapse before reorganization can be effected, while the necessary court procedure is being followed, but the first step, the filing of a bill of foreclosure, will probably be taken before the end of April.

Supreme Court Refuses to Review Utah Rate Case

THE Supreme Court by refusing to review the decision of a lower court has affirmed the decision sustaining electric rates prescribed by the Public Utilities Commission of Utah. These rates were complained of by the Ogden Portland Cement Company, the Union Portland Cement Company and the Utah-Idaho Central Railroad on the ground that they abrogate previous contracts with the power companies and are in excess of the old rates.

Dayton Power & Light $4,750,000 Expansion Program Under Way

GROUND has already been broken by the Dayton Power & Light Company for an addition to its Miller's Ford station, doubling its capacity. The total amount of the improvements is to be approximately $2,000,000. This is a part of the expansion program, involving a total expenditure of $4,750,000, which has been mapped out for the next five years.

San Joaquin Light & Power Gets License for 266,000 Hp. Development

THE San Joaquin Light & Power Corporation, Fresno, Cal., has been granted a license by the Federal Power Commission for the term of fifty years for a hydro-electric power development on the north and west forks of Kings River in California, which will involve an estimated expenditure of $51,000,000 and have an ultimate installed capacity of 266,000 hp. Work is to begin on the first plant next month, and if the present rate of growth in power consumption in the vicinity of the project continues, it will be necessary to make the total capacity available by 1930.

The project will occupy about 14,000 acres of land in the Sierra and Sequoia National Forests. The developed power will be fed into the company's present transmission system through its substation at Sanger by means of a 110,000-volt transmission line to be built in two parallels, one of which will carry a single three-phase circuit on wood poles and the other two three-phase circuits on steel towers.

The project will consist of three storage reservoirs to provide a combined storage capacity of 204,000 acre-feet, eight diversion dams and seven power houses, of which two will be built into storage dams and will operate under variable heads, the maximum being 175 ft. and 245 ft. respectively. Three others will operate under heads of 365, 1,420 and 1,430 ft. respectively. Two power houses will operate under heads of 2,350 ft. and 2,380 ft. and will be among the very few plants in the United States operating under heads exceeding 2,000 ft.

The entire development is covered by the license, but its provisions as to storage do not become effective until the corporation shall obtain from the California Department of Public Works the right to store water for power purposes. It now has the right to use the natural flow of the streams on which its diversion dams are to be built, except of Rancheria and Bear Creeks, tributaries respectively of the north and west forks of Kings River.

The main construction program is divided into five parts, as follows, for each of which the time of commencement and completion has been fixed subject to later modification with the approval of the commission:

1. Balch Development No. 1.—This will consist of Balch diversion dam No. 1, Balch tunnel with capacity of 500 second feet, penstocks, Balch power house with an initial installation of 31,000 kw. and provision for future increase to 93,000 kw., and transmission line from the power house to the main transmission system at Sanger substation. Work is to begin in May, 1922, and be completed by June 1924.
2. Haas Plant.—This will consist of diversion dam, Haas tunnel with capacity of 500 second-feet, penstocks, Haas power house with an initial installation of 31,000 kw. and provision for future increase to 62,000 kw., and transmission line to the Balch plant. Work will begin in April, 1924, and be completed by June, 1926.
3. Kings River Plant.—This will consist of diversion dam, Kings River tunnel with capacity of 750 second-feet, penstocks, and Kings River power house with an installed capacity of 7,500 kw. and provision for future increase to 15,000 kw. Work will begin in January, 1926, and be completed by June, 1927.
4. Balch Development No. 2.—This will consist of Balch diversion dam No. 2, Balch tunnel No. 2 with capacity of 250 second-feet, and an additional 15,500 kw. unit in Balch power house. Work will begin in April, 1926, and be completed by June, 1928.
5. Farnham and Meyer Plants.—The Farnham plant will consist of Farnham diversion dams Nos. 1 and 2, penstocks, and power house having initial installation of 8,300 kw. and provision for future increase to 16,600 kw. The Meyer plant will comprise tunnel, penstocks, power house with an initial installation of 2,300 kw. and provision for future increase to 8,300 kw., and transmission line to Balch power house. Work will begin in April, 1927, and be completed by June, 1929.

Construction of the remainder of the project will be undertaken when market demands have grown to the extent which will warrant installation of additional capacity, and will comprise Wishon dam, reservoirs and power plant; Meyer dam and reservoir; Peart dam, reservoir and power plant; Rancheria Creek diversion dam and tunnel, and Bear Creek diversion dam and canal.

Heavy Power Demand Awaiting Muscle Shoals Development

TESTIMONY by Thomas W. Martin, president of the Alabama Power Company, in behalf of that company's Muscle Shoals offer was the principal event of the week in connection with the Congressional investigations now going on for disposal of that project. One of the high points of Mr. Martin's testimony was his attitude toward any final proposal his company might make. This was expressed in response to questions by Senator Kendrick as to whether the power company might be willing to eliminate from its offer the Sheffield steam plant, which Senator Kendrick thought under some circumstances the government ought to continue to own even though it also continued to lease it, as it is now leased, to the Alabama Power Company or to others. Mr. Martin testified that in presenting the power company's proposal it was assumed that it was in line with what might be the policy of the government. Senator Kendrick said: "My idea of negotiation is one in which each party involved has a right to change his mind and insist upon having conditions met." Mr. Martin replied: "If the government decides upon a policy, I have no doubt a different proposition can be worked out. We had no specifications on what Congress would lay down as its policy, in suggesting a plan which in no sense was intended to be final and irrevocable."

Mr. Martin expressed the conviction that by the time Dam No. 2 could be completed the market demands for power in the territory adjacent to Muscle Shoals would justify a public utility company in proceeding with the development at Dam No. 3 under a license from the Federal Power Commission. He told the committee that "there are certain demands for power in the localities which would be reached from Muscle Shoals, running as high as 25,000 hp. to 30,000 hp., which must be met within a reasonable time." He added: "I have in mind one large community. The operators of the utilities of that community are going ahead—must go ahead to meet the required needs—to build a new steam plant unless the Muscle Shoals source of power is made available within some reasonable time, and such operations as that are involved in this whole big problem."

FORD MUST ALTER PROPOSAL

While Mr. Martin and others were testifying before the Senate committee on agriculture and forestry, the "informal conversations" which were reported in the ELECTRICAL WORLD last week between members of the House military affairs committee were continued. These conversations have not reached a point, as this is telegraphed from Washington, which would warrant a forecast as to the report of the House committee beyond a continued belief by a majority of members of the committee that Henry Ford's offer to purchase the Muscle Shoals projects cannot be reported out of the committee favorably unless Mr. Ford consents to increase his offer and make in it alterations of the most far-reaching importance to him and to the government. Just what increases and alterations in his offer Mr. Ford may make, if any, are being withheld from jublic view in Washington, although W. B. Mayo, Mr. Ford's chief engineer and personal representative, remains at the capital, waiting to be called by either committee of Congress.

HEARING ON ENGSTRUM OFFER

After the hearings in behalf of the acceptance of the Alabama Power Company's offer before the Senate committee, that committee began to hear former Senator Marion Butler of South Carolina and Frederick E. Engstrum in behalf of the Engstrum offer to construct at government expense. The committee will later reach a hearing on the Ford offer. Both committees of Congress express a wish to hear Mr. Ford personally, but doubt is expressed whether he will consent to appear for examination by the committees.

Later on in the Senate hearings it is the intention to hear President Martin of the power company and Hubert S. Dent of counsel for the power company in connection with the legal phases of the contract the power company has to purchase the government's interest in the Gorgas plant of the company, which Mr. Ford desires to buy. It is also the intention of the Senate committee to hear representatives of the Air Nitrates Corporation, which has a contract to purchase Nitrate Plant No. 2, which Mr. Ford also desires to buy.

In addition the Senate committee wishes to hear William H. Onken, Jr., editor of the ELECTRICAL WORLD, as well as the presidents of the national technical and engineering societies, who have been invited to appear at their own convenience. When hearings on the present offers are concluded, other hearings will be held on Senator Norris' own bill for government ownership and operation under a federal corporation.

Stay of Injunction Asked in Langmuir Lamp Patent Case

ATTENTION has been drawn to the item on page 699 of the April 8 issue of the ELECTRICAL WORLD stating that the Continental Lamp Works, Inc., and the United Lamp Manufacturers' Corporation have been enjoined by the United States Circuit Court of Appeals on petition of the General Electric Company, pending settlement of litigation, from manufacturing vacuum tungsten and gas-filled lamps covered by the Just and Hanaman and Langmuir patents. As a matter of fact, the Court of Appeals did not grant an injunction, but reversed the decision of the lower court denying the injunction and ordered the lower court to grant the injunction.

Counsel for the Continental Lamp Works on Wednesday applied to the lower court, on permission of the Court of Appeals, for a stay of issuance of the injunction on the ground that to issue it would enable the General Electric Company to carry out an unlawful monopolistic plan.

Only the Langmuir patent for a gas-filled incandescent lamp is involved.

Water-Power Permit Applications

THE Smith-Sanders Power Company of Rogersville, Tenn., has applied to the Federal Power Commission for a preliminary permit covering a power project in the Holston River in Hawkins County, Tenn. The estimated primary power which will be developed is 15,000 hp., but it is the intention to install equipment sufficient to generate 25,000 hp. The power is to be used for public utility purposes.

The Southern California Edison Company has applied for a license covering that part of the Kaweah River project which is outside the boundaries of the Sequoia National Park, in Tulare County, Cal.

The Mineral County Light & Power Lines of Hawthorne, Nev., have applied for a license to cover 52 miles of transmission line.

The Willow Creek Mines of Seattle, Wash., have applied for a preliminary permit covering a 650-hp. mining project on Craigie Creek in Alaska.

Thebo, Starr & Anderton, Inc., of San Francisco, have applied for a preliminary permit covering a power development on McCloud and Pit Rivers in Shasta County, Cal. The power is intended for public utility use.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Southern Power Building Another Transmission Line. — The Southern Power Company is stringing an additional power line on steel towers from Great Falls, in Chester County, S. C., to Newberry, S. C., via the Monticello section of Fairfield County. This additional line will reinforce one running to Newberry by another route. It will be about 60 miles in length and will cost about $8,000 a mile.

A New Italian Paper in Electrical Field.—A well-illustrated journal, *Sincronizzando,* has been started by the Società Idroelettrica Piemonte of Turin, Italy, and associated companies for the purpose both of promoting good will among employees and publishing articles of general electrical interest. This excellently arranged house organ is, it announces, the first and so far the only one of its kind in Italy.

Purdue Holds Electric Metermen's School.—The second annual school for electric metermen held at Purdue University began on April 10 and continued until April 14. This school was held under the direction of C. F. Harding, head of the electrical engineering department, and the Indiana Electric Light Association in co-operation with the Public Service Commission and electric meter companies. The course consisted of a series of lectures, demonstrations, tests and discussions on various types of meters.

Reduced Rates Offered at Winona, Ind.—The Middle West Utility Company, which recently bought the property of the Winona Electric Light & Water Company at Warsaw, Ind., has proposed a new schedule of rates for street lighting there which provides for a 25 per cent reduction. The rate for 250-cp. lamps would be reduced from $70 a year to $52.50 and the rate for 60-cp. lamps from $40 to $30 a year. The company also has offered a slight reduction on energy for power and asks that a petition for lower rates now before the Public Service Commission be dismissed.

The Term "Luminaire" Wins Approval of I. E. S.—The council of the Illuminating Engineering Society has formally approved the report of the society's committee on nomenclature and standards recommending the adoption from the French of the word "luminaire" to denote what has sometimes been infelicitously called a "movable fixture"—that is, an appliance which can be moved from place to place. "Luminaire" was preferred by the committee to any of the coined words suggested, and other electrical bodies have indorsed its adoption.

Richmond (Ind.) Municipal Plant Seeks to Have Commission Fix Its Rates.—The city of Richmond, Ind., through its Board of Public Works, will ask the Indiana Public Service Commission to make an inventory of the municipal electric light and power plant and arrive at a valuation, based on present equipment, for rate-making purposes. The plant underwent many changes last year and was the target for criticism because of alleged mismanagement. The present city officers believe that an inventory should be taken and have decided that the commission should supervise the work rather than have the city employ experts for the purpose.

Two-Way Telephony Between Ship and Shore.—The first actual conversation by telephone between a person on a moving ship and another on shore took place last month when President Thayer of the American Telephone & Telegraph Company and the captain of the United States line steamship America exchanged greetings. Mr. Thayer was at his home in New Canaan, Conn., and the steamship was 370 miles from Ambrose Lightship, with twenty-four hours still to elapse before it could dock at New York, nearly 400 miles away. The conversation was transmitted by the ordinary two-wire system between New Canaan and the operating rooms in New York, by the four-wire system to the New Jersey coast, and thence to the ship by radio. Two land stations were used, Deal Beach for transmitting and Elberon for receiving. The success of the experiment prefigures the time when those crossing the ocean will be within telephonic reach of land during the entire passage.

San Joaquin Corporation to Install New Unit to Supply Southern Edison.—The California Railroad Commission has approved an agreement whereby the San Joaquin Light & Power Corporation will install in its Midway steam plant, at a cost of $1,200,000, a 12,500-kw. unit to furnish power to the Southern California Edison Company. The San Joaquin further has agreed to develop, if possible, an additional 7,500 kw. capacity on its system or to obtain it through purchase, making a total addition of 20,000 kw. According to the term of the contract, the San Joaquin will sell to the Edison company 80,000,000 kw. from Aug. 1, 1922, to June 1, 1923, at a price of $42,485 per month, plus 3⅜ mills per kilowatt-hour. The commission points out that under the agreement the Edison company will benefit by reason of the cheap gas supply available as fuel at the Midway plant and will save additional investment in steam plants pending the bringing in of new hydro-electric power. At the expiration of the agreement the San Joaquin company expects to need the additional plant capacity for its own growing business.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Florida Engineering Society. — This society is to hold its annual meeting at Daytona, Fla., on May 15 and 16.

American Society for Testing Materials.—Atlantic City, N. J., will be the place and the week from June 26 to July 1 the time for holding the annual meeting of this society.

Iowa Section, N. E. L. A.—The annual meeting of the above section will be held at the Inn Hotel, Lake Okoboji, Iowa, June 20, 21 and 22, and the annual meeting of the Iowa Electric Railway Association at the same place on June 23. An interesting program, with business sessions in the mornings and entertainment in the afternoons, is being arranged.

New York Electrical Society.—The New York Electrical Society will celebrate its four hundredth meeting on Wednesday, April 26, by a visit to the new Hell Gate plant of the United Electric Light & Power Company, when Frank W. Smith, vice-president of that company, will give an address on "Thirty Years of Alternating-Current Service in New York City."

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, April 22; Philadelphia, May 6; Chicago, May 8; Cleveland, May 8.

A. I. E. E. Section Meetings — Toronto, April 24; Atlanta, April 27; Utah, April 28; Vancouver, B. C., May 5.

American Welding Society — New York, April 26-29. (For program see issue of April 15, page 750.)

American Electrochemical Society—Baltimore, April 27-29.

Missouri Association of Public Utilities — Columbia, Mo., May 4-6.

A. S. M. E. Spring Meeting—Atlanta, May 8-11. (For program see issue of April 15, page 750.)

Florida Engineering Society — Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see "News of the Industry")

National Electrical Credit Association—Detroit, May 18-19.

Electrical Supply Jobbers' Association — Hot Springs, Va., May 24-26.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio, May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22.

Electric Power Club — Hot Springs, Va., June 5-7.

Canadian Electrical Association — Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Commission Lacks Jurisdiction to Compel Public Utility to Pay Debts.—In Ashley vs. Railroad Commission, the Supreme Court of California sustained the commission in holding that that body lacked jurisdiction of a proceeding to compel a canal company supplying water for irrigation to repay money borrowed to construct its plant. (204 Pac. 825.)*

Courts Should Be Slow to Interfere with Discretion of Commission.—The Public Service Commission of Washington State, now organized as the Department of Public Works, is invested by the statute with broad powers, and the courts should be slow to interfere with its discretion. This expression of policy was made by the Supreme Court of Washington in Public Service Commission vs. State. involving railroad log-hauling rates, (204 Pac. 791.)

When Punitive Damages May Be Allowed.—Reversing a verdict for the plaintiff in Beeler vs. Green River Light & Water Company, an action for damages because of injuries received from the explosion of a defective boiler, the Court of Appeals of Kentucky declared that punitive damages are not authorized and should never be allowed in any case unless the evidence tends to show that the defendant acted maliciously, willfully, or with such gross negligence as to indicate a wanton disregard of the rights of others. (237 S. W. 1.)

Damages Allowed Against Electric Companies for Destruction of Grain.—An appeal from the decision of the District Court in Fabry vs. San Joaquin Light & Power Corporation and in Vanderburgh vs. Same (see ELECTRICAL WORLD, Feb. 4, 1922, p. 251; also for cognate case, issue of Aug. 7, 1920, p. 304) has been heard by the California Supreme Court. In these cases heavy damages were awarded to farmers for the destruction of grain from a fire alleged to have been started when employees of the defendant company were engaged in repairing a power line. The Supreme Court sustained the verdict, finding that the evidence was sufficient to show that the repairmen were negligent in failing to prevent or extinguish a grass fire started by sparks from their fire pot and that testimony to the effect that when their attention was called to the fire, then just starting, one of them said, "Never mind, partner, we will attend to the fire," was admissible as tending to establish defendant's responsibility. (204 Pac. 558.)

Waiver of Valuation Proceedings No Ground for Reversing Commission's Order.—Although valuation of a public utility's property is an essential in fixing rates, if the utility and the complainant expressly waive this requirement, with the consent of the commission, then the Supreme Court of Ohio found, in a gas-rate case (City of Lima vs. Commission), if the net return is found below what is just and reasonable upon a valuation conceded by the complainant, no prejudicial error arises which demands a reversal of the commission's order. (134 N. E. 453.)

Powers of Indiana Commission.—In reversing a certain order of the Indiana Public Service Commission affecting the New York Central Railroad, which brought suit against the commission to have the order set aside, the Supreme Court of Indiana pointed out that the duties of the commission are prescribed by statute, the manner of the exercise of the power prescribed being the measure of the power given, and when it receives authority to do a certain thing the duty is imposed upon it by statute to do it and it has no authority to delegate the power to any one else, as had been done in the case under review. (134 N. E. 282.)

Validity of Commission Order Where Commissioners Were Succeeded by Others After Testimony and Before Order.—The Supreme Court of Arkansas has found, in the Van Buren Waterworks vs. City of Van Buren, that in proceedings before the Corporation Commission for increase of rates the fact that the testimony was adduced prior to the appointment of two new commissioners, who were members of the commission at the time the final order was made, did not invalidate the proceedings so as to require the Circuit Court to reverse the ruling of the commission, since the court hears the cause *de novo* and not merely for the purpose of reviewing the proceedings before the commission for error. (237 S. W. 696.)

In Action for Damages Against Two Companies Jointly, Details of Company Agreement Need Not Be Proved.—It was not incumbent upon the plaintiff, the Kansas City Court of Appeals held in Adams vs. Moberly Light & Power Company and Citizens' Electric Light Company, to prove the details of the agreement between the two companies in order to recover damages in a suit brought against them jointly; it was enough to show that they operated together to furnish electricity to their customers. In this case a boy of eleven was killed by contact with a broken high-tension wire, and the appellate court sustained a verdict awarding $5,000 damages to his parents, holding that the amount was not excessive and that the jury was the judge of the facts as to the negligence of the companies and the contributory negligence of the victim. The appellate court refused to attach importance to the testimony of expert witnesses to the effect that insulation gives little protection from a charged wire. (237 S. W. 162.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Cost of Selling Securities.—The Wisconsin Railroad Commission in excluding from operating expenses the cost of selling securities of the Wisconsin Telephone Company said: "In technical commercial accounting there might be reason for treating this cost as an operating expense if incurred in connection with the sale of stock rather than the sale of bonds. However, if the company sells securities directly rather than through a banking house, its selling cost takes the place of the discount or commission ordinarily given to the banking house for handling the securities. In the case of a bond issue or any debt issue with definite term costs of this nature are considered by the commission as part of the interest on the issue and are amortized over the life of the securities. In the case of a stock issue with no definite term the amortization period, of course, cannot be based upon the life of the securities, but we think the principle still holds that expenses of this character constitute a part of the return."

Determination of Connected Power Load.—In a case involving the Central Illinois Light Company recently heard by the Illinois Commerce Commission the consumers concerned, who had installed motor-generator sets to convert the three phase, 60-cycle alternating current supplied by the company to direct current, contended that by interposing the motor-generating sets between the source of supply and the ultimate use they had limited the possible demand on the company's system to the capacity of the motor of the motor-generator set. The utility, on the other hand, maintained that in calculating active load the percentages should be applied to the total rating in kilowatts of the motors used by the consumers. The commission pointed out that in the case of some of the complainants, who had installed motor-generators of a greater capacity than that of the motors connected to them, the application of the company's rule resulted in a decrease of the bill. The evidence showed that motors can continue to be connected to a motor-generator set in use until the capacity of motors connected is approximately twice the capacity of the motor-generator set. To permit an application of rate schedules which would allow one consumer to be billed one-half of the amount which another consumer would pay with the same work to perform and the same size installation of motors with which to perform it would unquestionably be a discrimination.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Clare N. Stannard has been elected vice-president and general manager of the Denver Gas & Electric Light Company. Mr. Stannard comes to this new position after twenty-four years of experience in the organization and operation of public utilities. He was born in New York State in 1870. At the age of twenty-one years he entered the service of the gas and electric company of Binghamton, N. Y., and after eight years with various gas, electric and street railways entered the employ of the Denver Consolidated Electric Company, the forerunner of the present company. Until the appointment just made Mr. Stannard was secretary of the Denver Gas & Electric Light Company and also of the Summit County (Col.) Power Company of Colorado. He is an active member of the Denver Civic and Commercial Association and is also treasurer of the Denver Tourist Bureau. He is a past-president of the Denver Rotary Club and was a delegate to the international convention of that organization in Edinburgh, Scotland, last summer. He is a member of several Denver clubs and of national technical and professional organizations.

C. N. STANNARD

John R. Marsh has been appointed assistant manager of the public relations department of the Georgia Railway & Power Company. Mr. Marsh succeeds Paul Warwick, who recently resigned to become executive secretary of the Georgia Committee on Public Utility Information.

Prof. Dugald C. Jackson, head of the department of electrical engineering, Massachusetts Institute of Technology, and senior member of the firm of Jackson & Moreland, consulting engineers, Boston, was unanimously elected president of the Boston Society of Civil Engineers at the annual meeting of the society March 15.

G. M. Miller, superintendent of electric distribution for the Louisville Gas & Electric Company, has been elected president of the Electric Club of Louisville.

H. D. Miller has been appointed manager of the new-business department of the Western States Gas & Electric Company, Stockton, Cal. Mr. Miller has been with this company for several years in various capacities.

Henry Tideman, who has opened an office at 33 South Clinton Street, Chicago, as an electrical and mechanical consulting engineer, brings to this undertaking years of experience acquired as a manufacturer and engineer. After attending the Universities of Heidelberg and Berlin, Mr. Tideman entered the Polytechnic Mitweida of Saxony and was graduated as an electrical-mechanical engineer. Soon after this he came to America and founded the Menominee Electric Company at Menominee, Mich., becoming its president. When this company was reorganized in 1919 at Cairo, Ill., Mr. Tideman headed the new company, which carried his name until his resignation in October, 1921.

Fred W. Insull was elected president of the Oklahoma Utilities Association at its recent meeting in Oklahoma City. Mr. Insull is president of the Public Service Company of Oklahoma and the Chickasha Gas & Electric Company. He was born in 1875 and started in the electric light and power business in Winnipeg, Canada, in 1891. In 1902 he was appointed secretary and treasurer of the North Shore Electric Company, with offices in Chicago, this company being the predecessor of the present Public Service Company of Northern Illinois. He continued in this position until March, 1909, when he went West and was associated with H. M. Byllesby & Company as auditor for their properties on the Pacific Coast, later moving to Pueblo, Col., as auditor for the Arkansas Valley Railroad, Light & Power Company. In January, 1913, Mr. Insull went to Oklahoma for the Middle West Utilities Company to take charge of the properties now consisting of the Public Service Company of Oklahoma and the Chickasha Gas & Electric Company. Mr. Insull is a member of several technical organizations and has been closely identified with many associations and clubs of local importance.

William H. McInnis has been appointed commercial manager of the Keokuk Electric Company, succeeding Iner Carlson. Mr. McInnis was formerly with the Reno (Nev.) properties of the Stone & Webster Company.

Rufus E. Lee has been elected president of the Continental Gas & Electric Corporation, Cleveland. Mr. Lee assumes his new position after many years of organizing and operating public utility plants. He was for many years general manager and secretary and treasurer of the Lee Light & Power Company of Clarinda, Iowa. In 1917 he resigned from this company to operate as owner the Hubbard Ice & Coal Company of Cedar Rapids, Iowa. Along with that business he also acted as receiver for the Nebraska Electric Company, which formerly owned and operated several properties in Nebraska. In November, 1919, he again became interested in the Lee Light & Power Company, and he has since reorganized and put this property on a paying basis. The Continental Gas & Electric Corporation, of which Mr. Lee has been elected president, owns and operates more than one hundred plants, and negotiations are now pending for the purchase outright of other valuable plants in its territory. Mr. Lee is a past-president of the Iowa Electrical Association.

R. E. LEE

W. I. Whitefield has resigned as assistant superintendent of the lighting and power department of the Roanoke (Va.) Railway & Electric Company, and has become associated with the Charles M. Kelso Company, engineers and contractors. He will be stationed at Utica, N. Y.

J. P. Pulliam, in charge of the operation of the properties of the Wisconsin Securities Company, has been elected president of the Wisconsin Utilities Association, which is a new organization including the former Wisconsin Gas Association and the Wisconsin Electric Association. Mr. Pulliam was president of the Wisconsin Electric Association the past year

R. H. McLain has accepted the position of sales manager of the Maine Electric Company, Portland, Me. Mr. McLain has been with the General Electric Company at the Schenectady works for a number of years.

J. L. Fellows, the new president of the American Washing Machine Manufacturers' Association, is the secretary and treasurer of the Grinnell Washing Machine Company. After graduation from Grinnell College in 1901 Mr. Fellows went to Sherwood, N. D., and took charge of the lumber yard of the F. H. Stoltz Lumber Company. He remained there until 1907 and then returned to Grinnell, where he purchased a partnership in the Carney Lumber Company. During the next year Mr. Fellows became interested in the washing-machine industry, and he finally organized the Thompson Brothers Company, which was later called the Grinnell Washing Machine Company. In the summer of 1908 the company produced one of the early electrically driven washing machines with a power-driven wringer. In 1909 he sold his interest in the Carney lumber yard and devoted his entire attention to problems of patent rights affecting his company. In addition to his duties as secretary and treasurer Mr. Fellows has been actively connected with the sales work of his company.

J. L. FELLOWS

F. L. Bunker is now connected with the Southern Radio Corporation, Charlotte, N. C., as commercial engineer. He was previously with the Westinghouse Electric & Manufacturing Company at Charlotte.

H. A. Vernon is the recently appointed sales manager of the Art Lamp Manufacturing Company, Chicago. After graduation from the University of Illinois in 1908, Mr. Vernon became associated with Sears, Roebuck & Company and in 1912 went with the Alcazar Range & Heater Company, Milwaukee, as assistant advertising manager, remaining there until 1916. Until recently he was advertising manager of the Wahl Eversharp Company.

Ernest N. Calhoun, formerly connected with the Cutler-Hammer Manufacturing Company as sales engineer, has been appointed sales manager of the electrical heating department of the Edwin L. Wiegand Company, Pittsburgh.

F. W. Stolley, district manager for the last five years for the Willcox & Gibbs Sewing Machine Company, is now taking an active interest in the American Metal Moulding Company, Newark, N. J., as vice-president and sales manager.

P. L. Goddard has been appointed executive secretary of the Rocky Mountain Electrical Co-operative League to succeed Charles H. Talmage, who has resigned. Mr. Goddard has been connected in the past with the Utah Power & Light Company and the Hawaiian Electric Company as purchasing and sales engineer.

Paul C. Sorsby has been appointed turbine and generator expert for the International General Electric Company, with headquarters at Yokohama, Japan. Mr. Sorsby is a technical graduate and has had fourteen years of engineering experience, including twelve years with the General Electric Company. He sailed from San Francisco for Japan the latter part of March.

C. H. McCullough, connected for many years with the Pittsburgh district office of the Westinghouse Electric & Manufacturing Company, has resigned to organize the C. H. McCullough Engineering Company with offices in the Oliver Building, Pittsburgh. The company represents among others the Post-Glover Electric Company and Van Dorn & Hutton.

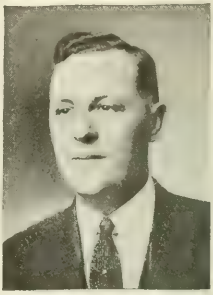
G. E. Lewis is president of the newly formed Wisconsin Electric Appliance Company, electrical jobber, Menasha, Wis. Mr. Lewis received his electrical training with the Allis-Chalmers Company, with which he was connected from 1904 to 1910. He spent the years from 1910 to 1917 with the S. F. Bowser Company, Fort Wayne, Ind., and left there at the end of that period to organize the Twin Cities Supply Company at Menasha.

H. S. Killelea has severed his connection with the New England Power Company to enter business for himself in Brattleboro, Vt., where he has organized a repair and contracting company and in addition will act as a consulting electrical engineer. Mr. Killelea has been with the New England Power Company for the past three years as superintendent of electrical construction, with headquarters at Worcester, Mass. For the past two years he has maintained field headquarters in Brattleboro, handling several large hydro-electric construction projects near there. After graduation from an engineering school Mr. Killelea entered the service of the General Electric Company and later was connected with the Turners Falls Power & Electric Company as construction superintendent.

H. C. Budd, has resigned his position with the Canadian General Electric Company and has joined the sales staff of the Moloney Electric Company of Canada, Ltd. He will have his headquarters in the York Building, Toronto.

Russell S. Gibson, formerly chief electrician of the Eastman Kodak Company, is now with the Ajax Battery Company, Rochester, N. Y.

O. A. Lawrie has recently been appointed district sales manager for the Ohio Brass Company, Mansfield, Ohio. Mr. Lawrie's appointment takes effect at once. He is to have his headquarters in Boston. For the past sixteen years Mr. Lawrie has been connected with the American Copper Products Corporation in various positions.


O. A. LAWRIE

John D. Goodliff, who has been connected with the Northwestern Electric Equipment Company, New York, for the past ten years, has accepted the position of sales manager with the Parr Electric Company, Inc., New York.

Obituary

Walter Ferguson died at his home at Stamford, Conn., on April 7, after a long illness. Mr. Ferguson was born in Stamford in 1842 and was graduated from Trinity College. He was one of the organizers of the Brooklyn Edison Company and founder of the Kings County Electric Light Company, which eventually was obsorbed by the Brooklyn Edison Company. He was also active in the establishment of the Union Carbide Company, of which he was a director, and at one time was a director of the People's Gas Light Company of Chicago and of several railroad companies. At the time of his death Mr. Ferguson was president of the Stamford Trust Company, a director of the First Stamford National Bank and chairman of the board of directors of the Stamford Gas & Electric Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Gain Reported in Industrial Lighting Installations Since Jan. 1

A CONSIDERABLE gain in lighting installations for industrial plants has been noticed in the last three months by several representative manufacturers of fixtures. This is welcome business, but it is discounted somewhat as an indication of a revival of general business for the reason that many of these installations have been worked on for as long as six or eight months, specifications having been prepared and the projects having reached the point where bookings naturally follow. Some of the plants in which the systems are being installed are partially shut down, while others are working close to capacity, so that an increase in lighting-fixture business is not an accurate index of industrial prosperity.

The installations have been well scattered through the manufacturing world, and it is becoming increasingly easy to convince factory managers of the advantages of a high standard of illumination. Textile mills have been particularly good buyers of "more light," the metal industry has also shown much interest, and floodlighting has been another lucrative field.

The large manufacturing companies are finding that the expense of a large engineering department for the purpose of drawing up specifications and advising clients is well repaid, not only by securing the original installations, but by laying the foundation for obtaining other electrical business from the customer at a later date. How successful the engineering service is in securing the initial order after inquiry may be seen from the fact that plans prepared by one company are turned down about once in eighteen times.

Prices of equipment seem to bear little relation to the demand. One concern has not lowered its quotations on fixtures for more than a year, but continues to get its share of the business. Requests for technical assistance in working out lighting problems are coming in in good volume, with the question of price more or less disregarded.

Conduit Up With Second New Card Since January

MANUFACTURERS of rigid conduit have issued Card No. 50, which became effective April 15 and superseded Card No. 49, issued on Jan. 11. With the issuance of the new card conduit prices increased approximately 7 per cent. The actual decrease in discounts amounts only to 1 point, but a special discount of 5 per cent on Card No. 49 has been abolished so that the total rise is about 7 per cent in actual price. Discounts on Card No. 50 are now 46 per cent off list on ¼-in. to ½-in. galvanized conduit in less than carload lots and 52 per cent off on the same sizes of black pipe in similar lots.

This is without doubt a direct result of the present situation in the coal and steel industries. Steel mills are not seeking business on account of the possibility of a fuel shortage preventing operations. Stocks of rigid conduit are short, not only as far as jobbers are concerned but extending to manufacturers also. Construction is taking large quantities of pipe, and within the last week the realization has come that hand-to-mouth stocks cannot fill the demand. Orders have piled in on manufacturers, and the result has been a reaction of prices to higher levels.

Discussing the possibilities of a shortage, one large manufacturer stated to the ELECTRICAL WORLD that the situation is not acute now and probably will not be if the coal strike is broken by the beginning of May. However, should it last until the first of June, construction will be seriously impeded more by lack of raw material than by lack of fuel. The expectation is that coal production will increase soon and that the next six weeks will see the danger of a pipe shortage averted.

American Electrical Imports in March Are Unimportant

MUCH has been heard in recent months of the large amounts of electrical goods being imported into this country and of the harm being done American electrical manufacturers thereby. That there exists no basis, at least at present, for these fears is disclosed by figures gathered unofficially by the Bureau of Foreign and Domestic Commerce and covering electrical imports through the port of New York for March of this year. The total amounts to $26,250, or less than two-thirds of 1 per cent of the amount exported in the same month. Certainly, as far as the electrical industry is concerned, the balance of trade is in our favor. It is the intention of the bureau to gather these figures for April and then to discontinue the work unless these imports are in very much greater volume for the month.

Germany, according to the figures, occupies first place on the list of the countries from which we buy these goods. Her total sales to us for March amounted to $11,828, not quite half of the total. Our largest purchases from her, which were not so large at that, consisted of carbons, heaters and heating pads and table lamps. England sent us small amounts of dynamo brushes, heaters, telegraph instruments and radio apparatus, while France furnished us only dynamo brushes in any considerable amount. Czechoslovakia sold us only lighting fixtures, but the total for this item was $5,201, almost 20 per cent of our total imports. Switzerland, Belgium and Italy are represented in the list, but with negligible amounts. Data received by

SPECIAL PRELIMINARY FIGURES (UNOFFICIAL) SHOWING IMPORTS OF ELECTRICAL GOODS THROUGH PORT OF NEW YORK, MARCH, 1922

	Countries of Origin						
Kinds of Goods	Germany	England	France	Czecho-slovakia	Switzer-land	Belgium	Italy
Carbons	2,720						
Dry cells	42						
Dynamo brushes		1,360	3,826				
Fans	104						
Hair driers	1,595						
Heaters general	1,580	305					
Heating pads	1,550						
Immersion heaters	251						
Incandescent-lamp filaments			445				
Lighting fixtures	95		700	5,201	....		
Motors—small types	97		160			380	....
Pocket flashlights	320						
Sockets	20						
Table lamps	2,218						195
Telegraph instruments		150					
Telephone condensers	600						
Time switches					560		
Vibrators	540						
Wireless apparatus	26	1,050					....
Miscellaneous appliances	70				90		....
Totals	$11,828	$2,865	$5,131	$5,201	$650	$380	$195
Total from all countries							$26,250

the bureau for the port of Boston indicate that March imports of electrical goods there did not run over $750, of which $505 represents fixtures and $182 heaters. These data do not include the last two days of March and may be slightly low.

The table does not include incandescent lamps, which for some time have been the United States' most important electrical import item and on which figures are given in the official monthly summary of foreign commerce. During February, the latest month on which figures are given, incandescent lamps were imported to the value of $36,725, while the average value for the eight months ended February, 1922, was $38,271 per month. A comparison of the totals of quantity and of value shows that most of these lamps must have been of the miniature type, the value per lamp having ranged around 2 cents.

Street Lighting Assuming Importance in Illumination Sales Work

THE most active branch of the illuminating industry just at the present time, says a large manufacturer, is the street-lighting branch. In the past few years it has got beyond the point where the city fathers would tell the city electrician to string a few lights at various corners, on the assumption that any sort of light was good enough for street lighting. Today the city engineer confers for a long time with sales engineers of manufacturers before deciding on just the type of post and shade and globe to use, the object being to obtain the most light and the best appearance. Manufacturers have taken advantage of the desire for better-lighted streets and in fact are more or less responsible for creating this desire through their educational campaigns.

Within the last three months these manufacturers of street-lighting equipment have been turning many of these inquiries and conferences of the last year into actual orders. For some reason small municipalities were somewhat hesitant to spend money during 1921 but are now either in better shape financially or are convinced it is no use waiting longer to invest in adequate street lighting. Orders are coming in mainly from cities of between 20,000 and 100,000 population, though there are a few large cities tentatively in the market. The greater part of this demand is, of course, for "white-way" systems rather than for boulevard or ordinary street-lighting; the first thing a town of moderate size demands is that its business section be as brilliantly lighted as that of any other town its size within a radius of a hundred miles. This spirit of friendly rivalry grows more the further west the town lies, and this perhaps is why sales of ornamental street-lighting systems are only fair in the East, very good in the Central West and excellent on the Pacific Coast.

Instrument Manufacturers Report Sales Holding Their Own

A FAIR demand with no great improvement looked for before fall is reported by manufacturers of electrical instruments. These manufacturers serve a widely diversified number of industries, however, so that, as at present, a slump in one industry often is made up for by an increased demand from another. Thus there is now a call for instruments for radio work that is bringing up the sales volume to a satisfactory total in spite of decreased sales of other types of instruments. The manufacturers have fallen behind in deliveries mainly because six months ago this demand was entirely unlooked for and none of them was in a position to go into quantity production.

There is little call for instruments for farm-lighting plant systems, and when business will develop here is hard to tell. Much depends on crops and crop prices during the coming summer. In the Middle West there is considerable optimism, for both grain and stock prices have shown an upward tendency, and the Pacific Coast should be a good market also. A slight improvement is noted in the South.

The automobile industry should take a large number of instruments before the year is over, though one instrument manufacturer informed the ELECTRICAL WORLD that the reported improvement in automotive conditions had not been felt by his company yet. However, there is no doubt that production of automobiles and trucks is increasing constantly, and it will not be long before the producers must come into the market for instruments. There is little demand from schools and colleges for laboratory instruments, but this is a seasonal business and will revive again when these institutions reopen in the fall.

Switchboard instruments are in very good demand and central stations have been buying in normal amounts since the first of the year. Industrial customers have also been in the market, and, outside of radio instruments, the switchboard types are showing the most activity. Portable instruments are also selling well, and what with the latter type, the switchboard and those for radio, the stagnant condition of the other markets is being discounted.

It is estimated that unfilled orders during the first quarter of 1922 were 75 per cent of those for the first quarter of last year. However, the current unfilled orders are almost entirely new business, while last year the greater part of orders on the books had been carried over. Deliveries now are normal against two to three months at the beginning of 1921. There has not been much change in prices, owing to the fact that 90 per cent of the manufacturing cost is for labor, and although wages have been reduced, the reduction has not been large enough to warrant much reduction in selling cost.

Metal Market Situation

STEEL mills in the Pittsburgh and other districts have plenty to do under present circumstance. They are working at from 70 to 80 per cent capacity as a result of the buying movement which began when the coal strike took on a serious aspect. Customers feared a shortage, and further price increases and orders piled up. So far the coal strike has not made itself much felt, but the mills are evincing a desire to husband their fuel supply. Some continue to sell, but a certain amount of conservatism is shown and a relatively quiet steel market may be expected for a while, with mills making fairly heavy shipments and buyers drawing on accumulated stocks.

The estimated production of tin plate in the first three months of this year is about 375,000 gross tons. Inasmuch as exports have been running fairly light, it follows that with a record production the shipments for domestic consumption were a record by a still greater margin. Prices are easily maintained.

The price situation in the copper market showed no change, the quotation being firm at 12¾ cents. There was little selling below this price and not many bookings at 13 cents. There was a slight recession of the buying movement of the week before. Export demand has been the mainstay of the market, and shipments abroad through the port of New York in the second week in April were 19,500,000 lb. The total shipped through New York in the first fifteen days of the month is around 26,000,000 lb.

NEW YORK METAL MARKET PRICES

	April 11, 1922	April 18, 1921
Copper:		
London, standard spot	£ s d 57 2 6	£ s d 59 5 0
	Cents per Pound	Cents per Pound
Prime Lake	12 87½ 13 00	12 87½
Electrolytic	12 75	12 75
Casting	12.50	12.50
Wire base	14.00 –14.25	14.00 –14.25
Lead, Am. S. & R. price	5 00	5 00
Antimony	4.87½	5.00
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.22½–5.27½	5.22½–5 27½
Tin, straits	30.50	30.87½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11 00 –11 25	10 75 –11 12½
Brass, heavy	5 00 – 5 50	5 25 – 5 62½
Brass, light	4.75 – 4.87½	4.75 – 5.00
Lead, heavy	4.00 – 4.12½	4.00 – 4.25
Zinc, old scrap	2.50 – 2.75	2.50 – 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS continues to gain, though here and there a depression exists by reason of a local condition such as weeks of bad weather or strikes. Where trade has a fair chance there rarely fails to be an increase in sales. An instance of this is the territory around Atlanta, where the cessation of long rains has given farmers and planters a chance to start cultivation and has been the cause for more optimism in the small towns. Atlanta jobbers report fan season prospects very good. In St. Louis general business is on the increase, though labor troubles have almost stopped building. Chicago reports satisfactory business in a number of lines, and the steel mills there are working at an estimated capacity of 85 per cent. New England business is good outside of the textile area, and construction contracts awarded continue to break all records. In both Intermountain territory and the Pacific Northwest bad weather has cut down retail sales and has slowed up building of all sorts. However, lumbering and mining, the mainstays of these regions, are recovering. Another building strike looms in San Francisco and the bay cities, and such a development would have a serious effect on business.

NEW YORK

The improvement in electrical trade as reported last week has held up well, although the increases all along the line have been very gradual. Wiring supplies of all kinds are in very fair demand. Present indications are that this demand will continue to improve, as general building activity, not only in the residential sections but in the business districts as well, is decidedly on the increase.

Stocks are in very good shape, and prices remain steady with the exception of rigid conduit, on which the manufacturers have announced an increase of 7 per cent, putting Card No. 50 in effect.

The appliance business has shown more life during the past week than at any time since the first two weeks of this year. Jobbers state that this particular branch of their business seems to be rather periodical—a good number of orders is received at about the same time and then follows a lull of from six to ten weeks. The fan business has been exceptionally good this spring, and so far there has been no let-up in the demand for radio equipment.

Rigid Conduit.—Manufacturers have announced an increase of 7 per cent in the price of rigid conduit, and card No. 50 is now effective. While jobbers have not as yet prepared a new schedule of prices, quotations will be made at a 7 per cent advance over the following: For $\frac{1}{2}$-in. black pipe in 2,500-ft. lots, \$44.50; $\frac{3}{4}$-in., \$58.10, and 1-in., \$82.79 per 1,000 ft. Galvanized pipe in the same sizes and quantities is quoted at \$50, \$64.50 and \$92.20 per 1,000 ft. Demand is steady and stocks of most sizes are ample.

Rubber-Covered Wire.—No change in price or conditions in the wire market was noted this week. There is a fairly active demand and jobbers' stocks are in good shape. No. 14 rubber-covered is quoted at \$6.25 to \$6.35 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—This material continues in active demand and sales have been very good. Stocks are fair. Quotations on No. 14, two-wire, single-strip, range from \$43 to \$45 per 1,000 ft. for that quantity, and double-strip sells for \$45 to \$47 per 1,000 ft.

Sockets.—Schedule material generally is moving fairly well and jobbers have good stocks on hand. Pull sockets in standard-package lots of 250 are quoted at 33 cents each. Key sockets in lots of 500 sell for 18 cents, and keyless for 16 cents in the same quantity.

Dry Cells.—Standard cells are moving steadily. No. 6 regulars in lots of twelve to fifty sell for 34 cents each, in lots of fifty but less than a barrel for 30$\frac{1}{2}$ cents each, and barrel lots of 125 sell for 29 cents each. Quotations on ignitors are 1 cent higher than the foregoing for the same quantities.

Appliances.—Sales of heating devices have picked up considerably during the past week, and jobbers report some fair-sized orders for irons, toasters, percolators and grills. This business has been very spotty since January, and it remains to be seen whether or not the present activity will hold out.

Fans.—The fan business has been expectionally good this spring, and orders for stock continue to come through from dealers. More attractive prices this year and small carry-overs are largely responsible for better sales.

Radio.—Demand for wireless apparatus continues strong, and new dealers are appearing every day. Jobbers have little or no stocks, and some have expressed the opinion that this business will drop off sharply during the summer months because of static conditions.

CHICAGO

While the gradual improvement in the electrical industry seems rather slow, a curve with time plotted against volume of business probably would show a decided gain since the first of the year. Spring construction is under way so that most of the staple electrical equipment is moving fairly well. Wiring materials have been selling steadily for some time, and prices are often cut to allow very little profit. A good week for the high-tension manufacturers was reported. Increased activity in the sign industry was also announced. Radio is continuing to be the booming feature of the trade, but deliveries are always in the future. Both porcelain and bare stranded wire are being swept along with this boom.

During the week contracts were signed for two new 30,000-kw. units to be installed in the Calumet station of the Commonwealth Edison system. Under present plans the capacity of this station will be increased to 180,000 kw.

Wire.—The steady action on No. 14 rubber-covered wire noted during the last few weeks has been sustained, practically all jobbers reporting a good volume of business. No price changes have been noted, and it still sells around \$6.25 per 1,000 ft. in 5,000-ft. lots. Stocks are ample. The demand for both weatherproof and bare wire has been steady, and there have been no variations in price.

Rigid Conduit.—The good movement on conduit during the week seems to indicate that building construction has started. The $\frac{1}{2}$-in. black pipe sells in 5,000-ft. lots for \$40 per 1,000 ft. Stocks are good.

Flexible Armored Conductor.—A similar activity in armored conductor has resulted in a good movement on the No. 14 two-wire, single-strip size. The price on this material varies between \$41 and \$42.50 per 1,000 ft. in 5,000-ft. lots.

Signs.—Business in this line is good and inquiries are increasing. One company reports that the average 1922 business is 25 per cent higher than last year's. All sizes are moving well and several new installations of theatrical signs have been made.

Porcelain.—An improved market for insulators has been noticed, possibly due to radio requirements. No price changes have been announced.

Metal Molding.—The movement appears to be rather sluggish. The three-wire size sells around \$50 per 1,000 ft. in 1,000-ft. lots.

Lamp Cord.—The market for lamp cord has fallen off a bit and sales are scattered. The No. 18 parallel, $\frac{3}{64}$-in. insulation, cotton, is available for \$16 per 1,000 ft. Silk in the same size is quoted at \$27 per 1,000 ft.

BOSTON

A gradual improvement in general business conditions is apparent. The building industry is expanding rapidly, contracts for the week ended April 11 totaling $13,314,800 for New England. The preceding week's total was $9,279,100, and a year ago the figure was $4,070,400. This is again the best week's record for twenty years, according to the Dodge reports. Retail trade in New England is improving outside the textile strike areas. While many orders of moderate size are being handled by jobbers in the electrical wiring line, the demand is better as a whole, and the measured upward trend of trade is regarded as healthier than a boom. Money is getting easier and the building of new residences is rapidly progressing toward a point where the increased demand for electrical supplies will be marked. Some of the New England electrical factories which were operating at a low ebb last winter are picking up gradually. Non-employment is lessening. The demand for electrical accessories for automobile service is growing and nothing seems to check the extraordinary interest of the general public in radio equipment. Central-station earnings in many quarters are better than last year.

Storage Batteries.—Trade is brisk, especially in the smaller sizes used in connection with radio telephony and automobile service. Prices are firm, and so far stocks are meeting the situation well.

Loom.—Fair sales are being handled for interior points. Prices are quiet, 1,000-ft. lot orders going through at $15.50 per 1,000 ft. on the 7/32-in. size and at $18 for the 1/4-in. size. Stocks are adequate.

Wire.—Buying has picked up somewhat on insulated wire. Rubber-covered No. 14 sells at $6.75 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is steady at 16 cents. Very little bare is moving this week, apart from scattering trolley and central-station requirements. Bare base is 15 cents.

Tape.—Friction tape is moving in hand-to-mouth quantities. In less-than-10-lb. lots the 3/4-in. black is quoted at 45 cents per pound, and at 35 cents in 100-lb. lots; white tape in corresponding lots, 90 cents and 80 cents. The supply is ample.

Sockets.—Competition between different grades of sockets and for small-order business is holding down prices. In case lots, pull sockets now move at 32 cents net. There is much dissatisfaction over prices among jobbers.

Lamps.—Lamp orders are tapering off seasonally, and the advent of statewide daylight saving April 30 will cut further into sales. By and large, however, the past year's lamp business in this district has been remarkably good in comparison with many other lines. Replacement orders are active in mills, and much new business is being handled as a result of central-station house-wiring campaigns.

Radio Equipment.—One local manufacturer is booked well into 1923 on radio-telephone equipment, and business is still coming. The exhibits in retail display windows are largely unsupported by stocks beyond very restricted assortments.

ATLANTA

Little change in electrical jobbing lines has taken place during the past week, though conditions in general have somewhat improved. Dry weather has allowed the farmers to commence active work of preparation of the soil and planting. Fertilizer manufacturers and dealers report that business improved greatly during March, after having been very dull during the early part of the season. Railroads coming into Atlanta report that shipments of fertilizer during March were 15 per cent greater than in March, 1921. While planting is later than usual, the ability to get into the fields and do some tangible work is having a beneficial effect in the rural communities. Business in the small towns is reported somewhat improved over thirty days ago.

Textile-plant operation throughout the territory is very spotty, some of the mills operating full time, some overtime, while a few are shut down for an indefinite period. Knitting mills seem to be fairly busy, while the overall plants report a healthy volume of orders. Building permits continue to be taken out in good volume and this should shortly be reflected in a brisk movement of all electrical building material. Construction of moderately priced homes continues to feature the building development. Building activities are reported throughout the Southeast, and as a result of this development the lumber and common brick industries have been stimulated and non-employment is being reduced. It is predicted that non-employment in Georgia will have virtually disappeared by July.

Safety Switches.—The movement in this line continues to hold up well, and the popular sizes show a very satisfactory gain in sales. In general, stocks are in good shape with factory shipments satisfactory.

Poles.—Sales of poles are reported only fair. High freight rates have caused purchasers to call for local-cut poles in a number of instances. Producers have accumulated good to heavy stocks and shipments are prompt.

Lamps.—The price reduction in lamps on April 1 caused a slight flurry of buying, but business has again settled to its normal volume for this period of the year. Stocks are in good shape throughout the entire line.

Schedule Material.—Building activities have not yet stimulated this line, though a more active market is anticipated in the near future. The entire line of schedule material is well stocked throughout the section.

Fans.—The first little touch of hot weather is stimulating fan sales, and there are prospects for a very successful season. Jobbers' and retailers' stocks have been brought into good shape in anticipation of the demand.

Exhaust Fans.—This line continues to move steadily, particularly in sizes up to 30 in. Sales in this line are not so good as in buzz fans, but hot weather is expected to cause a better movement in the near future. Local stocks are in good shape with factory shipments on special sizes satisfactory.

Lighting Fixtures.—Industrial, commercial and residential lighting fixtures are all showing a healthy movement, commercial and residential types being particularly good, though the more expensive variety in commercial fixtures leads in popularity. Jobbers' stocks are in excellent shape throughout the territory.

ST. LOUIS

Business generally shows continued improvement of a solid character. One of the dominant factors is the greater purchasing power in the agricultural districts, occasioned in part by higher prices of grains, but due principally to substantial improvement in the pork and beef markets. Until the recent heavy rains the outlook for this year's crops was excellent, and no official reports have been issued showing the effect of the abnormally heavy precipitation during the past two weeks. High water has overflowed farming land in some places, but not sufficiently to affect the general agricultural conditions.

The industrial plants continue to extend their operations. A street-car manufacturing company recently resumed work and is re-employing additional men at the rate of about 100 per week as the result of orders placed in the last thirty days. A large steel company announces its intention to go from one-third capacity to two-thirds capacity in the next three weeks. Conservatism still rules the market, and as a result there are a large number of small orders.

Construction work in St. Louis is virtually at a standstill until some settlement can be reached between the contractors and the carpenters regarding wages. Outside of St. Louis, where money is probably a little tighter, extensive construction is being held back by high prices of materials. Notwithstanding these conditions small residential jobs are demanding an increasing amount of wiring materials and devices.

Cross-Arms.—While the total movement is still small compared with normal times, it is much heavier than has been experienced for several months. Buying is principally for distribution work of the central stations, as the transmission jobs have not yet materialized. Stocks are in excellent condition, and prices for fir arms, 3¼-in. x 4¼-in., per 100, f.o.b. St. Louis, are nominally as follows: 3-ft., $51.38; 4-ft., $68.31; 6-ft., $102.77; 8-ft., $137.03; 10-ft., $152.25.

Dry Cells.—The demand has slackened slightly the last few weeks, but on the whole has been exceptionally good so far this year. The steady demand and the firm prices have resulted in the carrying of comparatively liberal stocks. In barrel lots, the regular item is priced at 31 cents each and the ignitor at 32 cents each. The four-cell battery is priced at $1.70 each in lots of twenty-four and at $1.80 each in smaller lots.

Bell-Ringing Transformers.—Though improvement in sales is reported, the total demand is comparatively small. Education of the public to the greater use of this device is needed before there will be substantial movement.

Tape.—This item is moving in attractive amounts, though the individual orders are small. On account of the conservative policy in stocking, individual jobbers' stocks are occasionally exhausted. A local manufacturer reports business about 25 per cent better than a year ago. Friction tape is priced from 35 cents to 60 cents per pound, depending upon quality, the largest sales being for a 38-cent grade. Rubber tape is priced at 36 cents per pound.

Soldering Materials.—Representative prices are about as follows: Paste, 5 cents per ounce; soldering sticks, 14 cents per stick; salts, 36 cents per ½-lb. can in lots of twenty-five; wire solder, 22 cents per pound; bar solder, 25 cents per pound; ribbon solder, 24 cents per pound. The demand is up to the general average of wiring materials and stocks are in good shape.

PORTLAND—SEATTLE

Continued bad weather is affecting retail sales, road construction, building construction and logging operations. This season is from three to four weeks behind this year. The continued increase in lumber production from week to week is one of the bright spots in the business revival of the Northwest. Production for the week ending April 8 was only 6 per cent below normal. It is reported that the lull in Japanese buying is over and that from now on that market will be active.

The gradual increase in the price of agricultural products is putting new life and hope into the hearts of the rural population, and as a result business throughout the country districts is noticeably improved. The electrical business is moderately good. The outstanding feature is the inability of deliveries of radio apparatus to meet the unprecedented demand for this class of material. The Gray's Harbor Railway & Light Company recently let a contract for a 3,750-hp. steam turbine-generator set to add to its present generating capacity. Bids for supplying switching equipment for the City of Seattle's Skagit plant have been opened. The lowest bid calls for the expenditure of $115,000. Manufacturers' agents of Portland report business improving materially in the past week or two. Both inquiries and bookings are active. Jobbers report business fair, the greatest activity being in wiring devices. Some price reductions have been noticed during the past week. Single-pole plug switches and switch plates, flexible-conduit fittings and porcelain cut-outs all record a drop of approximately 10 per cent. Contractor-dealers of Portland report store sales inactive. Fixtures are exceptionally good, and wiring demands, particularly for residence and apartment work are active.

Knobs.—Solid No. 5½ knobs are quoted at $9.65 per 1,000 in packages of 500. "Nail-it" knobs are quoted at from $18 to $22 per 1,000 in barrel lots and lots of 500 respectively.

Tubes.—3-in. x $\frac{5}{16}$-in. tubes are quoted at from $4.95 to $5.85 per 1,000 in lots of 500.

Loom.—Demand is fair. The $\frac{7}{32}$-in. loom is quoted at from $16.35 to $18.50 per 1,000 ft. in coil lots.

Insulators.—No. 9 phonograph insulators are quoted at $56.05 per 1,000 in barrel lots of 400. No. 20 double-petticoat glass insulators are quoted at $82.80 per 1,000 in barrel lots of 200.

SAN FRANCISCO

The prevailing industrial harmony of San Francisco and the bay region apparently will be broken by the refusal of the unions to work alongside non-union men. So far the plasterers and bricklayers are the only unions out, but unless some mediation is accepted by the extremists of both sides another builders' strike is looming. The peak of non-employment seems to have been passed. Crops are coming along nicely, a little damaged here and there by frost, but standing up surprisingly well everything considered. Export business is improving, although so far electrical supplies have not been greatly affected.

Batteries.—Battery business is somewhat better than last year, being greatly increased by the big demand for wireless radio batteries. Standard bell batteries are selling in lots of fifty for 37 cents each, in barrel lots for 35½ cents each, and the ignitor for 38 cents each and 36½ cents each respectively.

Conduit.—Twin-armored conduit, No. 14 size, is selling for $93 per 1,000 ft. in coil lots, and No. 18 armored lamp cord in coil lots for about $16 per 100 ft. with an approximate 10 per cent decrease in five-coil lots.

Metal Molding.—Metal molding has just dropped about 25 per cent. The demand is very steady, principally because certain contractors like to use this molding and make a practice of doing so in each of their jobs.

Wiring Material.—Wiring material is very active. Big stocks are arriving and are often largely sold before their arrival, conditions on certain items of this line recalling 1919 conditions. A feature of this business is the low prices made on the standard items.

SALT LAKE CITY—DENVER

A recurring spell of winter in the Intermountain regions is having a depressing effect on business. Sales in all lines for the past month have shown a decline. Cottage building has begun, and building permits issued indicate a big summer in construction of homes. The campaign is being greatly facilitated by easily available loans. Builders' hardware and electrical construction materials are moving in better volume than this territory has seen in several years. Road men report a better tone prevailing among retailers generally. Orders are being obtained at a rate that points to satisfactory revival. Collections are easier and credit is steadily improving. There is money for every legitimate enterprise, with financing concerns running competitive advertising campaigns to get clients.

The War Loan Corporation is still active in the Mountain States supplying much-needed aid to the live-stock and beet-sugar industries. These are two of the basic sources or wealth here, and the outlook now is highly promising. Great reclamation and power projects are pending development which, when under way, will employ thousands of men now idle.

The coal strike is reported to be making some slight gains in the non-union fields. Agitators from the strike centers are busy securing recruits and organizing walkouts. There is little appearance of worry about the strike among owners of industrial plants, the supplies of coal on hand seeming to be ample to meet the needs for an indefinite period.

Auto Lamps.—Stocks are ample to meet all demands. The improved market for used cars has created a corresponding improvement in auto lamp sales.

Vacuum Cleaners.—Most electrical advertising is concentrating on this seasonable line. Dealers are placing some fairly good orders in anticipation of business when spring comes and housecleaning gets under way.

Wire.—Wire, both bare and insulated, continues to move sluggishly. There is little line construction under way, and there is a tendency to retrench in the matter of repairs. Stocks are heavy, with no price changes noted.

Radio.—Wide interest is being shown in radio. The public is aroused and dealers are clamoring for stocks. Jobbers are practically helpless, awaiting stocks that are slow in coming.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Hygrade Lamp Company to Enlarge Plant

The Hygrade Lamp Company, Salem, Mass., has completed plans for an extension of its plant. The addition will be of mill construction, four stories high, 50 ft. wide and about 110 ft. long. It will include quarters for the packing department, quality department, engineering department, a centralized pump room, storage facilities, and cafeteria, hospital, dance hall, smoking room and other accommodations for employees. It is expected to complete the addition by August.

Petition for Midwest Engine Company Receivership Withdrawn

A suit for receivership for the Midwest Engine Company, Indianapolis, which was filed by the General Electric Company in a federal court recently, has been dismissed by the petitioner. It is understood that another complaint differing in several particulars from the one filed may be filed later. The petition alleges that the Midwest Engine Company had on Feb. 21, 1922, nominal assets amounting to $12,875,433.36 and liabilities of $6,379,945.51. Of these liabilities $4,349.69 was due the plaintiff and $1,046,950 was due to Indiana Trust Company, trustee. It was stated the company was wholly solvent, but that in order to pay its debts in full it would be required to sacrifice its assets in a manner which would so impair the credit of the company that it no longer could continue in business. In order that business may be carried on, the appointment of a receiver was asked for.

It is understood that the filing of an amended complaint by the plaintiff and an answer of admission by the defendant were considered by the parties to the suit, but this plan was discarded finally and the suit dismissed.

Graton & Knight Make Changes in Management

Important changes in the management of the Graton & Knight Manufacturing Company, Worcester, Mass., belting manufacturers, were made at the recent annual meeting of shareholders. Preferred shareholders as a result of the passing of the dividend on preferred shares had the right to vote and elected a minority of the board. The new directors are: Stanley A. Russell, vice-president National City Company; W. R. Grace, vice-president and treasurer Ingersoll-Rand Company; George DeB. Greene, E. H. Rollins & Son; H. G. Stoddard; W. M. Spaulding; Dr. Homer Gage, and J. E. White.

Mr. Spaulding who was formerly president of the company, will remain as chairman of the board. J. E. White has been chosen as the new president and general manager. He is president of the Worcester Bank & Trust Company and will remain identified with the management of the bank while giving the necessary time to the management of the company.

Mr. White issued this statement;

"The new management is assured the active and loyal co-operation of both common and preferred shareholders. The officers, heads of departments and employees have signified their desire to do the utmost in working out the future of the company, and with loyalty we are sure of splendid results."

March Activity for Electric Furnace Company

Increased activity among the railroads and in the railroad supply field is indicated by recent sales of electric furnace equipment reported by the Electric Furnace Company, Salem, Ohio. A large Western manufacturer of manganese-steel castings for railroad purposes has just placed an order for a 250-kw. car-type Baily annealing furnace for one of its plants on the Pacific Coast. This equipment will have a capacity to heat 17 tons of manganese steel per day.

Another order received in March calls for a 125-kw. melting furnace for ferro-manganese. This furnace is to be installed at the plant of the Pettibone-Milliken Corporation, Chicago, and will have a capacity of 1,000 lb. of ferromanganese per hour.

The Griffen Wheel Corporation has ordered a 75-kw. melting furnace for melting bronze for railway bearings. This furnace will have a hearth capacity of 1,000 lb. and will be installed at Tacoma, Wash. The Best Foundry Company, Bedford, Ohio, a subsidiary of the American Stove Corporation, has contracted for a 50-kw. 500-lb. melting furnace for melting its copper-zinc alloys. April sales also are expected to be good.

Constructive Program for National Electrical Credit Association Meeting

Twenty-third Annual Meeting at Detroit to Discuss Problems of Financing Electrical Industry—Jobbers' Credits Attract Attention

Arrangements have been completed for the twenty-third annual meeting of the National Electrical Credit Association, to be held at the Hotel Statler, Detroit, May 18-19. A large attendance is expected this year because in the past year credits and collections became two of the most important business activities. The tentative program is as follows:

THURSDAY, MAY 18

9:00 a.m.—Registration, greetings by president, reports from board of managers, report of auditing committee, report of secretary-treasurer, announcements of committees on arrangements and entertainment.

10:30 a.m.—Problems of financing the electrical industry.

11:15 a.m.—The trend of distribution within the electrical industry.

11:30 a.m.—Discussion to be led by a member of Philadelphia association.

11:45 a.m.—Open discussion of same subject.

12:00 a.m.—Creative credit management (paper by member of New England association).

12:15 p.m.—Discussion to be led by member of Central Division association.

12:30 p.m.—Open discussion of same subject.

12:45 p.m.—New business.

1:00 p. m.—Luncheon.

2:30 p.m.—Entertainment by committee in charge.

FRIDAY, MAY 19

9:30 a.m.—Credit problems and solutions (paper by member of New York association).

9:45 a.m. — Discussion to be led by member of Pacific Coast association, if present; if not present, to be led by Central Division member.

10:00 a.m.—Open discussion of same subject.

10:15 a.m.—The credit problems of the electragist, and how jobbers' credit men may help in their solution.

11:00 a.m.—Comparative financial statements, and their value as a basis for credit (paper by member of Central Division association).

11:15 a.m.—Discussion to be led by member of Philadelphia association.

11:30 a.m.—Open discussion on same subject.

11:45 a.m.—The viewpoint of the ultimate consumer of merchandise.

12:15 p.m.—Open discussion of same subject.

12:30 p.m.—Résumé and suggestions.

1:00 p.m.—Adjournment for luncheon at golf club and tournament play during afternoon.

7:00 p.m.—Banquet—Hotel Statler.

Allis-Chalmers Report Shows 1921 Profits

The annual report for 1921 of the Allis-Chalmers Manufacturing Company, Milwaukee, shows that the company earned $4.07 per share on its $26,000,000 worth of common stock. The net profits were $2,215,468 as compared with net profits of $3,564,249 the year before. Sales billed during the year were $24,685,258, against $31,516,209 in 1920, $30,224,083 in 1919 and $35,031,233 in 1918. The surplus for the year after payment of dividends, charges and federal taxes, was only $29,827, as compared with $1,647,207 the year before.

Woodward Governors Sold on 7,500-Hp. Units

The statement made in the April 8 issue of the Electrical World that the Woodward Governor Company supplied waterwheel governors ranging from 1,500 hp. to 20 hp. was incorrect. The governors installed varied from 7,500 hp. down.

Dutchess Bleachery to Sell Own Insulation Products

Sales of the products of the insulation division, Dutchess Bleachery, Inc., Wappingers Falls, N. Y., will be controlled hereafter by the Dutchess company itself. The company manufacturers varnish-insulated fabrics. Under the previous arrangement the American Di-Electrics, Ltd., 466 East Seventh Street, Brooklyn, had charge of sales. The Dutchess company recently opened a new coating plant at Wappingers Falls, which at full capacity will have an output of 2,000,000 yd. of varnished fabrics per annum. Additional equipment is under course of construction. Charles A. Barker is managing engineer.

Crocker-Wheeler Reports Good First-Quarter Business

While the first quarter of the current year perhaps will not be so profitable as the corresponding period of 1921, according to A. L. Doremus, vice-president Crocker-Wheeler Company, new business has run considerably ahead of last year and the outlook is much more healthy. The first three months of 1921, Mr. Doremus said, saw the delivery of many orders which had been carried over from the previous year, and with prices higher than at present this meant a profit in spite of the fact that the sales curve was steadily slumping. This year, on the contrary, sales are constantly increasing, while there is little in the way of back orders. January, February and March each showed an increase in sales over the preceding month and, taken collectively, were the best three months for the company in more than a year.

A large part of this business has been done in engine-generators for isolated power plants, while motor sales have been steadily holding their own. Contracts for generating equipment for a number of large buildings have been obtained by the company since the first of the year, and it is expected also to supply a good part of the motor equipment for these buildings. Business coming in through general trade channels also is picking up, and the expectation, Mr. Doremus said, is that the second quarter this year will outstrip the second quarter of last year.

The radio business is also occupying a share of the company's attention, and, according to Mr Doremus, this department is working to capacity. There is litle doubt, he said, of the future of the radio industry, though it will never replace the telephone or the phonograph. It has, however, a very definite place.

Electric Storage Battery Has $10,015,812 Gross Sales

The consolidated annual report for 1921 of the Electric Storage Battery Company and the Willard Storage Battery Company, both of Philadelphia, show gross sales of both companies to have been $10,015,812. Gross sales of the two companies for 1920 were $12,134,614, so that last year's business showed a drop of approximately 17½ per cent from that of the year previous. The net earnings for 1921, before payment of federal income and excess profits taxes, were $5,602,383 as compared with $6,157,091. Federal taxes for 1921 are estimated at $1,100,000.

Business of the company during the first quarter of 1922 has recovered very substantially over the amount done in the first three months a year ago, when factory operations were running about 60 per cent of capacity. The new plant at Crescentville is being prepared with machinery and equipment so that it can be turned over for manufacturing within sixty days after it is definitely decided to put in operation. No date has yet been decided on for starting this new unit.

There has been considerable revival in demand for batteries for central stations and also for train-lighting equipment. The company also finds real improvement in the automobile trade, which buys starting and lighting equipment. One day recently a record output of batteries is reported to have been made in the automobile equipment department.

Radio development is opening up a new and profitable field for the company, all radio equipment including batteries. The manufacturers are mainly interests with which the company already had well-established business relations.

General Electric Opens Porcelain Plant

The porcelain plant of the General Electric Company at Pittsfield, Mass., which has been idle nearly six months, has been reopened. It is expected that within two or three months the plant will be at about 50 per cent capacity.

Radio Corporation Swamped by Demand Last Fall

The 1921 report of the Radio Corporation of America states: "The demand for radio apparatus came up very much overnight, and no apparatus had been developed which lent itself to quantity production. Radio as an art is advancing very rapidly. Owing to the continuous research which has been carried on, apparatus embodying the latest improvements and of a character suited for general use has now been developed for manufacture in large quantities, and it is believed by the officers of the corporation that the demand, large though it may be, will soon be filled."

The company reports that the transatlantic circuits are now carrying about 20 per cent of the international message traffic between the United States and Europe. Gross income for the year amounted to $4,160,844 the net profit on which was $426,799, which amount was applied against reserve for depreciation and patents.

Suit Alleges Infringement of Marsh Patent

The owners of the Marsh patent have filed suit against Otto Reiman of Chicago for infringement of the Marsh patent covering the use of certain alloys in the construction of electric heating units. It is understood that Otto Reiman is selling heating appliances using an alloy sold under the trade name of "Sicro" or "Silichrome" in the construction of the heating units of these appliances.

The H. T. Paiste Company, 3210 Arch Street, Philadelphia, manufacturer of electrical equipment and supplies, has awarded contract for a new four-story plant, 104 ft. x 108 ft., at Thirty-second and Cherry Streets, to cost in excess of $100,000.

The General Electric Company has appointed H. L. R. Emmet manager of the production department of its Schenectady works to succeed Langdon Gibson, retired on account of ill health.

Roy R. Burnham, consulting engineer, formerly at 15 Beacon Street, Boston, has moved his offices to 119 Water Street, Boston.

The Eager Electric Company, Watertown, N. Y., manufacturer of motors, dynamos and electric specialties, has announced the establishment of a Western selling agency with the Julius Brunton & Sons Company, San Francisco.

The Fuller Engineering Company, Allentown National Bank Building, Allentown, Pa., has just closed a contract with the Tennessee Coal, Iron & Railroad Company for the installation of coal-drying, pulverizing and conveying systems to serve the Tennessee company's new boiler installation at Ensley, Ala.

Foreign Trade Notes

GERMANY EXPORTING ELECTRICAL MACHINERY TO CHINA.—Since the import trade has been revived and the building of business houses, roads, railways and factories has been resumed in China, *Commerce Reports* states, German firms have been doing a large business in electrical machinery. A German firm is competing with an American company for the contract for installing a telephone system in the principal city of Shantung and also in Shanghai, where a sugar refinery is to be established which will have a working capital of £2,500,000 and will require a complete new outfit of machinery.

MARK'S DECLINE HITS GERMAN ELECTRIC CONCERN.—The annual report of the Siemens Elektrische Betriebe, according to Associated Press reports, shows the stockholders to have been severely hit by the appreciation of foreign exchange, especially that on Swiss money. The report states that the company's debt on this account amounts to 183,000,000 marks. Part of this can be recovered from the reserve fund, but there remains an uncovered loss of more than 162,000,000 marks.

New Apparatus and Publications

HOISTS.—The New Jersey Foundry & Machine Company, 90 West Street, New York City, has recently brought out an electric hoisting machine, under the name of "Handiman." It can be furnished for operation on both alternating current and direct current.

EVAPORATOR SYSTEMS.—The Griscom-Russell Company, 90 West Street, New York City, is distributing bulletin No. 360, describing the "Griscom-Russell" evaporator systems for the economical production of distilled boiler-feed water.

RANGES.—The George D. Roper Corporation, Rockford, Ill., is distributing a circular describing its No. 2,001 R. E. type 12 and No. 2,001 R.M.M.A. type 12 electric ranges.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletins L.D. 135, L.D. 136, L.D. 137 and L.D. 107A, entitled "The Lighting of Public Buildings," "Church Lighting," "Residence Lighting" and "The Edison 'Mazda' Lamp for Motion-Picture Projection" respectively.

SIGN DEVICES.—The Reynolds Electric Company is distributing a poster illustrating the "Reco" devices for electric signs, including color hoods, flashers, motors of 1/20 hp. to ¼ hp., reflectors for bulletins and billboards, and also the "Reco" food mixers for restaurants, etc.

RECEPTACLE.—Pass & Seymour, Inc., Solvay, N. Y., are distributing a leaflet describing their new deep box receptacle and loom-box strap.

LAMP HANGERS.—Data sheets have been issued by the F. W. Wakefield Brass Company, Vermilion, Ohio, giving information on the "Red Spot" line of hangers designed for use with the urn-shaped glassware at present being used for commercial lighting purposes.

INSTRUMENTS.—Bulletin 322 issued by the Esterline-Angus Company, Indianapolis, covers its various graphic instruments, including meters, portable transformers, etc.

CEDAR POLES.—The Bell Lumber Company, Minneapolis, has issued its 1922 catalog, containing sixteen pages, in which it describes the manufacture of Western red-cedar and Northern white-cedar poles, with particulars about creosote treating and the official specifications.

RADIO BATTERY CHARGER.—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a leaflet describing the "Ward Leonard" vitrohm radio-battery charger for use on a 110-volt direct-current line.

VALVES.—The Atlas Valve Company, Newark, N. J., has issued a small handbook (first edition), which is a reference book of rules, tables, curves, data and formulas, to determine the correct size and capacities of reduction valves and pipe connections.

BOILERS.—The Heine Boiler Company, St. Louis, is distributing bulletin No. 51, entitled "Boiler Practice for Textile Mills," in which it describes and illustrates various "Heine" boiler installations in textile plants and also the first "Heine" boiler after thirty-five years of continuous service.

CONVERTER.—Bulletin No. 130, entitled "Light for Motion Picture Projection," issued by the Wagner Electric Manufacturing Company, St. Louis, describes the "Wagner" white-light converter for motion-picture projection.

MOTOR STARTER.—The Monitor Controller Company, Baltimore, has issued bulletin No. 102, which gives instructions regarding the Monitor "Thermaload starter."

PANELBOARDS.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, is distributing a four-page leaflet covering "Sprague" narrow-unit panelboards (safety type).

New Companies

THE LAUREL RUN (PA.) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000 to supply electricity for lamps, heaters and motors. The incorporators are R. V. Moyles, 114 Park Avenue, Wilkes-Barre; T. M. Moyles, Wilkes-Barre, and others.

THE GENERAL UTILITIES COMPANY, Covington, Ky., has been incorporated with a capital stock of $100,000 by Frank S. Hitch, Walter E. Falk and L. B. Falk.

THE INDIANA POWER COMPANY, Vincennes, Ind., has been incorporated with a capital stock of $1,000,000 to do business in Illinois.

THE HOLSTON RIVER POWER COMPANY has been organized by Gen James B. Cox, Johnson City, Tenn., to construct three dams on Holston and Watauga Rivers. F. Butler, Orbisonia, Pa., is engineer.

THE EAST TENNESSEE HYDRO-ELECTRIC COMPANY, Johnson City, Tenn., has been organized by Gen. James B. Cox to develop the water power of Clinch and Powell Rivers in Anderson, Claiborne and Grainger Counties in east Tennessee. F. M. Butler, Orbisonia, Pa., is engineer.

Record of Electrical Patents

Notes on United States Patents

(Issued March 28, 1922)

1,411,043. Control System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed March 8, 1919. Field control for motors and generators on closed circuit.

1,411,074. Adjustable Casing for Therapeutic Application of Light; Fritz A. Anderson, Milton, Wis. App. filed April 30, 1921. For accurately directing light.

1,411,080. Impulse-Starter Coupling; Albert Erickson, Chicago, Ill. App. filed April 10, 1918. Spring attachment produces high speed for starting.

1,411,112. Electric Alarm System; Walter S. Ludlow, Jr., Cincinnati, Ohio. App. filed May 6, 1918. Watchman's time-recording and fire-alarm service combined.

1,411,131. Electrical Switch; Oscar S. Swanson, Jamestown, N. Y. App. filed Dec. 10, 1918. For lamp sockets.

1,411,157. Furnace Flue Closure; Walter E. F. Bradley, Los Angeles, Cal. App. filed July 5, 1919. Furnace employed for metallurgical reduction.

1,411,158. Electric Furnace Construction; Walter E. F. Bradley, Los Angeles, Cal. App. filed Aug. 27, 1918. Electric arc type for metallurgical operations.

1,411,161. Electric Fitting; Hoyt Catlin, Bridgeport, Conn. App. filed Oct. 3, 1919. Balances load on three-wire electric ranges.

1,411,194. Spark-Plug Protector; Morrison M. Sharp, Waxahachie, Tex. App. filed Aug. 16, 1919. Protects plug from moisture.

1,411,206. Reel for Portable Electric Lamps; Michael Dorion, Rumford, Me. App. Feb. 2, 1918. For convenient shifting of portable lamps.

1,411,235. Sound-Reproducing Machine; Charles L. Chisholm, New Glasgow, Nova Scotia, Can. App. filed Oct. 18, 1915. Phonographic reproduction by means of of microphone.

1,411,243. Electromagnetic Clock; Maurice P. Favre-Bulle, Paris, France. App. filed Sept. 23, 1920. Pertains to connection between pendulum and rocker arm.

(Issued April 4, 1922)

1,411,256. Electrode for Electric Cells; Robert Amelm and Carl O. J. Montelius, Stockholm, Sweden. App. filed May 27, 1919. Composed of flattened tubular receptacles.

1,411,263. Electrical Connector; Frank Bellis, Chicago, Ill. App. filed Dec. 9, 1920. For use on apparatus subjected to vibration.

1,411,269. Multiple-Control Apparatus for Electric Railways; Abraham Couwenhoven, Höngg, Switzerland. App. filed April 16, 1919. Means for operating control motors.

1,411,293. Swivel Plug; Ralph S. Mueller, Cleveland, Ohio. App. filed Nov. 23, 1916. Screws into lamp socket.

1,411,309. Motor-Control System; Leigh J. Stephenson, Chicago, Ill. App. filed Nov. 28, 1919. Direct-current motors for operating mill rolls, hoists, etc.

1,411,311. Temperature Compensation for Electric Instruments; Raymond H. Sullivan, Rochester, N. Y. App. filed Dec. 16, 1910. By balanced resistances of different temperature coefficients.

1,411,333. Soldering-Iron Heater; Leonard J. Fazendin, Orillia, Ontario, Can. App. filed Dec. 20, 1920. Head of iron short-circuits heavy current coil.

1,411,339. Speed-Regulating Apparatus; Valère A. Fynn, St. Louis, Mo. App. filed April 25, 1918. Adjusts speed of prime movers, such as internal combustion engines.

1,411,340. Welded Joint and Method and Means for Making Same; John F. Gail, Evanston, Ill. App. filed March 31, 1920. For metal bed and furniture construction.

1,411,354. Polyphase Dynamo and Motor; Alexander Heyland, Brussels, Belgium. App. filed June 1, 1914. Two-phase and three-phase repulsion motors.

1,411,366. Electric Transmission Arrangement; Antonin Monteilhet, Paris, France. App. filed May 6, 1913. Telephotographic system for long distances.

1,411,385. Signaling Apparatus; Samuel P. Shackelton, New York, N. Y. App. filed April 1, 1918. Ringing apparatus for composited telephone and telegraph lines.

1,411,393. Dynamo-Electric Machine; Hans Weichsel, St. Louis, Mo. App. filed Dec. 17, 1920. Connection of field windings on automobile starters.

1,411,394. Alternating-Current Arc-Welding Apparatus; Edward J. Wiggins, Buffalo, N. Y. App. filed June 20, 1919. Transformer converts polyphase into single-phase.

1,411,396. Electrical Resistance Thermometer; Charles H. Wilson, Mount Vernon, N. Y. App. filed March 10, 1921. Reduces lag in readings.

1,411,414. Storage Battery; Thomas R. Cook, East Cleveland, Ohio. App. filed April 7, 1919. Pertains to sealing sleeve.

1,411,419. Arrangement for Starting and Regulating Direct-Current Electric Motors; Fernand Cumont, Paris, France. App. filed April 1, 1913. For starting speed regulation and regenerative running.

1,411,430. Incandescent Lamp Tester; John Graves, Madison, Wis. App. filed Jan. 16, 1920. Especially for testing miniature lamps.

1,411,442. Dynamo-Electric Machine; Bennett M. Leece, Cleveland, Ohio. App. filed March 14, 1921. Frame construction of automobile starting motors and generators.

1,411,465. Operator's Circuits; Harold T. White, Kansas City, Kan. App. filed Sept. 6, 1917. Balanced telephone circuit provided with test circuit.

1,411,478. Electromechanical Switching System; Isaac D. Budd and Claude I. Cronburg, Chicago, Ill. App. filed May 25, 1914. Automatic and semi-automatic telephone switching.

1,411,497. Electric Call System for Hotels; Irwin A. Hill, Fairbury, Neb. App. filed Aug. 9, 1920. Automatic signal to call guest at predetermined time.

1,411,499. Direction Signal for Automobiles; William W. Lincoln, Washington, D. C. App. filed Oct. 7, 1920. Operated by relays.

1,411,507. Apparatus for Effecting Chemical Reactions by Means of Amalgams; Herman W. Paulus, Richmond Hill, N. Y. App. filed Feb. 26, 1921.

1,411,530. Electrolytic Caustic Soda Cell; Noel Statham, Hastings-on-Hudson, N. Y. App. filed May 31, 1917. For producing caustic alkali.

1,411,537. Method of Making Graphitized Material; Alan P. Sullivan, St. Marys, Pa. App. filed Jan. 26, 1921. For electrodes, brushes, etc.

1,411,584. Lawn Mower; John W. Peters, Roslyn, N. Y. App. filed Aug. 10, 1921. Electrically propelled.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CHESTER, MASS.—The Chester Electric Company contemplates the installation of a 40-hp. to 50-hp. oil-engine-driven generating unit (125-250 volts, direct current). E. Roy Gardiner is manager.

EVERETT, MASS.—The Everett Factories Corporation will build a one-story power plant on Vine Street, in connection with a new four-story industrial plant at this location.

PLYMOUTH, MASS. — The Plymouth Electric Company contemplates the erection of 12 miles of three-phase, 22,000-volt transmission line this year. C. F. Gardner is manager.

READING, MASS.—The Municipal Light Department is planning to install thirty-five additional street lamps. Arthur G. Sias is manager.

WESTERLY, R. I.—The Westerly Light & Power Company will install a new switchboard. W. C. Clarke is general manager.

Middle Atlantic States

ALBANY, N. Y. — The Municipal Gas Company has awarded a contract to the William G. Sheehan Construction Company for the erection of an addition to its Riverside electric plant, 52 ft. x 70 ft.

ALBANY, N. Y.—Plans are under consideration by the State Engineering Department, Albany, for the construction of hydro-electric plants at the Crescent Dam and Visscher's Ferry to develop about 10,000 hp. The power will be used to operate locks, bridges, etc., on the barge canal.

CANAJOHARIE, N. Y.—The Montgomery Electric Light & Power Company contemplates the erection of 2 miles of 2,200-volt rural lines and a new secondary substation. A. B. Ciarns is superintendent of distribution.

COHOES, N. Y.—The Cohoes Power & Light Corporation will make extensions and improvements to its hydro-electric plants and system, to cost about $750,000.

COPENHAGEN, N. Y.—The Deer River Power Company contemplates the installation of a 1,000-kw. General Electric generator directly connected to a S. Morgan Smith waterwheel. V. C. Wood is manager.

DANSVILLE, N. Y. — The Cottonwood Point Cottage Association, recently organized, plans the installation of an electric light and power system at Cottonwood Point. Peter LeForce is in charge.

LISLE, N. Y.—The Lisle Electric Company has applied to the Public Service Commission for permission to construct an electric lighting plant to supply electricity in Lisle.

NEW YORK, N. Y.—The New York Edison Company has awarded a contract to the Keen-Well Contracting Company, 841 Broadway, for the erection of a substation at 33 Attorney Street, to cost $75,000. Plans have also been completed for extensions to the substation at 115 East Twelfth Street, to cost about $120,000.

ROCKVILLE CENTRE, N. Y. — The Knickerbocker Ice Company will build a two-story addition to the power house, 34 ft. x 54 ft., at its local plant.

UTICA, N. Y. — The New York State Railways, Inc., has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements in electric plants and system. J. F. Hamilton is president.

HAWTHORNE, N. J.—The Cupra Silk Company will build a one-story power house in connection with a mill at Clifton, N. J. The Technical Advisory Corporation, 132 Nassau Street, New York, is engineer.

JERSEY CITY, N. J.—The Fulton Terminal Lumber Company, 21 East Fortieth Street, New York, will install a complete electrically equipped yard at its new terminal on the Hackensack River, near Jersey City, including cranes, conveying, hoisting and other machinery. Ernest R. Shaw is manager.

LAKEWOOD, N. J.—The Lakewood & Coast Electric Company is considering the installation of two 500-hp. boilers. A. S. Phelps is general superintendent.

BROCKPORT, PA.—The Brockport Electric Company, recently organized, has made application to the Public Service Commission to install and operate a local system.

HARRISBURG, PA. — The Harrisburg Light & Power Company will build a one-story substation on Maclay Street. The station has been ordered by the Public Service Commission.

KINGSTON, PA.—The Luzerne County Gas & Electric Company contemplates extensions to its power plant, including the installation of a 20,000-kw. turbo-generator and auxiliary equipment, to cost about $350,000.

PHILADELPHIA, PA.—The Pennsylvania Apartments, Inc., will build a two-story power plant, 25 ft. x 108 ft., in connection with a new apartment hotel at 3905 Sansom Street, to cost about $1,000,000.

SCRANTON, PA.—The Scranton Electric Company contemplates replacing the overhead system with underground wires in different parts of the city during the present year, to cost about $60,000.

TURTLE CREEK, PA.—The Council has passed an ordinance authorizing the installation of an ornamental street-lighting system on Braddock, Penn and Air Brake Avenues, from the East Pittsburgh to the Wilmerding city lines.

TYRONE, PA. — Plans are being considered for the construction of a hydro-electric plant on the Juniata River to supply electricity in this section of the State. Frank Waring, Tyrone, is said to be interested in the project.

WRIGHTSVILLE, PA.—The Wrightsville Light & Power Company is preparing to extend its transmission lines to East Prospect, a distance of 4 miles, to furnish electrical service in that borough.

BALTIMORE, MD.—A one-story power house will be erected by the General Chemical Company, Race and Winder Streets, at its local plant.

BALTIMORE, MD.—The Mexican Petroleum Corporation, 120 Broadway, New York, will build an electrically operated pumping plant in connection with a number of new buildings on First Avenue, Baltimore.

LURAY, VA. — The Shenandoah River Light & Power Corporation is considering the installation of a new generating unit. E. M. Berrey is manager.

NORFOLK, VA.—Bids will be received at the office of the United States Engineer Office until May 12 for the construction of a switchboard room at Fort Story, Cape Henry, Va.

PETERSBURG, VA. — The Community Power Company will construct a dam and hydro-electric power plant on the Potomac River, near Romney, W. Va. Permission has been granted by the Public Service Commission.

PURCELLVILLE, VA. — The Loudon Light & Power Company will extend its lines to the towns of Hillsboro and Lincoln. R. B. Brown is secretary and manager.

SOUTH HILL, VA.—Bids will be received by N. G. Smith, town clerk, until May 1 for the construction of a municipal electric plant. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

North Central States

CASEVILLE, MICH.—The Council contemplates the construction of a transmission line to Kinde to connect with the lines of the Central Power Company. A local distributing system will be installed.

DETROIT, MICH.—The Detroit Edison Company contemplates the construction of a new substation on Scotten Avenue.

HARTFORD, MICH.—Anderson Brothers, owners of the local electric light plant, expect to install a 200-hp. oil engine, generator and switchboard. M. J. Anderson is manager.

KINDE, MICH. — The Central Power Company, Bad Axe, plans to extend its transmission line from Kinde to the Lake Huron summer resort district, to supply electrical service.

PONTIAC, MICH.—Plans are under way for extensions to the street-lighting system in the business district. City Manager Brower is in charge.

WINTERFIELD, MICH. — The Winterfield Light & Power Company is planning to build a hydro-electric plant in Winterfield County and to erect a transmission system to include Tustin, Leroy, Avondale, Ewart and other towns in this section. W. L. Kinney is general manager.

BELLEFONTAINE, OHIO.—Bonds to the amount of $133,680 have been authorized for municipal improvements, of which about $90,000 will be used for extensions to the municipal electric plant.

CARDINGTON, OHIO.—The Cardington Electric Light, Heat & Power Company expects to make connection with a high-tension transmission system this summer. George M. Schambs is secretary.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, room 219, City Hall, until April 27 for furnishing and setting lead wall-insulating lining for the city hospital building, Scranton Road, Cleveland. Bids will also be received until April 28 for fiber conduit.

GALION, OHIO. — A combined electric and waterworks plant is being erected on a reservoir east of the town. The present boilers and the Allis-Chalmers 200-kva. engine unit will be used. The new equipment will include a 750-kva. turbo-alternator, stokers, coal and ash-handling equipment, motor and turbine driven auxiliaries, condensers, heater, etc. H. L. Herrick is superintendent.

GANGES, OHIO. — The Rural Electric Service Company, Shelby, will erect a new transmission line and distributing system at Ganges.

WEST UNION, OHIO.—Charles W. Riffle, owner of the local electric light plant, contemplates the installation of a new 90-hp. oil-engine-driven generating unit.

CARROLLTON, KY.—Improvements are contemplated to the municipal electric light plant and water works, which may include the installation of new boilers and a third generating unit. Preparations are under way for installing electric motor-driven machinery, for which bids have been received. J. W. Nash is manager.

CLAY, KY. — The Kentucky Utilities Company will build a 33,000-volt transmission line from Clay to Morganfield, to cost about $75,000.

GHENT, KY.—The Ghent Electric Light Company contemplates installing a 15-hp. Fairbanks-Morse gas engine, type Y, with a small generator, for auxiliary use, to replace its storage batteries for day service. The company would like to obtain a good second-hand machine if possible. L. G. Matthews is secretary.

LIBERTY, KY.—The Liberty Roller Mill Company will install a 25-hp. Fairbanks-Morse oil engine and a 35-kw. direct-current generator. John D. Allen is manager.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates the erection of a hydro-electric plant in the vicinity of Dam No. 41, Ohio River, with initial capacity of 25,000 hp. and ultimate capacity of 75,000 hp. Application for permission has been made to the Federal Power Commission.

WILLIAMSBURG, KY.—The Williamsburg Electric Company expects to extend its transmission lines to the village of Savoy, a distance of 1 mile. C. Perkins is manager.

HOPE, IND.—Pulse & Hope, owners of the local electric light plant, contemplate the erection of a 16-mile transmission line to Edinburg to connect with the system of the Interstate Public Service Company, from which it will purchase electricity. Kenneth Hodges is manager.

JASPER, IND.—The Municipal Electric Light Department is considering extending the electric line about 1 mile into the suburbs. A. P. Dudine is city clerk.

PERU, IND.—The Council contemplates the purchase of a 2,000-kw. turbo-generator and a 525-hp. water-tube boiler for the municipal electric light and water plant. William O'Hara is general superintendent.

ATLANTA, ILL. — Contract has been closed whereby the Atlanta Electric Light & Power Company will erect a high-tension transmission line to the power station of the Lincoln Water & Light Company, where it will secure electricity to operate its system.

HIGHLAND, ILL.—The installation of a 750-kw. generating unit, driven by a "Uniflow" engine, in the municipal electric light plant and rebuilding the distributing system are under consideration. Charles E. Easley is electrical engineer.

JOLIET, ILL.—The Public Service Company of Northern Illinois has issued $5,000,000 in bonds, part of the proceeds to be used for a new generating plant at Waukegan, Ill., to have an ultimate capacity of 200,000 kw.

LINCOLN, ILL.—The Lincoln Water & Light Company has closed a contract with the Atlanta (Ill.) Electric Light & Power

Company, which serves Atlanta and McLean, whereby it will furnish the latter electricity to operate its system. E. MacDonald is manager.

MOUNT CARMEL, ILL. — The Mount Carmel Public Utility & Service Company contemplates the purchase of new generating equipment of 600 kw. capacity, and also rebuilding about 3 miles of pole line. P. Barnhard is manager.

NAPERVILLE, ILL. — Contracts have been placed for one 360-hp. Diesel oil engine and a 312-kva. generator for the municipal electric light plant. A 125-hp. engine and a 75-kw. generator will be discarded when the new equipment is installed. Oliver W. Strubler is manager.

BIRCHWOOD, WIS. — The Wisconsin-Minnesota Light & Power Company, Eau Claire, will build a transmission line from Rice Lake to Birchwood, about 21 miles. Distribution systems will be installed at Mikana, Campia, Angus and other points along the route.

WAUWATOSA, WIS. — The Milwaukee County Board of Administration, Milwaukee, has plans under way for the erection of a new electric power plant at Wauwatosa for county service, to cost about $500,000. Vaughn & Meyer, Security Building, Milwaukee, are engineers.

KENYON, MINN.—The Gunderson Electric Company, Inc., may erect a few miles of farm lines. R. T. Gunderson is manager.

CEDAR RAPIDS, IOWA.—John A. Reed and associates are organizing a new company to construct and operate a hydro-electric power plant on the Maquoketa River, at Maquoketa. Holland, Ackerman & Holland, Ann Arbor, Mich., are engineers.

MONTGOMERY CITY, MO.—The Montgomery Power Company expects to erect a transmission line to New Florence. E. H. Algermissen is president and manager.

FESSENDEN, N. D. — The Fessenden Light & Power Company contemplates the installation of a 100-hp. Fairbanks-Morse type Y engine and a 125-kva. generator of the same make, and switchboard panel. H. C. Whitcomb is manager.

ARNOLD, NEB.—The Brittan Electric Company expects to install an additional water turbine. W. Brittan is manager.

COTTONWOOD FALLS, KAN. — The Home Light & Power Company is contemplating the erection of 22 miles of transmission line and purchasing electricity from the Kansas Electric Utilities Company, Emporia. W. W. Austin is owner and manager.

LEAVENWORTH, KAN.—The Leavenworth Light, Heat & Power Company contemplates the installation of a 1850-kva. Westinghouse turbine and auxiliary apparatus. W. H. Frost is general manager.

PLAINS, KAN.—The installation of a 50-hp. Fairbanks-Morse type Y engine, with a 30-kw. 110-120-volt direct-current generator, in the municipal electric plant is under consideration by the Municipal Water and Light Department. J. H. Jerrell is superintendent.

Southern States

BAILEY, N. C.—E. H. Liles, Middlesex, and associates have been granted a franchise to install and operate an electric lighting system in Bailey. Similar systems will be installed at Middlesex and Wilson, to cost about $60,000.

CHAPEL HILL, N. C.—Extensions are contemplated to the electric plant of the University of North Carolina, including the installation of 300-kva. generator and engine, Babcock & Wilcox boilers (350 hp.), and also improvements to the transmission lines and distribution system. J. S. Bennett is general superintendent.

WASHINGTON, N. C.—The installation of a 500-hp. boiler in the municipal electric light plant is under consideration. George P. Womble is superintendent.

ATLANTA, GA.—The Fulton Bag & Cotton Mills plan the erection of an addition to their power plant, to cost about $75,000. J. E. Sirrine & Company, Greenville, S. C., are engineers.

BROXTON, GA.—The installation of a 60-hp. boiler in the municipal electric light plant is under consideration. C. A. Poer is clerk.

MILLEN, GA.—Plans are being prepared for an addition to the munipical power plant, to cost about $25,000. Lawrence Manning is city engineer.

MOULTRIE, GA.—During the coming year the municipal electric generating plant will be discontinued and electricity will be obtained from the hydro-electric plant of the Baker County Power Company, Newnan, 50 miles west of Moultrie. J. M. George is superintendent of municipal plant.

THOMASVILLE, GA. — The Municipal Water and Light Department is considering the construction of a new building, to cost about $25,000, within a few months. D. R. Pringle is superintendent.

WAYCROSS, GA. — The Ware County Light & Power Company contemplates the installation of additional ornamental lamp standards, extensions to street-lighting system, etc. R. E. Trexler is assistant treasurer.

BUNNELL, FLA.—The Light and Water Department contemplates the installation of complete electric generating unit in the municipal electric plant. Charles Harris is superintendent.

CHATTANOOGA, TENN.—The Chattanooga & Tennessee River Power Company and the Tennessee Railway, Light & Power Company are being consolidated in a new company to be known as the Tennessee Electric Power Company. Tentative plans are under way for extensions.

JOHNSON CITY, TENN.—The Holston River Power Company, recently organized, has plans under way for the construction of a power plant on the Holston River. At a later date a similar hydro-electric plant will be erected on the Watauga River, with total capacity of stations of about 100,000 hp. James B. Cox heads the company.

MEMPHIS, TENN.—An electrically operated pumping plant will be installed in connection with improvements and extensions to the waterworks, to cost about $300,000. Equipment bids will be taken in June. Fuller & McClintock, 421 Produce Exchange Building, Kansas City, Mo., are engineers.

EUFAULA, ALA.—The Council will soon call for bids for the construction of an electrically operated pumping plant in connection with improvements to the waterworks. The Ludlow Engineering Company, Winston-Salem, N. C., is engineer.

BATESVILLE, ARK.—The commissioners of the municipal electric light and water plant will rebuild pole line and install a filter at the water plant this summer. W. H. Walkup is manager.

BENTON, ARK.—The Board of Water and Light Commissioners is considering the installation of a 150-kva. or 200-kva. "Uniflow" engine, generator and switchboard in the municipal electric plant. G. A. Smith is superintendent.

DE QUEEN, ARK.—The De Queen Light & Power Company will build a transmission line from Horatio to Lockesburg, 40 miles long, and will install substations and local distributing systems at these places as well as other points along the route.

PINE BLUFF, ARK.—The Pine Bluff Company is considering a possible extension of 12 miles to its transmission lines. J. L. Longino is manager.

NEW ORLEANS, LA. — Fire Commissioner Fitzpatrick is considering making a recommendation to the Commission Council for the purchase of a portable light plant.

WINNSBORO, LA.—The White Light & Power Company will install a 150-hp. generating unit and is also considering furnishing power for operating the waterworks pumping station. E. O. White is secretary and manager.

MUSKOGEE, OKLA. — The Oklahoma General Power Company has purchased a site near Muskogee and is preparing plans for the erection of a new steam-operated electric generating plant, with extensive transmission system, to cost about $2,750,000. The initial installation will have an output of 10,000 hp. It is operated by the Byllesby Engineering & Management Corporation, Chicago, Ill.

SHIDLER, OKLA.—The Shidler Light & Power Company, recently organized, contemplates the construction of a transmission line from Shidler to Pawhuska, to supply electricity in Shidler. J. C. Blankenship heads the company.

TALIHINA, OKLA.—The City Water and Light Department will build a new waterworks system and will probably install hydro-electric equipment. Edgar M. Cooper is general superintendent.

TULSA, OKLA.—The Oklahoma Power Company will build an addition of 10,000 kw. capacity to its hydro-electric plant on the Arkansas River.

CAMERON, TEX.—The Cameron Water, Power & Light Company contemplates extensions to its generating plant, to cost about $60,000.

GREENVILLE, TEX.—Plans are under consideration for extensions to the municipal electric light plant within the next eighteen months, including the installation of a 1,000-hp. boiler and a 1,000-kw. turbine. H. L. McLow is manager.

CONROE, TEX.—The Conroe Gin & Light Company contemplates the installation of a 95-hp. Diesel engine. Henry Thompson is secretary and manager.

DECATUR, TEX.—The Decatur Light & Water Company expects to erect a 3-mile transmission line to the pumping plant at Lake. C. P. Dodson is proprietor and manager.

HEMPSTEAD, TEX. — The Hempstead Light & Power Company contemplates installing an additional 75-hp. oil engine during the coming winter. W. A. Darter is president.

PAMPA, TEX.—The Pampa Water, Light & Power Company contemplates installing another 75-hp. oil engine and making further line extensions. W. P. Davis is manager.

PORT ARTHUR, TEX.—Bids will soon be asked for electric pumping machinery for the municipal waterworks. N. C. Erwin is city engineer.

Pacific and Mountain States

SEATTLE, WASH.—Bids will be received by the Board of Public Works, County-City Building, until May 5 for steel penstocks for the Gorge plant at the Skagit River power development.

YAKIMA, WASH.—The Pacific Power & Light Company will make improvements in its local system to cost about $18,000.

McMINNVILLE, ORE.—Plans are being prepared for the construction of a municipal hydro-electric power plant on the Nestucca River, to cost about $300,000.

MORO, ORE. — The Sherman Electric Company expects to rebuild the Wasco and Moro distributing system to standard construction and install series street-lighting systems. Roy F. Dean is manager.

MYRTLE CREEK, ORE. — Extensions and improvements are to be made to the municipal light and water plant for which $30,000 in bonds have been issued. The work will include the installation of a 75-kw. alternating-current generator and a new water supply. S. S. Morris is engineer power station.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has issued $3,500,000 in bonds, the proceeds to be used in connection with the erection of new hydro-electric generating plants and transmission-line extensions.

QUINCY, CAL. — The Quincy Electric Light & Power Company will start work about May 1 on the erection of a three-wire, three-phase transmission line from Quincy to Indian Falls, to connect with the system of the Great Western Power Company. William Charles Walls is superintendent.

SALINA, CAL.—The Coast Valleys Gas & Electric Company contemplates an extension of its 11,000-volt transmission line from King City to San Ardo, a distance of 20 miles, to reach an unserved portion of Monterey County. James F. Pollard is vice-president.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 26 for the installation of a street-lighting system at the naval hospital, San Diego. (Specification 4614.)

BONNERS FERRY, IDA.—The Council is considering the construction of a municipal power plant at Moyea, near the city, to cost about $25,000.

CAMBRIDGE, IDA.—The Adams County Light & Power Company contemplates the construction of a dam to increase its water-storage capacity and also some new extensions. N. Gustard is secretary and treasurer.

NOGALES, ARIZ.—The Nogales Electric Light & Power Company expects to purchase an oil engine of about 300 hp. capacity. C. C. Nordholm is superintendent.

EUREKA, MONT.—The Eureka Hydro Electric Company contemplates the construction of a new hydro-electric plant on Graves Creek.

DENVER, COL.—Extensive additions are contemplated to the ornamental street-lighting system for the Broadway extension and several of the streets in the lower part of the city. The cost is estimated at about $100,000.

RYE, COL.—An electric power plant will soon be installed in the town of Rye. The proposed plant will be driven by water power.

YUMA, COL.—Extensions are contemplated to the municipal electric light plant and waterworks system, including the installation of forty ornamental street lamps, one 500-gal. and one 750-gal.-per-minute fire pump. After July 1 the municipal plant will supply electricity to the town of Eckley. Dan J. McQuaid is city manager.

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Our Unwatched Pot

CONDITIONS in the coal field have turned the thought of many men back to our old unsettled problems of labor and immigration. We replant our forests. We protect our water supply. We irrigate and fertilize our agricultural lands. But we make no effort to guide or to develop our man-power supply, the most fundamental of all our natural resources. Yet this matter of the condition and supply of labor is vital to all industry. It concerns electrical men in no uncertain way.

Today the immigrant comes in, seeks out a colony of his kin and kind and is abandoned. The result we know. But take this picture of the possibilities for America in a common-sense system of selective immigration that would undertake to make him into a prosperous citizen, located where his work will have the most productive value:

OLE OLESON, dairyman, arrives from Sweden, approved by Uncle Sam's agent abroad. He wants to go to Minnesota. "Too many Swedes in Minnesota, Ole," he is told. "They need you most in Indiana. Work there three years, attend school, become a citizen. Go on to Minnesota then, if you still wish." So Ole, with his new settlers' certificate, reports to the New Settlers' Bureau in Indiana and is placed in a dairy job.

In the township where he works he finds a new settlers' committee—the mayor, the school head, two business men, a doctor. He studies a new settlers' course run by the public school. Each year, on New Citizens' Day, which is a national holiday, he marches in the new citizens' parade. The third time it is *his* class that walks in front. For he has passed. He is an American! The mayor, the welcoming committee of leading citizens, all shake his hand. It is a celebration. And he is now free to go to Minnesota. But already he belongs in Indiana, and so he stays.

It is a simple plan, with many advocates. It leads not to the slums nor to the jail, but out into the open country, where there is eternal need for broad backs, sturdy hearts and willing minds.

AMERICAN industries will soon absorb our present unemployed. Home building, public works, our own construction projects will then be needing foreign labor and it will come. Shall we with blind neglect pursue our former course and leave the immigrant to drift—more miners to the glutted coal fields? Or shall we guide him to his opportunity and ours?

Call it a melting pot, if you will, but let the pot be stirred. And pour into this great pot of ours—America—good food for industry and for society, well mixed.

Thomas Ahearn

Pioneer in the establishment and development of electric public utilities in Canada.

TO BE a constructive pioneer in any one of the numerous phases of the electrical industry is a distinction accorded to few. Here, however, is a man who has been a factor in the early commercial development of each of the five major applications of electricity, namely, telegraphy, telephony, light, power and traction—Thomas Ahearn, president of all of the privately operated public utilities in the city of Ottawa, Canada.

Mr. Ahearn was born in Ottawa June 24, 1855. Like so many other pioneers in the electrical industry, he started in the telegraph business, first as a messenger boy and then, as soon as he could learn how, as an operator. At the age of eighteen he had graduated to the main office in New York, where he quickly demonstrated his ability. Four years later he moved up to Western Union headquarters. About this time the telephone came into commercial existence, and it at once fired the enthusiasm of young Ahearn as it did that of so many telegraphers. He saw its possibilities and in 1878 went back to his home city, where he took charge of the telephone department of the Montreal Telegraph Company. He was thus one of the first to enter the telephone field in Canada. In 1880, when the Bell Telephone Company of Canada was organized, Mr. Ahearn became manager at Ottawa. Although he severed active connection with the telephone company in 1887, he has continued to be associated with it in a consulting capacity and in this way has been able to assist in shaping its progress. In 1915 he was elected to the board of directors of the system.

In 1882, when the electrical industry was so young as hardly to be entitled to that designation, Mr. Ahearn and Warren Soper formed a partnership and started in business in Ottawa as electrical engineers and contractors. This firm constructed and equipped some of the largest systems in the Dominion, among which were some lines which were the foundation of what was later to become the North American Telegraph System. In this connection Mr. Ahearn became one of the pioneer constructors of central electric stations in Canada. In 1886, only seven years after Edison's famous discovery of the incandescent lamp, Mr. Ahearn boldly entered the electric service field as one of the founders of the Chaudière Electric Light & Power Company, which nine years later was merged in the Ottawa Electric Company, the last-named company in its turn, with the local gas company, being absorbed by the Ottawa Light, Heat & Power Company.

About the time Mr. Ahearn became engrossed in the development of the electric light the electric street railway came into existence, and in this case, as formerly, he was quick to see the opportunity offered. Winter conditions offered severe handicaps to successful operation so far north, but he was not deterred. He obtained a franchise and, although there was little public confidence in electric railways to back him up, he went ahead and solved the difficulties of operating under severe climatic conditions.

In this manner it has been the privilege of Mr. Ahearn to be a pioneer in each of the major applications of electricity. He has kept abreast of developments and maintained a close contact with every phase of the art. Today, besides being the executive head of all of the privately owned and operated public utilities in Ottawa, he is looked to throughout the entire Dominion of Canada as one of the leading authorities of that country in all public utility matters.

Editorial Comment

Electrical World, April 29, 1922
Volume 79 Number 17

Erroneous Information from Official Sources

THE public statement of the New York Public Service Commission this week relative to certain rate reductions ordered is a curious mixture of fact and fiction.

"Public utilities," reads an explanatory note in the statement, which reiterates what the commission said last fall, "just as other departments of business, must expect to cope with periods of depression and short earnings, just as at other times they enjoy periods of prosperity and full dividends. If the public is expected to make up every deficiency in order to give a utility a good round rate of earning power, then the public is entitled to the benefit of the surplus over the agreed-upon earning ratio in times of prosperity. It must be borne in mind that we are not dealing with the conditions of 1920, nor with the previous abnormal years, but with the present period, which is one of profound economic readjustment. It is with this pregnant fact before us that a decision must be made."

Tommyrot, say we. When have public utilities enjoyed periods of prosperity and full dividends? The 1917 census of "central light and power stations," the last to be issued, shows that 68 per cent of the total number of incorporated central electric stations, or 71 per cent of all which had outstanding capitalization, paid no dividends at all. The commission seeks to convey to the public the idea that public utilities are veritable gold mines, whereas the facts show them to be poorly paid servants. If, with the rates of return limited, deficits are never to be made up, heaven help the industry! Regulation then becomes confiscation. Fortunately we operate under a constitution in this country, and that historic document provides for proper redress. No doubt the commission has overstated the case, but overstatements from such a source and on such a subject do incalculable harm to the public utilities and add nothing to the prestige of the commission.

Running Down False Fire Accusations

IT IS good to see the results that are coming out of the systematic investigation now being made by the Society for Electrical Development into the facts behind each case of fire reported as of electric origin. It has long been the custom of the over-hasty newspaper reporter to blame the fire on electricity if no other cause was discernible. The fire chiefs, not liking to admit ignorance of fire causes, have done the same. The underwriters have rattled the bones and waved the crape continually, accusing electricity of appalling aggregate fire losses, when as everybody knows electric service in every building that it enters banishes other fire hazards infinitely more dangerous. If it were not so, the fire insurance man would not use it in his own home. But the combined influence of all this has been a drag on the electrical industry.

In a recent issue of the S. E. D. monthly publication, *Do It Electrically*, there is a report on twenty-seven cases of fire reported from different cities as of electric origin, the causes being variously classified as defective wiring, cross wires or short circuits. The society communicated with the local central-station company and the fire chief in each instance and found that in these twenty-seven cases, with an approximate loss reported as $1,637,525, only three fires could possibly be blamed on the wiring. In one of these cases there was doubt. The twenty-four other fires admittedly were clearly chargeable to other causes, but the newspapers had blamed them on the wiring.

It will take a long while to cure the newspaper reporter of this bad, careless habit. It will take some time to make the fire chiefs appreciate that loose testimony of this kind does serious injury to an industry that in reality is the greatest ally of the fire fighters. But how long it will take will depend much on how well the central stations of the country co-operate with the Society for Electrical Development in running down these false fire accusations, themselves exerting every possible influence to set the matter right in the minds of the fire people, the newspaper men and the public.

The Radio Telephone as an Operating Asset

THE rapid development of radio telephony in the past few months has brought with it a tremendous interest in the use of radio for central-station operating purposes. This interest has been intensified in some sections of the country by the occurrence of severe sleet storms which not only tore down light and power lines but temporarily paralyzed communication by wire for periods ranging from a day or two up to a week or more. Restoration of service was seriously hindered in many instances because owing to impassable roads there was no means of finding out just what had happened, especially in some of the smaller communities, and it was therefore impossible even to make plans for reconstruction work.

The fundamental problems that confront the central-station experimenter with radio telephony are hard to determine. This is very largely due to the fact that even the more experienced radio operators are not yet out of the experimental stage of development and every day brings some new and previously unheard-of experience. In addition, the present unprecedented development has been made under the legal regulations and the governmental control that were established for radio telegraphy. The radio telephone has advanced so rapidly that these regulations have not been able to keep pace with it. In truth, it is difficult to say at the present moment what the new regulations should be. Added to this is a patent and manufacturing situation that for a number of reasons seems to be chaotic.

One of the principal things that the experimenter must realize is that there is serious traffic congestion in the air and that no one class of users can expect to have the ether to do with as it wishes. In the present state of the art, even with the best of regulations, it will be necessary for every one to do a large amount of giving and taking in the effort to get results. Unless the experimenter is prepared to take part in much good-natured controversy, as well as to make many trials with the apparatus itself in the effort to develop a practical installation and get it on a satisfactory operating basis, he had better keep away altogether. If he is prepared to go to the necessary trouble, there is ample promise of the development of a means of communication that will admirably supplement present methods. Incidentally the experimenter will take a part in one of the most fascinating studies that have ever engaged popular attention.

Interdependence of Engineers and Sales Forces

SPECIALIZATION of work in electric utilities of even medium size has been proved to be sound in theory. Its practical limitations show up, however, when there is evidence of indifference among employees as to the tasks of other departments than their own. It has been the fashion in some circles to overemphasize the differences between engineering and sales activities. Post-war economic pressure is beginning to drive new conceptions of mutual dependence into the receptive minds of progressive utility employees and to focus more sharply upon the screen of executive attention the need of team play between engineers and the sales forces.

Why the Hesitancy in Adopting Three-Phase, Four-Wire Distribution?

IT SEEMS hardly necessary to dwell upon the theoretical advantages of the three-phase, four-wire system of distribution, but there seems to be considerable need for encouraging its more general adoption. Very few operators will refuse to admit that the three-phase, four-wire system would work out very satisfactorily for their local conditions. They agree that considerable increase in line capacity can be obtained, that the line losses will be reduced to a large extent, that the regulation will be better, that advantage can be taken of the diversity factor more effectively, and that extensions of an existing system can be made more readily. Sometimes the change can even be paid for by the savings of the first year.

Despite all the foregoing benefits, we find many companies hesitating to take advantage of the system of distribution that for any given voltage is the most economical from the distribution-line point of view. Two principal obstacles seem to be in the way—first, the required changes in the substation arrangement and equipment; second, the changes on the underground lines or the overhead lines of the system. Neither of these obstacles is insurmountable; in fact, with careful study of conditions it will usually be found possible to accomplish the changes without much difficulty or much chance of impairing the service during the cut-over. It should not be forgotten, either, that the adoption of a three-phase, four-wire system is a step in the right direction toward distribution economy, though it may seem to promise relief of overloaded conditions for only a short period of time. Future steps to take care of increased loads will be facilitated, whether they are taken in the direction of increasing the distribution voltage or installing numerous automatic stations. In either case the most effective system of distribution will be available to handle the load requirements.

Foreign Financing a Source of Trade

LAST year more than $210,000,000 of Latin-American loans were financed in the banks of the United States. The greater part of this money was required for the construction of public works and therefore used for reproductive purposes. Here is a factor in the foreign trade situation that deserves considerably more interest and attention from the American manufacturer and the American engineer than it has commonly received. For though trade follows the flag it also follows the way of a nation.

If there is one thing that stands out clearly and impressively in the articles on the export outlook, the second of which appears in this issue, it is the vastness of the opportunity for engineering development in South America. The country is huge and the population is large. The desire for more of the material comforts of modern life is growing steadily and calling for the development of natural resources and public utilities. The engineering problems involved are very like our own, and we stand in a position of particular fitness and opportunity both to assist with the work and to furnish the things needed for doing it.

Here, then, is one of the obvious natural paths to follow in the upbuilding of trade with South America. We must encourage the Latin-American student to come to our technical schools and study American engineering and American industries. We must aid in the outfitting of South American technical schools with our apparatus, equipment and data. For this will bring better understanding of both our principles and our practice and a greater inclination among the peoples of the southern continent to come to our banks for money to finance their construction projects, and this money will be spent in large part for American products. Public opinion in this country should be energetically fostered in favor of these foreign loans for reproductive purposes in public works where American specifications will provide a natural demand for American goods.

Promoting "Club Life in Business"

THE phrase "club life in business" seems to strike right to the point when it is applied to the character of many of the present-day meetings of conventions of electrical men. The getting together of a group of men, if the sole result were listening to a number of often dry and generally shopworn papers or speeches, would be a nearly total loss of time and money. But knock out the stiffness that might be proper in, say, a meeting of the House to impeach a president, and inject into the convention some of the good-fellowship that abounds in a men's club, and the result will be a convention that will send every man away in the right spirit to meet his competitors, or his customers, or the man he buys from. Truly, a hearty good-fellowship among competitors profits more than destructive competition and still leaves business free to be divided on the basis of merit and service.

Financier Pleads for Unbiased Engineering Reports

"WHATEVER you do, do not put out a report merely for the money that is offered you," was the plea made by J. W. Perry, president of the Commerce Trust Company of Kansas City, before a recent meeting of engineers interested in oil-field developments. Intelligent and honest reports without any reference to the financing of projects were emphasized as the important thing from the standpoint of the banker. Mr. Perry laid no charges of incompetency or crookedness against engineers that are not equally or in greater degree applicable to others, but the one thing he emphasized in his address was the unusual responsibility that rests upon the engineer who must make recommendations on new projects. On those recommendations decisions that involve not only financial expenditures but the welfare of a business enterprise, or perhaps the entire welfare of a community or a state, are made. The consequences of incompetency or dishonesty, even though such cases be no more frequent than in any other line of endeavor, are farther-reaching, and therefore the responsibility of the individual on whose recommendations action is taken is the greater.

The old saw that a physician buries his mistakes but the mistakes of an engineer bury him may have been purely humorous in conception, but it carries a thought that no engineer who is sensible of the importance of his profession can afford to forget even for a moment.

Reclaiming the Abandoned Residence District

ONE of the sad and wasteful features of our modern city living is the very common strangulation of once prosperous residence districts. Whole squares of worthy houses, thirty years ago the center of the social life of the community, have been abandoned for recently developed sections where more modern dwellings give greater comforts. The former owners suffered the early stages of the depreciation and sold at a sacrifice to follow the progress of social migration. The present owners rent these properties to any one at the highest figure they can get, neglecting maintenance and intent on squeezing out the last cent regardless of the impending fate of the locality. So men sit back and say that such sections are doomed as though these houses suffered from some fell disease. But as a matter of fact they are simply starving—starving for electric lights and gas ranges and bathrooms and new paint.

The reclamation of these abandoned residence districts offers a very big and profitable opportunity to the central-station company that is enterprising enough to develop such a project in co-operation with the local plumbers, painters and decorators, the owners of the properties and perhaps the banks. Some of the most substantial, comfortable and conveniently located homes in almost every city are found in these old-fashioned quarters. Taken individually it is impossible by interior improvements to restore their prestige and their popularity, but in an operation that embraces solid blocks and squares it is another matter. And it is necessary but to do the job and advertise it to repay the owner with much profit through the increased rental value of the premises. Meanwhile the contractors will benefit through the work, the central-station company will gain new customers of better character, the banks will loan their money well, the community will gain distinctly, and many home seekers will be provided with abiding places of a good old character with far less expenditure of money and less delay than building an equal number of new houses would entail.

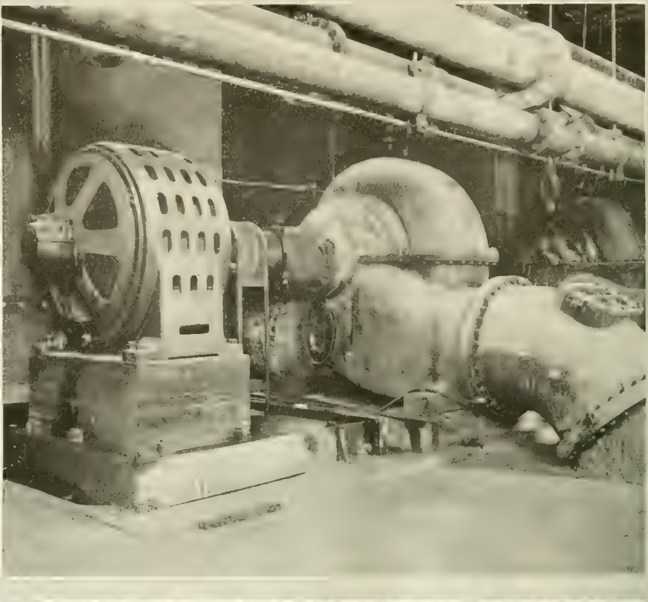
Commercialization of Gas Turbine Would Revolutionize Power Plants

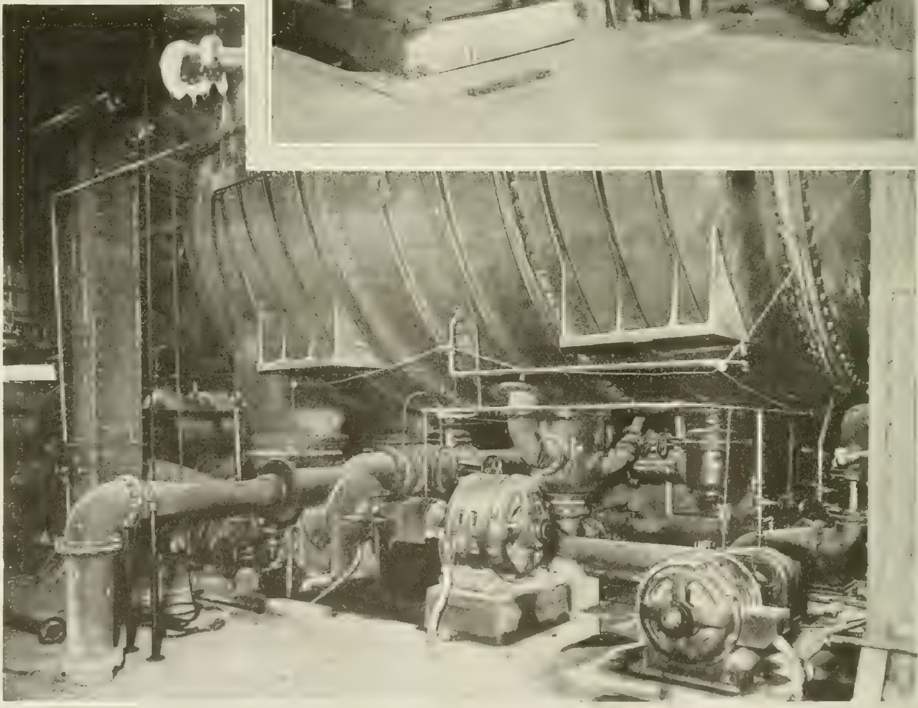
NOT many years ago the gas engine of the ordinary four-cycle type or the Diesel engine of somewhat equivalent character seemed likely to make a considerable impression on central-station practice, particularly in the function of reserve auxiliary apparatus. As time has gone on and the steam turbine has gradually undergone evolution, it has reached a degree of economy quite unknown in its earlier stages, and consequently we are hearing less about internal-combustion engines. Instead, the efforts of inventors have been steadily directed toward producing a gas turbine which should have the light-load characteristics due to small friction that are so desirable and a degree of economy at least comparable with that of the reciprocating internal-combustion machine.

The difficulty of getting a system of virtually continuous combustion which will keep the gas turbine up to speed and which can be governed well enough for electrical service is no small matter, but a far more serious difficulty is the requirement of high compression in the internal-combustion engine as a prerequisite for high degree of economy. Compression by reciprocating machinery runs into the very difficulty of high friction which the engineer desires to avoid, and rotary compressors of sufficient pressure capacity have not yet been produced. The long and short of the matter is that the negative work of compression looks for the present too big to permit of a respectable rivalry with the reciprocating type of gas engine, let alone the steam turbo-generator. There should be a way out of these difficulties, but it has not yet been found as regards the straight internal-combustion turbine. An interesting flank movement has been made in mixed turbines, where the heat of the combustion chamber is in part utilized to raise steam to add its store of energy, and the field of using the exhaust gases has also been to some extent explored.

It is going much too far to talk about the impossible in heat-engine development, and some scheme as yet untried may lead to at least a limited solution of the gas-turbine difficulty. One must, however, emphasize the fundamental limitation that is imposed by the peripheral speeds necessary for efficiency when one is dealing directly with the gases from internal combustion. The situation is bad enough with steam as the practical limits of temperature range are approached. It is much worse with the temperature range reached with internal combustion, upon which, of course, in the last resort improved efficiency depends. Commercialization of the gas turbine would bring about some startling changes and would shake up standardized power-station engineering in a way almost shocking to contemplate, so the developments which have been reported in Germany will be watched with intense interest.

Each Condenser in the Hell Gate Station Draws Circulating Water Directly from the East River





EXPENSIVE excavation and construction of concrete intake tunnels for the circulating water was avoided in the new Hell Gate station of The United Electric Light & Power Company by connecting each condenser directly with the East River, which flows along the east side of the station site. It was possible to make these connections very short by placing the turbine room next to the river. This arrangement required placing the boiler room between the turbine room and the electrical galleries, contrary to usual practice. However, this proved no disadvantage as in any event a coal-car cableway had to be run over the top of the boiler room to convey coal to outdoor storage, accommodating 100,000 tons.

Hell Gate—A Station of Many Features

With Its Turbine Room Next to the River, Phase Isolation of All Electrical Equipment and Alternating-Current-Driven Auxiliaries, This Station of The United Electric Light & Power Company Is Unusual

IN DEPARTURES from conventional practice and as representing the latest word in power-plant construction, the new Hell Gate station of The United Electric Light & Power Company easily takes the lead among generating stations completed in the last six months. For a station of its rating (300,000 kw. ultimate) its construction was completed in remarkably short order, four turbines, with a combined rating of 150,000 kw., having been placed in service within one year from commencement of the steel work. Hell Gate is also interesting because it will serve as the base-load station of the entire 60-cycle system shown in Fig. 3.

Among the features which make Hell Gate station stand out as an unusual plant are the following. The turbine room is next to the river, with the boiler room between it and the electrical galleries; alternating-current-driven auxiliaries are used, with one or two exceptions; phase isolation of all electrical equipment has been carried out; the ashes will be sluiced by hydraulic means; the station equipment has been divided into four independent groups, and heat-balance control is provided. The large outdoor coal storage, the arrangement of condenser circulating-water intakes and discharge, the use of boilers with superheaters only six tubes above the combustion chamber, the extensive equipment of motor-operated valves, the truck-type switchboards for station service and the coal-handling facilities are also worthy of note.

The need for this new station is readily evident from the accompanying chart (Fig. 1) showing the growth in 60-cycle peak load and the combined operating rating of the generating stations serving this load.

Considerable thought and time were given to the selection of a proper site for the new plant, the chief factors influencing its location being center of load, condensing water, coal supply and storage, and realty values. The site, shown in Figs. 3 and 5, combines in a quite unusual way all of the desirable features for the location of a tidewater plant.

The center of load of the United system is within reasonable distance of the new station (see map), and future growth of the load during the next few years should tend rather to diminish than increase the distance. The plant has an unlimited supply of fairly clean condensing water, the temperature of which rarely exceeds 75 deg. Fahr. Furthermore, the water is cleaner at the plant site than at most places along the East River.

By excavating the river to a depth of 35 ft. (10.5 m.) along the bulkhead it has been made possible to bring

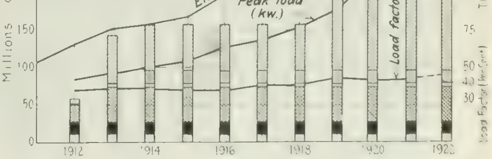


FIG. 1—GROWTH OF 60-CYCLE PEAK LOAD AND ANNUAL OUTPUT WITH CORRESPONDING GENERATOR RATING

From a peak load of only 10,000 kw. in 1911 the 60-cycle load has increased to more than 135,000 kw. peak and the annual output to nearly 550,000,000 kw.-hr. In the last few years the demand for service on two occasions almost overtook the operating rating of the system (that is, the combined 60-cycle rating of all plants minus the rating of the largest 60-cycle unit on the system), hence the need of the new Hell Gate station. Judging by the past increase of load, another 60-cycle unit may be required in Hell Gate in 1923. While the United company's system is essentially 60-cycle, Sherman Creek and Hell Gate stations have a combined 25-cycle rating of 110,000 kw., energy being supplied at this frequency to the New York Edison Company and the New York, New Haven & Hartford Railroad.

Turbine Room, Boiler Room and Condenser Floor Jointly Occupy 0.419 Sq.Ft. per Kilowatt of Rating

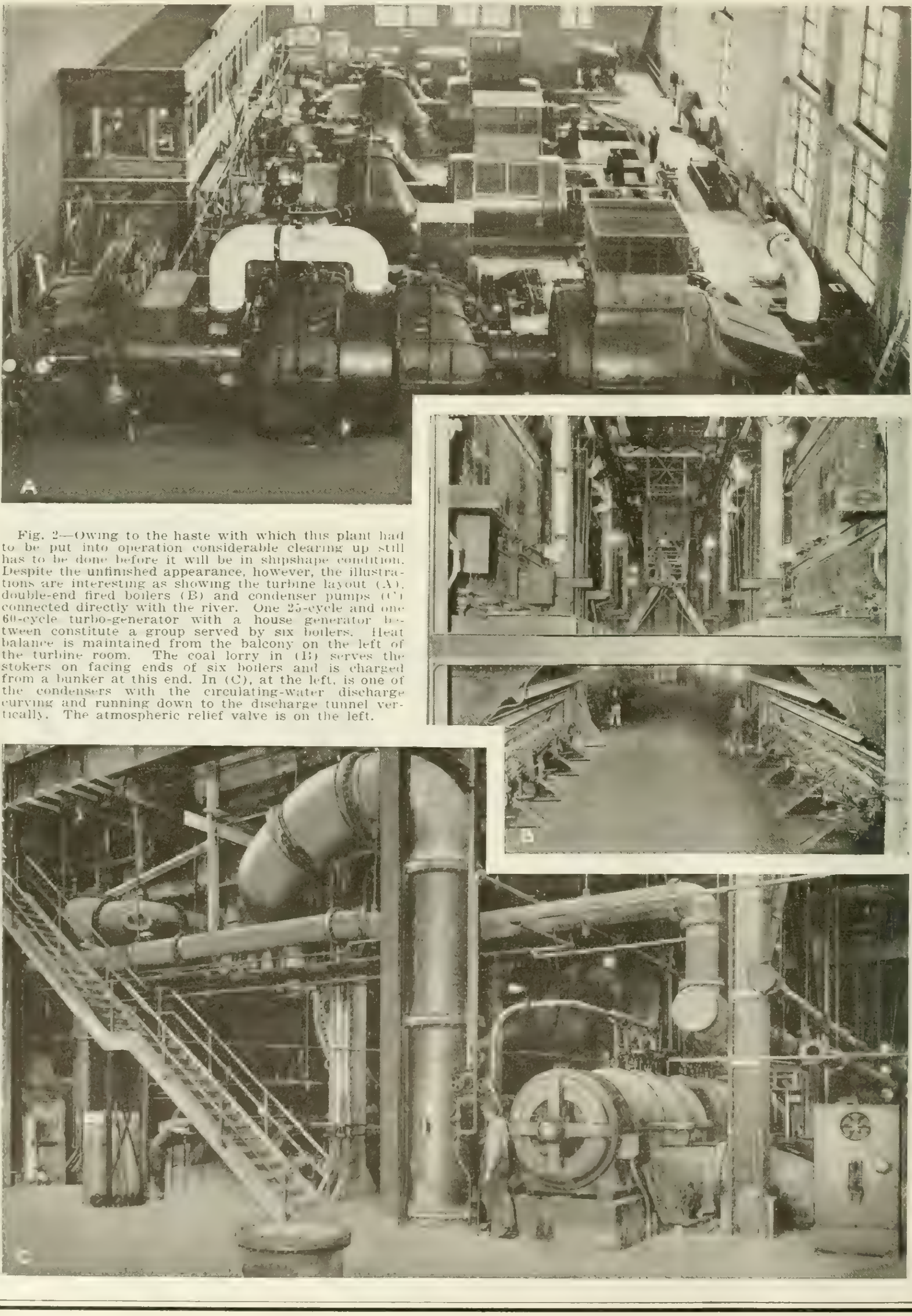


Fig. 2—Owing to the haste with which this plant had to be put into operation considerable clearing up still has to be done before it will be in shipshape condition. Despite the unfinished appearance, however, the illustrations are interesting as showing the turbine layout (A), double-end fired boilers (B) and condenser pumps (C) connected directly with the river. One 25-cycle and one 60-cycle turbo-generator with a house generator between constitute a group served by six boilers. Heat balance is maintained from the balcony on the left of the turbine room. The coal lorry in (B) serves the stokers on facing ends of six boilers and is charged from a bunker at this end. In (C), at the left, is one of the condensers with the circulating-water discharge curving and running down to the discharge tunnel vertically. The atmospheric relief valve is on the left.

oceangoing coal boats directly alongside the station for unloading by means of the coal towers. In addition, a direct siding from the New York, New Haven & Hartford Railroad permits the receipt of coal by rail—a feature possessed by Hell Gate alone among the generating stations in New York. The existence of two independent routes for bringing coal to the plant is of tremendous value in view of the absolute continuity of service that must be maintained on the system. The Hell Gate site possesses a further safeguard in this respect in having an outside storage capacity of approximately 100,000 tons, which insures about four weeks' operation at the utlimate load in case all the other sources of coal supply are cut off.

Contrary to the usual practice of placing the boiler house next to the river, Hell Gate station is constructed with the turbine room alongside the waterfront, while adjoining it on the land side is the boiler room. The electrical galleries are still farther inland, between the boiler room and the outdoor coal-storage space, being separated from the boiler house by a gap of 25 ft. (7.5 m.). With this arrangement it was made possible to dispense with expensive excavation and tunnel construction for the condenser circulating water since each condenser can draw its circulating water through short intakes directly from the river. Screens are installed along the entire river front of the station, thus providing considerably more screening area than is usually available in power plants. The discharge tunnel runs parallel with the river and empties into it near the upstream and downstream ends of the turbine room. This tunnel was constructed as a part of the station foundation, and provision was made for partitions so that half of it may be dewatered for repairs.

Unusual Layout Imposes No Limitation

Placing the boiler room between the turbine room and the electrical galleries has imposed no limitations on the boiler house because a cableway had to be run over the boiler house in any event to convey coal to the outdoor storage yards back of the plant. Normally coal will be brought to the station from the South in 10,000-ton seagoing barges, which will be tied up to the bulkhead and unloaded by electrically operated traveling coal towers mounted on a structure 130 ft. (40 m.) high. Each tower (two being provided) is rated at 250 tons per hour, a 2-ton grab bucket lifting the coal almost 200 ft. (61 m.) and dumping it into a hopper over the cable railway. After being crushed the coal is dumped into cable cars and weighed on automatic track scales, the cars continuing along the loop over the boiler house or coal-storage yard as desired. Automatic trippers dump the cars into overhead bunkers in the boiler house or into chutes that discharge into the coal-storage yard. To distribute the coal a drag-line scraper is employed.

Provision is also made for bringing coal to storage by rail, weighing on track scales, unloading by a locomotive crane and distributing over the storage space by the drag-line scraper previously mentioned.

Coal is reclaimed from storage by using the same scraper to drag the coal into a hopper below the elevated cable-car loop. From this point an automatic skip hoist elevates the coal to the cable cars, which transfer it to the bunkers in the boiler house.

The existing boiler-house coal bunkers have a total capacity of 1,700 tons, or about twenty-four hours' supply with the station operating at its present rating. These bunkers extend along one wall of the boiler house only. Running at right angles to them over each firing aisle are traveling lorries which transfer the coal to the stoker hoppers. Each boiler is double-end-fired and each stoker hopper has a capacity of 15 tons; thus, with the arrangement provided, no interruption to any one part of the coal-handling equipment should seriously handicap the station. The capacity of the lorries is such (25 tons for the double-aisles and 15 tons for the single-aisles) that each can serve all stokers along the corresponding aisle by making one trip per hour.

The boiler house measures 147 ft. x 370 ft. (44.8 m. x 112.7 m.), thus allowing 0.181 sq.ft. (168 sq.cm.) of floor area for boilers per kilowatt of generator rating installed. The boilers are arranged in rows of three across the narrow dimensions of the boiler house and are set singly. Two rows constitute a unit serving two turbines and having one smokestack. However, five boilers can carry the full load of two turbines, so that one unit can always be kept out of service.

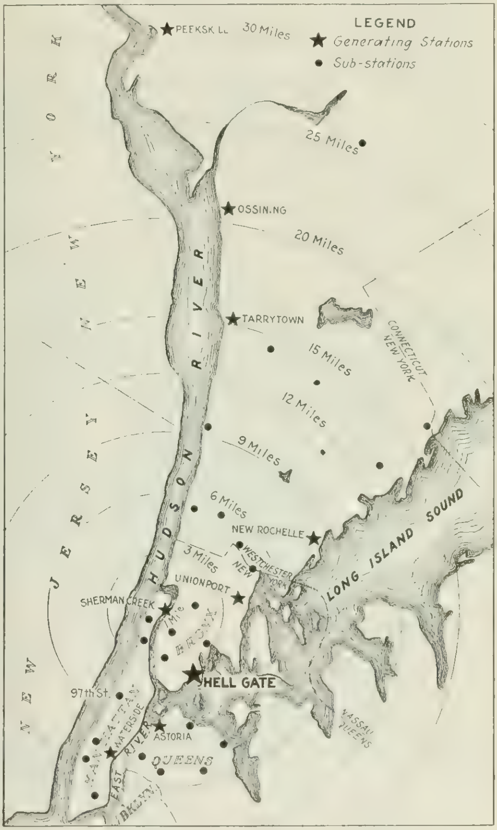


FIG. 3—GENERATING STATIONS AND SUBSTATIONS INTERCONNECTED WITH HELL GATE STATION

The present center of the 60-cycle load is approximately at the Ninety-seventh Street substation, which is the latest substation of The United Electric Light & Power Company.

The boilers are of the cross-drum, horizontal water-tube type with the superheater placed close to the combustion chamber, that is, just six tubes above the furnace. One advantage of this construction is the

Hydraulic Sluicing of Ashes a Feature of the Boiler Room

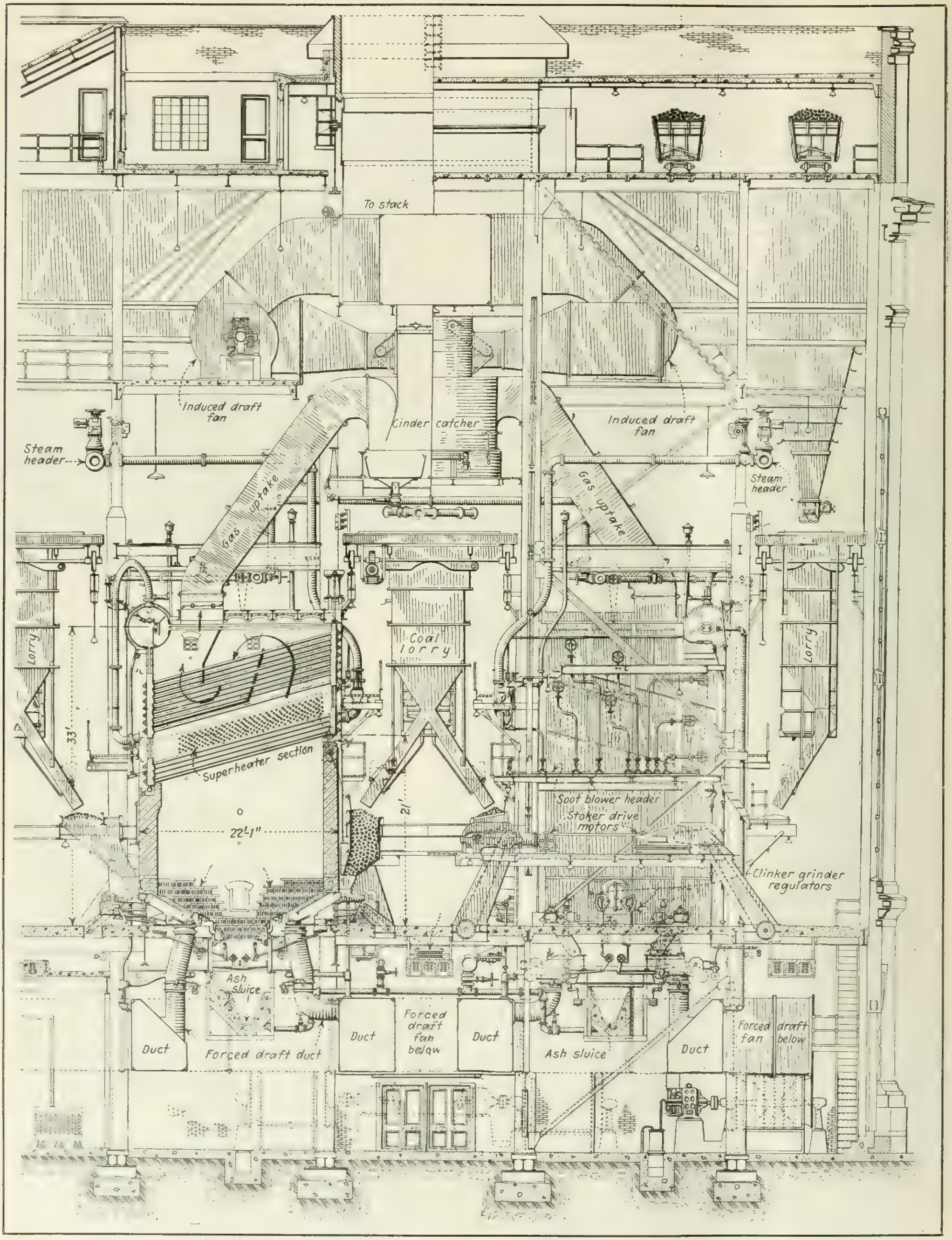


Fig. 4—One of the features of this boiler room is the hydraulic sluicing of ashes. Troughs run directly under each set of clinker grinders to a common header that discharges into under-water storage pits situated as shown in Fig. 5. Among other things of particular interest are the coal-handling arrangements, position of superheaters, types of boilers employed, the perforated blocks, use of double stokers, the cinder catchers and the absence of steam drive. The stokers, clinker grinders and fans are driven by motors, the stokers through double-cone drive, and the forced draft fans by brush-shifting motors. There is one coal lorry for each firing aisle, which receives its charge from a large overhead bunker along one side of the boiler room. It is filled by the cable cars above. The type of boiler employed allowed placing the superheaters above the sixth row of tubes. The cinder catchers, which are of the deflector water-pool type, are mounted back to back, as shown above.

more uniform superheat obtainable. Another feature of the boiler is the small tubes used, namely, 3-in. (7.6 cm.), which increase the steaming rate and reduce the hazard from tube failure. Each boiler is built in twenty-seven sections, fifty-four tubes wide and twenty high, making a total heating surface of 18,900 sq.ft. (1,738 sq.m.). Steam is generated at 250 lb. pressure (19.25 kg. per sq.cm.) and 200 deg. Fahr. superheat.

Two fourteen-retort stokers are installed under each boiler so no bridge wall is necessary. Perforated blocks are built into the furnace side walls to admit air and thus prevent adherence of clinkers. Air for these ducts as well as the stoker tuyères is provided by forced-draft fans installed in a basement room extending along the outside wall of the station. By providing ample air inlets to this room it has been possible to avoid creating a vacuum—a very objectionable condition because it has the effect of reducing the stack height and in addition draws a lot of cold air into the station in the winter. The fans discharge into a single air duct running the length of the station under one end of each row of boilers. Branches from this main run under each row of stokers. Between each pair of fans in the main duct is a damper which is normally kept closed so that each section of the duct, with its corresponding two fans and two branches, serves as a unit for one row of boilers. Any damper can be opened if necessary, permitting adjacent sections to be fed from three blowers in case one becomes inoperative. This arrangement permits very flexible operation and still preserves the unit layout which is characteristic of this plant.

The furnace gases, after making three passes over the boiler tubes, go through an uptake to a deflector type of cinder catcher. From this they are drawn through an induced-draft fan and discharged into the stack. Since the induced-draft fans are not required except at heavy loads, bypass dampers are provided above the cinder catchers to admit the gases direct to the stack. One induced-draft fan serves each boiler.

Instead of providing large ash pits under each furnace and having cars to remove their contents, a tile-lined concrete trough is run under each row of furnaces, immediately below the clinker grinders, and connected with a main trough that leads to settling pits at the bulkhead. Water is supplied to this trough by centrifugal pumps through nozzles at each boiler.

The sluiceways are open along the top so that they are easily accessible if anything tends to clog them.

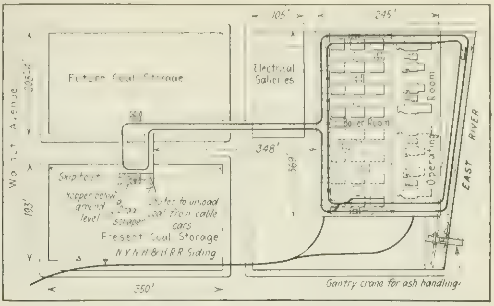


FIG. 5—STORAGE SPACE BACK OF PLANT ACCOMMODATES APPROXIMATELY 100,000 TONS OF COAL

However, no difficulty is expected as the discharge from the clinker grinders can be easily carried away by the water at the rate it is discharged through the troughs. For removal of the ashes from the settling pits a crane and grab bucket are provided that can directly load scows at the bulkhead or motor trucks.

Provisions for assuring flexible and reliable water feed to the boilers and steam feed to the main turbines, house turbines and two boiler-feed turbines are best shown in Fig. 7. It may be observed that each group of six boilers is fed by a loop header supplied by three boiler-feed pumps, two of which are motor-driven and one turbine-driven. Two of the pumps are capable of serving a boiler group at maximum load. Make-up water will not amount to more than 2 per cent of the total water used, but three independent sources of city water are provided to assure a reliable supply. Continuity of feed is further assured by connections between each group header, the valves being normally closed, however. There is a flow meter in each side of the loop header, and thus any pump may be tested. Two automatic feed regulators are on each boiler.

Although each group of six boilers is considered a unit in feeding two turbines, the headers along each row of three boilers run directly to the corresponding turbine. Interconnection is afforded by a cross-header running the entire length of the boiler room and joined with each individual boiler header. The valves between groups are normally closed. The house turbines, boiler-feed-pump turbines, house-turbine exciters, air ejectors on the condensers, fire pumps, whistles, etc., are fed

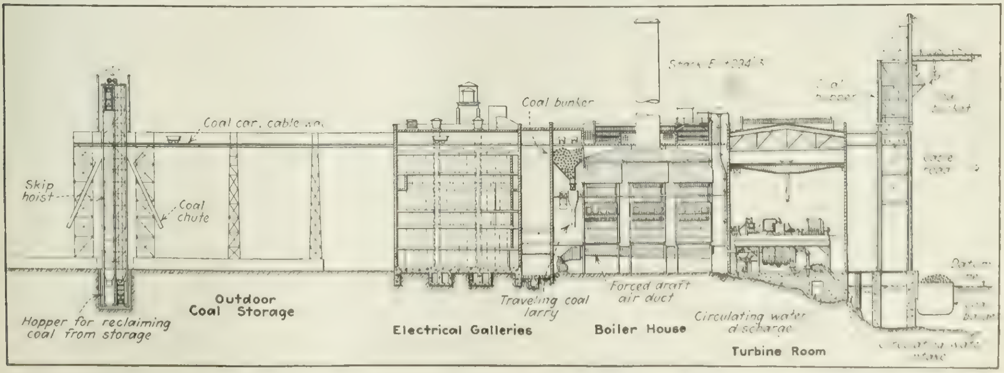


FIG. 6—CONTRARY TO USUAL PRACTICE, THE BOILER ROOM IS BETWEEN THE TURBINE ROOM AND ELECTRICAL GALLERIES

from the cross-header. Attention is called to the extensive provision of steam-flow meters and motor-operated gate valves. By having flow meters in both outlets of each boiler it will be easy to ascertain the distribution of steam between the two connections and hence to become aware of the sticking of either non-return valve.

An excellent idea of the layout on the turbine floor and the relative positions of the equipment under the turbines is afforded by Figs. 2A and 2C. Space is provided for four 35,000-kw., 25-cycle, 11,400-volt turbo-generators and four 40,000-kw., 60-cycle, 13,200-volt turbo-generators, but only two of each type are provided now. Since the turbine room measures 98 ft. x 364 ft. (29.8 m. x 110.9 m.) a floor area of 0.119 sq.ft. (110.5 sq.cm.) is available per kilowatt of ultimate rating.

The 35,000-kw. turbines are of the Curtis type, having twenty stages, and the 40,000-kw. turbines are of the tandem-compound reaction type. The high-pressure element of the latter is of the Parsons single-flow design, and the low-pressure element is of the semi-double flow design with two exhaust outlets. Each turbine exhausts into a 50,000-sq.ft. (4,600-sq.m.) surface condenser, rubber expansion joints being used between the turbine and condenser of the 40,000-kw. sets, and direct connection between the others. Expansion joints have been omitted in the 35,000-kw. sets because the condensers are supported on springs. Both types of condensers have divided water boxes which enable cleaning to be done without shutting down the units. Separate intakes and motor-driven circulating pumps serve each half of each condenser, although a cross-over connection may be opened if necessary. As mentioned at the opening of this article, the intakes are very short and connect directly with the river. (See page 820.)

Duplicate motor-driven condensate pumps are connected with each condenser. For removing air from the 35,000-kw. condensers four two-stage steam-jet air ejectors are used, whereas for the 40,000-kw. units duplicate Le Blanc air pumps are employed. Any of the duplicate pumps can carry the entire load of the unit unaided with only slight reduction in efficiency.

In considering the various systems of auxiliary drive available it was decided that the best combination of reliability, economy and ease of maintaining heat balance would be obtained by adopting alternating current for all auxiliaries except one boiler-feed pump of each group, one of the two exciters for each house alternator, and the fire pump. One-half of the load is carried on the main 60-cycle bus and the other half by the house alternators, so that in case of interruption of either source of power only one-half of the auxiliaries will be shut down. One house alternator is installed for each group of six boilers, two main turbines (25-cycle and 60-cycle) being placed between the latter. The house alternators generate at 2,300 volts and are driven by non-condensing turbines. Any of the auxiliaries except the coal tower, cranes and skip hoist may be connected to either bus by truck-type switches.

Heating of the feed water also is conducted on the unit or group plan, being accomplished as follows: The condensate from the two main condensers divides and passes through two closed feed-water heaters, both of which are heated by bleeder steam obtained from the main turbines at 6.5 lb. absolute pressure (0.4 kg. per sq.cm.). After being raised to 150 deg. Fahr. the main unit condensate leaves these heaters and enters an open feed-water heater which receives steam from the house alternator turbine and high-pressure packing of one of the main turbines. The condensed bleeder steam from the closed heater also passes through the open heater with the other condensate and is raised to 210 deg. Fahr. before being pumped to the boilers. Thermostatically controlled valves equalize the load on the two closed heaters. To insure a sufficient supply of steam to the open heater at all loads of the house alternator, steam is bled from the intermediate stages of the main turbines through pressure-control valves set for 1 lb. (0.07 kg.) back pressure.

Make-up water from the surge tank is first passed through oil coolers and condenser-air ejectors to a receiving tank, from which booster pumps deliver it to the closed heaters. From this point on the course is the same as for main-unit condensate. Since the surge tank receives all the water used in cooling the bearings of the induced-draft fans, etc., the foregoing method of handling the make-up water, steam and condensate

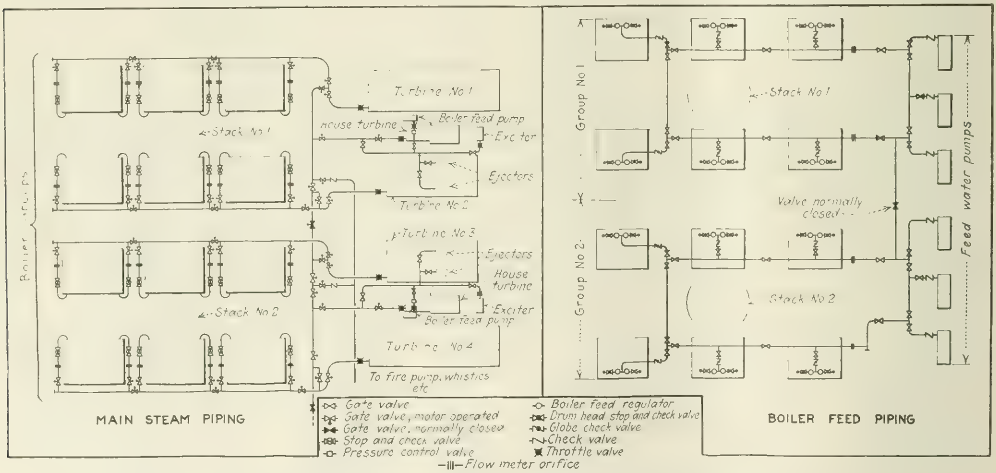


FIG. 7—STEAM AND BOILER FEED PIPING THAT ASSURES MAXIMUM FLEXIBILITY OF OPERATION

conserves all the heat from various sources. Virtually the only manual regulation which will be required for obtaining the proper heat balance will be the control of the forced-draft fans, which will be operated by push-button switches on a control board overlooking the turbine room (see balcony at left in Fig. 2A). All auxiliaries are controlled from this point. The induced-draft fans after being manually started are regulated by an automatic balanced-draft system. Very complete instrument equipment is provided to enable economical operation. Each boiler is equipped with a meter recording steam flow (through both outlets), air flow and flue-gas temperature on a single chart and indicating the steam flow and firebox draft on enameled scales.

On the heat-balance balcony overlooking the turbine room are additional instruments divided into groups, each set serving six boilers, two main turbines, one house turbine and the corresponding auxiliary equipment. The instruments are arranged in three horizontal rows. Considering one section of the board only, the top row includes two three-pointer draft gages (one for each row of boilers in the group), one exhaust-steam temperature recorder connected with the atmospheric exhaust line to detect loss, a city-water make-up recorder, and a feed-water temperature recorder. In the middle row are temperature recorders connected with each of the main throttles, air-pressure recorders connected with each forced-draft duct, a steam-pressure gage indicating the average condition in main header, and three ammeters connected to each induced-draft fan to indicate relative load. In the bottom row are recorders for measuring the condensate from each condenser, the feed water to each row of boilers, and the main steam pressure and feed-water pressure (on one instrument). In addition three ammeters are connected with each forced draft fan.

The design and construction of the Hell Gate station was carried on under the general direction of Thomas E. Murray, Inc., engineers, working in co-operation with an active construction committee made up of a large group of central station engineers from the allied electrical companies of Greater New York. Through these sources and the co-operation of Frank W. Smith, vice-president and general manager of The United Electric Light & Power Company, this article and one on the electrical features, to follow, were prepared.

Five Systems with an Output Over 1,000,000,000 Kw.-Hr.

"Electrical World" Survey Indicates that in 1921 Seventy-two Light and Power Companies of the United States and Canada Reported Individual Output Exceeding 100,000,000 Kw.-Hr.

A SURVEY just completed by the ELECTRICAL WORLD indicates that five electric generating and distributing companies of the United States had an output of more than 1,000,000,000 kw.-hr. during 1921. Canada was unrepresented in this group. In 1920, as was indicated by a tabulation appearing in the April 23, 1921, issue of the ELECTRICAL WORLD, nine companies in the United States and Canada reported an output in excess of 1,000,000,000 kw.-hr.

A study of the accompanying tables brings out some interesting results of the campaigns which the various generating and distributing companies have undertaken to find a market for their excess energy resulting from the industrial depression and consequent decrease in the power energy load. During 1921 the Commonwealth Edison Company of Chicago added approximately 40,000 new residential lighting customers to its lines. As a direct result and notwithstanding the loss of a large precentage of its power load, the output of this company was increased by 44,701,943 kw.-hr. over 1920, and in 1921 it leads the list of distributing companies in total output. Similar favorable deductions may be made from the output of other large companies. On the other hand, some companies which serve an intensely industrial section in which a material increase in the domestic lighting load was impossible or was not seriously undertaken reported a largely reduced output for 1921. For instance, the Niagara Falls Power Company carries an industrial load only, having no lighting load except such as is incidental to the power load. This company was totally unable to increase its energy market by an additional lighting load, and as a result its output during 1921 was 473,206,064 kw.-hr. under that of 1920, and it was forced to give way to the Commonwealth Edison Company as the leader in the electric light and power industry, in so far as output was concerned.

Table I is believed to be a complete list of the electric light and power companies and electric railway companies of the United States and Canada with an output in excess of 100,000,000 kw.-hr. during 1921, the table giving also their total output and the amount and date of their peak load. The tabulation also includes data on four companies which fell slightly below the 100,000,000-kw.-hr. mark, but the output of these companies under normal business conditions would exceed this figure.

Table II lists the electric light and power companies and electric railway companies by sections of the country and gives the proportion of the output which was generated and purchased and in addition the distribution of the energy between light, power, electric railways and miscellaneous distribution, the last-named item including intercompany business, line losses, energy sold to other public utilities, etc.

The number of electric light and power companies reporting an output in excess of 100,000,000 kw.-hr. would have totaled seventy-six if the addition of new companies to this classification had not been counterbalanced by the reports submitted by the four companies referred to above which showed a decreased total output. For this reason only seventy-two electric light and power companies and nine electric railway com-

Table I—Data on Output and Peak Load of Largest Generating and Distributing Systems in the United States and Canada

(This table includes all lighting, power and electric railway companies in the United States and Canada having yearly outputs in excess of 100,000,000 kw.-hr.)

		1921			1920			1919			1918		
	Rank in 1921	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)
Commonwealth Edison Company	1	525,640	Dec. 21	1,928,271,943	478,820	Dec. 17	1,883,570,000	428,630	Dec. 15	1,628,340,000	400,010	Dec. 2	1,508,070,000
Niagara Falls Power Company	2	298,120	Dec. 22	1,855,120,000	303,640	Apr. 29	2,328,326,064	275,803	Dec. 29	2,034,608,904	254,139	Apr. 8	2,054,360,080
Pacific Gas & Electric Company	3	265,925	Nov. 29	1,489,088,657	259,004	Dec. 22	1,475,678,675	244,732		1,267,159,767	219,339	....	1,168,797,446
New York Edison and United Electric Light & Power Company	4	422,721	Dec. 14	1,475,276,053	398,535	12/6 and 12/22	1,383,070,086	330,210	Nov. 25	1,104,521,883	286,103	Dec. 11	958,878,156
Southern California Edison Company	5	238,480	Dec. 13	1,224,718,196	213,450	July 12	1,079,474,091	200,020	July 23	1,021,977,519	163,125	July 12	779,758,000
Montreal Light, Heat & Power Consolidated	6	165,900	Nov. 16	907,231,573	169,450	Nov. 17	900,328,757	164,415	Dec. 16	852,680,550	166,730	Dec. 6	976,462,529
Detroit Edison Company	7	201,500	Nov. 23	897,980,200	218,800	June 16	1,002,306,000	210,000	Dec. 5	872,583,200	172,000	Dec. 13	773,876,700
Philadelphia Electric Company	8	213,570	Dec. 8	877,047,595	203,624	Nov. 23	910,327,693	199,247	Dec. 18	722,615,280	166,294	Dec. 6	693,447,962
Shawinigan Water & Power Company	9	160,500	Dec. 19	863,124,240	192,200	Nov. 17	1,140,759,076	172,900	Jan. 14	1,031,111,695	136,800	Sept. 24	1,058,136,117
Ontario Power Company	10	151,000	Jan. 5	825,115,600	152,000	Dec. 15	1,061,596,054	150,000	Nov. 12	949,223,500	119,000	Oct. 19	963,845,200
Public Service Electric Company of New Jersey	11	213,502	Nov. 28	821,198,975	216,452	Nov. 16	912,899,972	207,890	Dec. 16	821,355,239	185,738	Dec. 5	795,481,279
Southern Power Company	12	218,300	Feb.	790,000,000	210,000	Nov.	745,873,992	196,500	Dec.	585,596,925	162,600	Dec. —	551,313,367
Duquesne Light Company	13	164,240	Feb. 1	702,897,985	162,000	Jan. 29	810,401,406	157,900	Dec. 22	623,000,000	141,000	Dec. 6	641,874,585
Toronto Power Company	14	109,000	Nov. 28	630,468,000	109,000	Dec. 21	649,748,800	115,000	Jan. 8	548,477,616	125,000	Dec. 3	897,512,877
Mississippi River Power Company	15	117,450	Nov. 28	602,580,980	115,650	Nov. 13	644,163,000	113,450	Nov. 18	590,488,000	102,950	Mar. 8	557,200,000
Montana Power Company	16	116,600	Jan. 11	572,277,989	159,700	Aug. 7	1,103,620,644	133,500	June 13	865,998,552	157,800	Nov. 21	1,108,125,350
Cleveland Electric Illuminating Company	17	141,850	Dec. 15	564,819,267	155,041	Sept. 9	682,557,097	153,878	Dec. 5	576,131,649	128,319	Nov. 22	543,663,042
West Penn Power Company	18	106,919	Dec. 21	516,829,636	104,618	Nov. 24	524,976,000	94,130	Dec. 22	417,911,000	78,000	Dec. —	404,200,000
North American Company (Missouri System)	19	116,275	Dec. 9	508,893,262	105,749	Dec. 21	471,611,047	99,498	Dec. 3	408,920,575	92,000	Nov. 26	395,820,236
Great Western Power Company	20	95,540	June 7	490,584,257	80,600	July 27	408,577,754	48,000	May 12	213,189,992	45,780	....	180,040,171
Buffalo General Electric Company	21	115,000	Nov. 14	479,862,700	108,500	Oct. 26	544,293,410	106,500	Nov. 22	508,583,680	104,100	Nov. 22	587,761,870
Pennsylvania Power & Light Company	22	84,203	Sept. 27	442,507,974	87,685	Sept.	411,639,501	81,435	Nov.	342,071,900	69,100	Dec. —	310,151,400
Brooklyn Edison Company	23	137,800	Dec. 6	438,887,775	116,500	Nov. 30	382,963,027	105,400	Jan. 15	327,084,075	86,000	Dec. 11	282,424,822
Alabama Power Company	24	115,500	Dec. 20	432,991,540	97,900	Sept. 28	488,089,061	83,100	Jan. 10	347,993,284	86,850	Dec. 19	392,247,862
Pennsylvania Water & Power Company	25	83,000	Nov.	419,987,000	85,000	Very frequent	494,624,400	87,000	Nov. —	512,138,100	89,000	Feb. —	500,641,122
Puget Sound Power & Light Company	26	99,800	Dec. 1	419,197,581	95,725	Dec. 3	472,765,800	93,900	Dec. 18	452,209,000	88,230	Dec. 20	427,800,000
Consolidated Gas, Electric Light & Power Company of Baltimore	27	108,330	Nov. 30	415,335,614	88,990	Nov. 30	429,710,847	80,640	Dec. 5	392,201,280	82,760	Nov. 7	433,196,550
Niagara, Lockport & Ontario Power Company	28	87,000	Nov. 2	415,153,634	88,000	Jan. 6	492,466,460	....	....	....	....	....	....
New England Power Company	29	112,200	Nov. 9	405,979,457	103,450	Jan. 6	430,918,000	93,860	Dec. 9	357,303,224	76,900	Dec. 16	323,127,784
Consumers' Power Company	30	95,410	Dec. 12	397,815,027	106,924	May 19	476,095,098	108,847	Nov. 28	456,230,164	98,666	Nov. 21	404,412,000
San Joaquin Light & Power Corporation	31	61,700	June 27	396,174,690	47,180	Aug. 28	299,536,000	....	....	....	....	....	....
North American Company (Wisconsin System)	32	98,887	Nov. 22	375,354,892	90,347	Jan. 6	398,619,744	97,912	Dec. 4	331,874,192	87,855	Nov. 20	327,784,516
Edison Electric Illuminating Co. of Boston	33	128,200	Dec. 15	375,025,955	105,090	Dec. 9	395,076,738	103,136	Dec. 8	328,798,850	95,774	Dec. 6	293,966,604
Washington Water Power Company	34	70,110	Nov. 23	374,378,300	63,955	Jan. 21	351,087,900	63,220	Dec. 3	241,761,350	33,956	Nov. 26	195,628,500
Minneapolis General Electric Company	35	83,590	Dec. 15	373,378,515	78,010	Oct. 26	359,476,651	72,745	Oct. 24	332 264,401	66,189	Nov. 1	297,443,050
Utah Power & Light Company	36	75,661	Jan. 8	362,908,000	85,404	Nov. -	519,854,000	79,780	Jan. 14	461,531,633	81,313	Dec. 27	533,044,137
Tennessee Power Company	37	69,100	May 16	342,948,926	74,800	Apr. 30-June 4	428,649,835	82,300	Feb. 14	422,272,590	87,800	Dec. 11	519,959,383
Los Angeles Bureau of Power & Light	38	51,900	Dec. 21	300,353,806	46,500	Dec. 29	169,489,210	24,650	Apr. 12	134,893,270	....	....	....
Portland Railway Light & Power Company	39	64,800	Dec. 20	298,514,571	62,600	Dec. 6	292,318,971	56,300	Dec. 22	271,600,300	56,900	Dec. 23	258,424,940
Georgia Railway & Power Company	40	72,000	11/3 and 11/28	282,084,977	76,000	Apr. 9	293,721,290	71,700	Dec. 18	262,834,541	68,000	Nov. 8	238,489,012
Union Gas & Electric Company	41	75,000	12/14 and 12/23	281,537,273	65,050	Dec. 21	234,634,375	....	....	....	....	....	....
Michigan Northern Power Company	42	35,018	Aug. 14	258,249,673	35,408	Nov. 12	257,752,195	35,794	Apr. 23	264,272,468	33,519	Dec. 24	233,381,654
Adirondack Power & Light Corporation	43	61,500	Dec. 21	243,370,354	60,700	Dec. 2	277,100,000	66,000	Dec. 23	261,400,000	50,250	11/8, 1/23	174,567,275
Narragansett Electric Lighting Company	44	72,000	Nov. 23	243,087,000	54,000	Jan. 5 & Nov. 16	213,232,000	57,000	Dec. 23	155,678,890	45,000	June 20	150,028,780
Potomac Electric Power Company	45	65,000	Dec. 14	238,028,571	62,000	Nov. 30	225,994,701	55,000	Dec. 17	204,008,647	48,000	Dec. 20	173,180,014
Virginia Railway & Power Company	46	47,000	Dec. 14	208,323,000	46,150	Dec. 22	208,517,000	42,800	Dec. 18	181,280,000	35,700	Dec. 18	164,810,750
Kansas City Power & Light Company	47	50,531	Dec. 23	204,752,604	35,500	Dec. 23	175,939,618	....	....	....	....	....	....
Great Northern Power Company	48	44,200	Jan. 5	204,396,860	46,000	Apr. 20	229,146,730	48,000	May 12	213,189,992	45,780	.	180,040,171
Pennsylvania Ohio Power & Light Company	49	45,300	Nov. 9	202,670,200	48,900	Nov. 3	255,537,150						
Southern Sierra Power Co. & Nevada-California Power Co.	50	45,700	6/6 and 8/8	199,452,965	32,600	July 23	175,104,808	29,200	....	165,782,785	28,200	Aug. 6	161,347,690
Idaho Power Company	51	35,635	Sept. 1	190,215,255	34,235	July —	184,843,000	27,090	Aug. –	154,754,000	24,350	Sept.	134,355,000
Northern Ohio Electric Corporation	52	42,000	Oct. 12	187,249,647	44,400	May —	247,109,963	....	....	....	....	....	....
Rochester Gas & Electric Corporation	53	48,734	Dec. 16	185,480,692	49,400	Oct. 29	193,601,590	42,500	Dec. 2	172,892,249	52,300	Nov. 22	196,171,300
Toledo Edison Company	54	46,700	Dec. 13	179,121,428	52,400	Mar. —	207,830,610	48,220	Dec. —	199,771,799	40,305	Dec. 4	161,103,970
Turners Falls Power & Electric Company	55	57,900	May 17	170,826,000	55,500	May 27	212,926,530	....	....	....	....	....	....
Fort Worth Power & Light Co.	56	29,500	Oct. 15	163,286,500	....	....	....	....	....	....	....	....	....
Columbus Railway, Power & Light Company	57	38,440	Dec. 12	160,423,240			*153,626,000	....	....	....	....	....	
Texas Power & Light Company	58	33,620	Sept. 22	156,851,213	33,620	Oct. 14	159,939,831	29,000	Nov. 7	121,212,000	28,800	Sept.	118,850,000
Appalachian Power Company	59	35,600	Dec. 19	154,500,000	35,300	Oct.	148,700,000	....	....	....			
Dayton Power & Light Company	60	37,500	Nov. 28	134,588,457	31,500	5/25 and 9/28	129,618,270	.	..				
California-Oregon Power Company	61	20,270	Mar. 16	133,091,607	20,335	Jan. 28	143,025,818						
Northwest Utilities Company	62	31,885	April —	132,788,852	....	....			....	....	....	....	....
Kansas Gas & Electric Company	63	25,000	Dec. —	130,479,900	.	...			....	....	....	....	....
Nebraska Power Company	64	28,200	Oct. 28	127,758,800	25,500	Nov. 26	114,200,500	22,600	Dec. 22	97,444,900	19,700	Dec. 18	74,708,000
Scranton Electric Company	65	27,900	Dec. 2	117,579,851	26,580	Jan. 9	116,387,472	....	....	....	....	....	....
Central Illinois Public Service Company	66	26,300	Dec. —	114,587,986	....	....	....	....	....	....	....	....	....

Northwestern Electric Company	67	22,190	Dec. 12	113,913,335	20,600	Dec. 10	112,736,089						
Colorado Power Company	68	25,961	Mar. 9	113,805,044	29,078	Oct. 1	116,748,292						
Indianapolis Light & Heat Company	69	29,358	Nov. 9	108,829,278	27,240	Sept. 15	114,416,094						
Indiana & Michigan Electric Company	70	28,280	Dec. 16	105,593,490	27,130	Nov. 9	103,693,910	23,100	Dec 23	84,160,770	20,700	Dec 15	81,625,432
Empire District Electric Company	71	27,700	Dec. —	104,687,540	36,710	June —	148,740,220	32,030	Oct —	130,114,100	25,400	Sept 5	114,446,685
Connecticut Light & Power Company	72	28,255	Nov. 28	101,129,915	33,392	Oct. 12	145,111,822						
Metropolitan Edison Company	73	27,900	Nov. 30	99,815,200	28,000	Aug. 10	133,994,030						
Hartford Electric Light Company	74	31,700	Nov 14	97,754,000	32,500	Jan. 9	103,000,000						
Tacoma Department of Light & Water	75	28,400	Dec 20	95,697,600	22,700	Nov. 10	120,598,174						
New Bedford Gas & Edison Light Company	76	40,300	Dec 21	89,857,700	33,700	June 17	107,599,392						
ELECTRIC RAILWAYS													
Interborough Rapid Transit Company	1	242,760	Dec 30	846,487,668	242,020	Jan. 31	816,603,610	239,940	Dec 19	810,158,475	204,000	Dec 30	731,058,965
Brooklyn Rapid Transit Company	2	116,000	Dec. 22	383,009,325	111,147	Jan. 15	489,748,451	111,000	Dec 16	406,130,443	109,892	Feb 21	385,346,075
Philadelphia Rapid Transit Company	3	105,303	Dec 22	333 222,786	102,210	Jan. 14	349,027,334	101,120	Dec 18	349,542,666	94,730	Dec. 27	339,232,739
Boston Elevated Railway Company	4	75,905	Jan 18	223,061,330	72,295	Jan. 14	246,312,170	71,769	Mar. 23	240,429,915	67,965	Mar. 23	228,131,265
Pennsylvania R. R. Co., Long Island Power Plant	5	64,000	Dec. 30	201,922,210	55,200	Jan. 5	199,737,907	53,900	Dec. 19	181,017,940	48,600	Jan. 3	165,377,180
New York Central Railroad Company	6	50,750	Dec. 23	149,275,239	46,440	Dec 27	157,132,366	44,100	Dec 29	140,435,406	38,360	Jan. 22	127,412,457
Twin City Rapid Transit Company	7	44,599	Feb. 8	145,517,164	42,700	Dec. 21	139,711,248	42,612	Nov 28	133,676,028	44,966	Feb 19	131,351,288
Kansas City Railways Company	8	43,500	Jan. 13	129,804,772	51,740	Jan 8	189 172,898	49,430	Oct 27	211,707,571	57,280	Jan. 11	209,378,747
Western Power Company of Canada	9	27,200	Mar 1	122,684,800									

Blank indicates that no report covering year was received from company

panies reported an output of more than 100,000,000 kw.-hr. The total output of these electric light and power companies was 31,663,021,872 kw.-hr., of which 3,225,939,413 was distributed by Canadian companies. In other words, the total output of the electric light and power companies in the United States having an annual output in excess of 100,000,000 kw.-hr. amounted to 28,437,082,459 kw.-hr., which is 65 per cent of the total output of all the electric generating and distributing companies of the country during 1921.

The Commonwealth Edison Company of Chicago leads the country, reporting a total output of 1,928,271,943 kw.-hr. The Niagara Falls Power Company, which took the lead in 1920, is a close second, reporting as its output 1,855,120,000 kw.-hr. The Pacific Gas & Electric Company retains third place and is followed by the New York Edison Company and the United Electric Light & Power Company, these companies submitting a combined report.

The larger electric generating and distributing companies are not confined to any single section of the country but cover a widely scattered area. The Pacific States and the Middle Atlantic States are especially active in the consumption of electrical energy, each of these sections having two companies reporting over a billion kilowatt-hours output. The fifth company serves territory in the North Central section.

PRIVATELY OWNED PLANTS PREDOMINATE

The accompanying tables indicate that with one exception all the companies reporting an output in excess of 100,000,000 kw.-hr. are privately owned. The Los Angeles Bureau of Power and Light is the only municipal generating plant the output of which was in excess of 100,000,000 kw.-hr. The report of the Tacoma Department of Light and Water, the only other municipal generating plant appearing in the tabulation, showed an output of only 95,697,600 kw.-hr. for 1921, although during 1920 it reported an output of 120,598,174 kw.-hr.

It is evident from the data in Table II, on page 830, that the same tendency which was noted in the reports covering the generating and purchasing of the electrical energy of these companies for 1920 again prevailed during 1921. Of the sixty-eight light and power companies operating in the United States only eighteen do not purchase energy, although only four companies purchased more energy than they generated in their own plants. Of the nine electric railway companies only three purchased energy and only one company purchased more energy than it generated. In years past most companies have purchased power from other public utilities only at irregular intervals where there was an abnormal request for energy beyond the rating of their own generating stations. The accompanying tabulation would indicate that such an arrangement is now rather the exception than the rule, and that a majority of the large electric distributing companies are purchasing a high percentage of their total output. Two possible causes for these conditions are applicable. First, many of these companies are able to purchase a large portion of their power from other public utilities cheaper than they can generate it themselves, owing to the facilities for cheap development in the locality, such as water power having been acquired by other generating companies. Second, a comparatively high initial investment in plant and equipment of various kinds is needed to generate the additional power which is purchased. In the first case the arrangement is permanent, while in the second case a lowering in construction and equipment prices as well as a more favorable money market, including a lower rate of interest, will indoubtedly enable a large portion of these companies to construct additional units on their systems and to curtail their purchased power to enough for emergencies only. The latter condition is undoubtedly near to fulfillment and such extensions to generating systems will be undertaken in a large way during the present year.

A few companies were unable to report their output as distributed between that sold for light and power purposes and that sold to electric railways. In most cases the energy sold to electric railways is less than 12 per cent of the total output, but some of the larger companies report a distribution of from 25 to 30 per cent of their total output to electric railways.

Reports from electric railway companies indicate that only nine such companies generated more than 100,000,000 kw.-hr. during 1921.

Table II—1921 Detailed Output and Distribution Data for North American Systems

Section and System	Generated and Purchased Output			Distribution of Energy				
	Kw.-hr. Generated	Kw.-hr. Purchased	Total Output	Light	Power	Light and Power	Railways	Inter-Company Business, Line Loses, Etc.
New England States:								
New England Power Co.	231,376,723	174,602,734	405,979,457	148,469,906	158,391,563	306,861,469	33,277,467	65,840,521
Edison Elec. Ill. Co. of Boston	354,932,800	20,093,155	375,025,955	...	...	274,944,372	9,103,284	90,978,299
Narragansett Elec. Lt. Co.	229,667,000	13,420,000	243,087,000	25,700,000	40,800,000	66,500,000	†24,700	176,562,300
Turners Falls Pwr. & Elec. Co.	154,538,000	16,288,000	170,826,000	...	...	121,800,000	28,500,000	20,526,000
Connecticut Lt. & Pwr Co.	99,594,964	1,534,951	101,129,915	15,139,409	41,297,671	56,437,080	15,913,645	28,779,190
Hartford Elec. Lt. Co.	87,886,000	9,868,000	97,754,000	26,245,000	56,550,000	82,795,000	None	14,959,000
New Bedford Gas & Edison Light Co.	89,857,700	None	89,857,700	7,158,870	55,571,393	62,730,263	12,172,800	14,954,637
Middle Atlantic States:								
Niagara Falls Power Co.	1,855,120,000	None	1,855,120,000	None	1,762,780,000	1,762,780,000	7,592,000	84,748,000
N. Y. Edison Co. and United Elec. Lt. & Pwr. Co.	1,474,664,253	611,800	1,475,276,053	...	...	835,264,723	215,699,939	424,311,391
Philadelphia Elec. Co.	877,047,595	None	877,047,595	184,849,627	306,344,272	491,193,899	265,705,184	120,148,512
Public Service Elec. Co.	805,596,180	15,602,795	821,198,975	175,111,981	255,496,855	430,608,836	211,000,536	179,589,603
Duquesne Light Co.	691,681,650	11,216,335	702,897,985	163,983,494	243,886,732	407,870,226	214,920,589	80,107,170
West Penn Power Co.	516,814,057	15,579	516,829,636	40,360,523	346,401,763	386,762,286	27,884,226	102,183,124
Buffalo General Elec. Co.	57,026,700	422,836,000	479,862,700	94,376,425	243,693,247	338,069,672	70,204,600	71,588,428
Pennsylvania Pwr. & Lt. Co.	358,332,142	84,175,832	442,507,974	42,153,564	299,529,024	341,682,588	...	100,825,386
Brooklyn Edison Co.	438,163,215	724,560	438,887,775	125,880,614	182,137,015	308,017,629	1,947,630	128,922,516
Niagara, Lockport & Ontario Power Co.	79,301,150	335,852,484	415,153,634	None	39,461,473	39,461,473	73,121,456	302,570,705
Adirondack Pwr. & Lt. Corp.	194,447,916	48,922,438	243,370,354	23,621,665	101,677,731	125,299,396	68,154,364	49,916,594
Penn.-Ohio Pwr. & Lt. Co.	202,670,200	None	202,670,200	31,653,290	104,670,487	136,323,777	35,302,566	31,043,857
Rochester Gas & Elec. Corp.	164,891,101	20,589,591	185,480,692	64,524,025	43,813,637	108,337,662	41,478,129	35,664,901
Scranton Electric Co.	106,273,841	11,306,010	117,579,851	21,490,903	58,869,687	80,360,590	19,899,445	17,319,816
Metropolitan Edison Co.	99,575,600	239,600	99,815,200	22,455,000	35,457,000	57,912,000	23,874,000	18,029,200
South Atlantic States:								
Southern Power Co.	740,000,000	50,000,000	790,000,000	...	...	...	...	...
Penn. Water & Pwr. Co.	419,987,000	None	419,987,000	...	...	...	...	...
Consolidated Gas, Elec. Lt. & Pwr. Co. of Baltimore	172,371,114	242,964,500	415,335,614	85,655,448	191,965,911	277,621,359	81,449,895	56,264,360
Georgia Ry. & Power Co.	246,441,001	35,643,976	282,084,977	...	...	175,904,914	52,104,178	54,075,885
Potomac Electric Power Co.	238,023,683	4,888	238,028,571	67,794,243	43,467,901	107,459,477	88,327,569	38,438,858
Virginia Railway & Power Co.	208,323,000	None	208,323,000	Data not available	Data not available	...	Data not available	50,256,000
Appalachian Power Co.	151,500,000	3,000,000	154,500,000	5,000,000	121,300,000	126,300,000	None	28,200,000
East North Central States:								
Commonwealth Edison Co.	1,910,895,009	17,376,934	1,928,271,943	476,907,263	453,633,680	930,540,943	712,683,840	285,047,160
Detroit Edison Co.	897,978,800	1,400	897,980,200	199,992,300	407,225,600	607,217,900	109,030,100	181,732,200
Cleveland El. Illuminating Co	564,819,267	None	564,819,267	110,625,959	257,131,569	367,757,528	123,090,070	73,971,669
Consumers Power Co.	385,363,170	12,451,857	397,815,027	69,217,469	158,855,803	228,073,272	66,335,338	103,406,417
Union Gas & Electric Co.	281,537,273	None	281,537,273	53,763,298	113,571,410	167,334,708	...	114,202,565
Michigan Northern Pwr. Co.	258,249,673	None	258,249,673	None	257,529,473	257,529,473	720,200	258,249,673
Northern Ohio Elec. Corp.	98,408,050	88,841,597	187,249,647	36,896,432	64,791,614	101,688,046	45,162,335	40,399,266
Toledo Edison Co.	179,114,148	7,280	179,121,428	39,947,970	62,465,963	102,413,933	45,150,047	31,557,448
Columbus Ry., Pwr. & Lt. Co.	160,423,240	None	160,423,240	35,856,946	61,374,452	97,231,398	27,624,977	35,566,865
Dayton Power & Light Co.	134,588,457	None	134,588,457	25,914,622	75,333,128	101,247,750	10,945,726	22,394,981
Northwest Utilities Co.	108,030,574	24,758,278	132,788,852	4,207,047	114,440,729	118,647,776	None	14,141,076
Central Ill. Public Service Co	73,436,655	41,151,331	114,587,986	25,319,705	52,956,347	78,276,052	None	36,311,934
Indianapolis Lt. & Heat Co.	108,829,278	None	108,829,278	14,137,553	68,362,023	82,499,576	342,875	25,986,827
Indiana & Michigan Elec. Co	105,593,490	None	105,593,490	15,506,528	59,478,915	74,985,443	11,123,657	19,484,390
West North Central States:								
Mississippi River Power Co.	602,580,980	None	602,580,980	461,545,139	80,321,432	541,866,571	None	60,714,409
No. Am. Co. (Mo. System)	192,302,912	316,590,350	508,893,262	...	...	252,780,921	185,985,858	70,126,483
No. Am. Co. (Wis. System)	315,629,692	59,725,200	375,354,892	...	...	241,086,400	79,526,050	54,742,442
Minneapolis G. E. Co.	373,378,515	None	373,378,515	87,022,320	216,758,966	303,781,286	1,330,652	68,266,577
Kansas City Pwr. & Lt. Co.	196,802,630	7,949,974	204,752,604	...	...		...	44,024,281
Great Northern Power Co.	204,290,060	106,800	204,396,860	43,921,493	108,161,309	152,082,802	18,347,017	33,967,041
Kansas Gas & Electric Co.	110,728,300	19,751,600	130,479,900	22,590,127	72,417,823	95,007,950	None	35,471,950
Nebraska Power Co.	127,758,800	None	127,758,800	37,630,000	55,081,700	92,736,311	None	35,022,480
Empire District Elec. Co.	89,206,990	15,480,550	104,687,540	**64,830,000	23,226,000	88,056,000	None	16,631,540
East South Central States:								
Alabama Power Co.	429,112,940	3,878,600	432,991,540	8,227,766	***362,242,465	370,470,231	...	62,521,309
Tennessee Power Co.	340,819,926	2,129,000	342,948,926	694,082	303,620,636	304,314,718	None	38,634,208
West South Central States:								
Fort Worth Pwr. & Lt. Co.	163,286,500	None	163,286,500	15,207,001	42,750,270	57,957,271	None	105,329,229
Texas Pwr. & Lt. Co.	55,662,000	101,189,213	156,851,213	23,355,832	63,345,065	86,700,897	None	70,150,316
Mountain States:								
Montana Power Co.	572,277,989	None	572,277,989	24,069,740	350,854,376	374,924,116	‡100,070,699	97,283,174
Utah Pwr. & Lt. Co.		...	362,908,000	51,345,244	181,849,077	233,194,321	None	129,713,679
Idaho Power Co.	185,409,550	4,805,705	190,215,255	61,861,232	68,013,811	129,875,043	None	60,340,212
Colorado Power Co.	112,749,178	1,055,866	*113,805,044	3,999,312	20,653,693	24,653,005	6,422,400	82,729,639
Pacific States:								
Pacific Gas & Elec. Co.	1,266,179,450	222,909,207	1,489,088,657	143,675,405	496,937,216	640,612,621	240,612,977	607,863,059
Southern Calif. Edison Co.	1,079,144,624	145,573,572	1,224,718,196	134,599,562	504,254,192	638,853,754	271,422,279	314,442,163
Great Western Pwr. Co.	487,688,821	2,895,436	490,584,257	40,104,505	272,638,510	312,743,015	27,317,345	150,523,897
Puget Sound Pwr. & Lt. Co.	351,429,649	67,767,932	419,197,581	...	...	326,008,062	33,426,822	59,762,697
San Joaquin Lt. & Pwr. Corp.	395,398,090	776,600	396,174,690	30,560,682	200,567,585	231,128,267	4,389,219	160,657,204
Washington Water Pwr. Co.	374,378,300	None	374,378,300	70,288,672	227,433,923	297,722,595	14,820,528	61,835,177
Los Angeles Bureau of Pwr. & Light	201,585,412	98,768,394	300,353,806	10,697,359	224,656,265	235,353,624	None	65,000,182
Portland Ry. Lt. & Pwr. Co.	297,950,100	564,471	298,514,571	38,116,223	106,831,179	144,947,402	28,070,837	125,496,332
Southern Sierras Pwr. Co. and Nevada-California Pwr. Co	194,043,965	5,409,000	199,452,965	3,428,691	129,766,654	133,195,345	None	66,257,620
California-Oregon Pwr. Co.	129,368,808	3,722,799	133,091,607	9,754,925	27,151,855	36,906,780	None	96,184,827
Northwestern Elec. Co.	110,769,014	3,144,321	113,913,335	14,425,440	71,852,860	86,278,300	None	27,635,035
Tacoma Dept. of Lt. & Water.	93,993,430	1,704,170	95,697,600	24,559,417	40,049,608	64,609,025	1,119,100	29,969,475
Canada:								
Montreal Lt., Ht. & Pwr. Consolidated	696,575,624	210,655,949	907,231,573	...	...	870,000,000	37,231,573	...
Shawinigan Water & Pwr. Co.	558,710,340	304,413,900	863,124,240	...	...	751,188,640	21,000,000	90,935,600
Ontario Power Co.	825,115,600	None	825,115,600	...	...	...	...	...
Toronto Power Co.	630,468,000	None	630,468,000	...	...	516,279,650	100,039,900	14,148,450
Western Pwr. Co. of Canada.	122,684,800	None	122,684,800	...	...	7,516,690	None	115,168,110
Electric Railway Companies:								
Interboro Rapid Transit Co.	846,470,680	16,988	846,487,668	None	200,000	200,000	750,516,229	95,771,439
Bklyn. Rapid Transit Co.	383,009,325	None	383,009,325	None	None	None	383,009,325	None
Phila. Rapid Transit Co.	100,129,193	233,093,593	333,222,786	None	None	None	333,222,786	None
Boston Elevated Ry. Co.	223,061,330	None	223,061,330	None	None	None	223,061,330	None
Pa. R.R. Co., L. I. Pwr. Plant	201,818,905	103,305	201,922,210	4,599,120	None	4,599,120	197,323,090	None
N. Y. Central R.R. Co.	149,275,239	None	149,275,239	...	...	...	...	...
Twin City Rapid Transit Co.	145,517,164	None	145,517,164	None	None	None	145,517,164	...
Kansas City Rys. Co.	129,804,772	None	129,804,772	9,995,442	8,055	10,003,497	11,996,868	107,804,407

*Includes 1,037,946 excess by consumers in parallel **Includes sales to other companies ***Includes sales to other public utilities †December only
‡Includes 92,593,440 kw.-hr. sold to electric railways.

Outlook for Wiring Supplies in Spain and South America

Some Export Figures and What They Mean — Present Conditions and the Market for Wire and Cable, Railway-Line Material, Wiring Devices, Meters, Instruments, Lamps and Household Appliances

By PHILIP S. SMITH[*] and A. H. KELEHER[†]

THE basis of all foreign trade must be a knowledge of the desires and preferences of the peoples of the distant countries and an understanding of the conditions that exist there. Through the co-operation of a number of men of broad personal contact and experience with those far-off lands that offer to America's electrical industry its most favorable opportunities for export selling this series of articles is being written, in the hope that it may sketch a useful picture of the way that business overseas must be built up. A previous article discussed the market prospects for electrical apparatus in Latin America and Spain. Articles to come will deal with Europe and the Far East and also discuss some of the problems of distribution and personal selling abroad.

IT IS an interesting fact worth some consideration that the electrical goods sent from the United States to Spain, Latin America and other Spanish-reading countries formed one of the few items of our exports of which the value in 1921 was not less than the figure for the year 1920. The total electrical exports for these two years, compared with the fiscal year ended June 30, 1914, the last normal year, show an increase of 240 per cent, the actual figures being $10,194,964 in 1914, $34,456,554 in 1920 and $34,719,906 in 1921. Of these totals the portion applying to supply material, in so far as it is listed separately in government statistics, is given in the accompanying table.

Much of the benefit of a study of these statistics is lost, however, because of the item "All other" in the export figures, under which is hidden a large quantity of our supply material. This figure for 1914 was given as $3,736,630; for 1920 it was $9,476,349, and for 1921 it was $9,523,737. All classes of electrical material undoubtedly shared in these increases, although batteries, lamps, wiring devices and insulated wire and cable enjoyed the greatest percentage of improvement. The totals for 1920 and 1921 are unusual, and it is not expected that they will be approached in 1922. It is safe to assume, however, that the sales will not be below those of 1913, and the present indications are that they may go considerably higher. In either case the percentage that can be supplied by American manufacturers, if they desire the business, is much larger than in that year by reason of the more widespread familiarity in these countries with our products and the better facilities now existing for developing and handling trade.

ELECTRICAL SUPPLY MATERIAL EXPORTED FROM UNITED STATES TO SPAIN AND LATIN AMERICA

	1913–1914	1920	1921
Batteries	$172,971	$2,209,394	$1,381,171
Fans	165,905	590,252	468,003
Heating and cooking devices	*	599,207	721,240
Insulated wire and cable	1,314,314	4,717,822	3,431,621
Wiring devices	188,416	1,530,780	1,064,033
Incandescent lamps—metallic filament	146,450	2,182,747	2,245,452
Meters and instruments	172,862	698,425	777,479
Rheostats and controllers	*	874,102	309,483
Switches and accessories	*	1,145,381	1,106,623
Telephone material	645,595	1,478,178	1,391,389
Totals	$2,806,513	$15,926,288	$12,896,494

* Not listed separately in 1913-1914.

The outlook for the sale of all materials entering into the final distribution of light and power to these distant consumers seems extremely bright. Stocks on hand are in many instances very low, on account of the recent general policy of hand-to-mouth buying, and will have to be replenished. Additional demand is originating from the increasing activity in the construction of offices and homes after several years of almost complete cessation.

Political conditions are also satisfactory, with little likelihood of any serious disturbances, while the large amounts of loans made to various governments and municipalities during 1921 and 1922 offer good evidence of their basic economic soundness. The recovery of business and purchasing power is dependent more upon the demand for their own products than upon any needed internal readjustment. Industrial revival in the United States and Europe will bring greater exports of raw materials from Latin America, with resultant improvement in exchanges and counter demand for manufactured goods. This upward tendency has been felt already and is now being reflected in various ways in our export trade, and the electrical industry should be one of the first to participate in this permanent revival. A definite program for securing a fair share of this market should therefore be decided upon and put into effect at once.

WIRE AND CABLE

Spain as a purchaser of foreign wire and cable is less important than Latin America for the reason that its own factories supply much of the home demand for everything except a few very special types such as enameled wire for manufacturing purposes. One of the most attractive openings left to American houses is for bare copper trolley and transmission lines and the wire bars for local drawing.

Brazil, Mexico and Cuba are good markets which may be expected to open up again during the coming year. In these and the other South American countries, except Argentina, Uruguay and Chile, the American manufacturer enjoys the advantage of having his regular types recognized as standard by a majority of

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SPECIAL PARK AND FLOODLIGHTING IN LIMA, PERU, AN EXAMPLE OF SOUTH AMERICAN PRACTICE

the large users. In the three countries last named there is competition from European wire with insulation different from that used by us and marked in millimeter sizes. But these are not insuperable obstacles, and with rare exceptions American wire and cable is accepted and employed freely for all purposes.

Sales are facilitated greatly if stocks are carried locally to supply the requirements for immediate shipment. In the small sizes it is highly desirable to furnish the wire in 100-m. lengths and in metric dimensions.

Railway Line Material

The line material used by many trolley systems in these countries differs radically from that which is standard in the United States, and this fact sometimes hampers our representatives abroad. The roads do not like to mix several types and will not change from the ones to which they are accustomed except under great provocation. If reproductions can be offered at comparable prices, the way will be much easier. Otherwise it becomes a question of insistence and salesmanship to land an order for our standard goods. Considering the amount of such materials handled each year, however, it is business worth trying hard to get. Transmission lines are being extended continually, creating a demand for all types of pole-line hardware, insulators and even poles themselves. Telegraph and telephone systems form an ever-widening network over all of the countries, and these add to the opening for material of this general character.

Wiring Devices and Supplies

In Argentina the European types of wiring devices have gained a strong foothold, and American types, although selling in fairly large numbers, must be pushed vigorously to succeed. In Brazil, Cuba and Mexico, however, the conditions are much more favorable to standard American types which sell freely, often in preference to European devices.

The situation in Spain is made difficult owing to local manufacturers and the proximity to producing countries. In other days German exporters were in close touch with conditions and by means of rapid deliveries and local stocks were able to dominate the market. But, fortunately for American manufacturers, their products have been the only ones seen on sale for several years, and consequently they have received a splendid introduction to both dealer and consumer. The fact that they are of superior quality has been borne in upon those who have handled them during this period, and they now have a certain clientèle which will continue to buy them, if our efforts are not relaxed, in spite of competition from lower-priced material that is again making its appearance.

Meters and Instruments

There are still a large number of circuits in South American countries wholly or partially operated on the flat-rate plan. Except in the very smallest installations, however, the inclination is to adopt the use of house meters, thus increasing the already large demand created by the continual growth in the number of individual consumers connected to the central-station lines. European types of meters have proved very popular, partly because of their price and partly because they have been made with cyclometer or direct-reading dials. They suffer by comparison in quality with American meters, however, and on this basis, aided by intelligent and persistent distribution effort, the latter are gaining in favor with all the important central-station companies.

Switchboard instruments have a continuous outlet because many panels are made up locally for the power plants in mines, industrial establishments or small towns. They are carried in stock in the more salable ratings by all electrical dealers.

Incandescent Lamps

European lamps have always enjoyed a reputation throughout Latin America for better quality and longer life than those of American manufacture. Whether this discrimination is deserved or not, it will take the same kind of propaganda to overcome it that has put the European lamp in the front rank of consumer popularity. This consisted of extensive advertising over a period of several years, the manufacture of the popular sizes in round bulbs, with filament arranged to give an especially white light (which is decidedly preferred to the pear-shaped lamps), and the maintenance of large stocks from which the dealer can be supplied on short notice. These and other minor but well-conceived sales helps were very influential in the formation of favorable public opinion. They suggest the way to be followed by others who would introduce new makes in competition with the old, familiar ones.

Competition is going to be felt from domestic as well as from other European lamps, particularly in Spain, where until last year, when Dutch and British lamps again appeared in quantities, importations had dropped to less than 10 per cent of pre-war figures because of increased domestic production. Lamps are being made also in Brazil and Argentina, but the home product has not yet reached proportions that threaten the foreign trade with serious curtailment. This production will not take place in Argentina until a stronger and more experienced organization enters the field, and none is in sight at the present time. In Brazil there is a small but modern factory, equipped and managed in the American way, which expects to dominate the market when in final running order.

Public lighting in the more progressive centers is undergoing a radical change which will bring it into line with the best practice known in the United States. Arc lamps are being retired from service as they wear out and need repairs or with the deliberate intention of scrapping them to make way for the installation of high-power incandescent lamps. Hand in hand with this movement goes the increased demand for ornamental standards, reflectors and special glassware appropriate for this service.

A large increase in this field can be looked for owing to the increased use of the pleasure automobile, which brings in its wake good roads and boulevards.

Fan Prospects

Electric fans are growing in favor each year, and it is largely inferior merchandising methods that limit the number sold in the large cities. They will become one of the best selling lines if they can be got into the homes and not, as now, confined to offices and business houses.

The temperature in some of the countries under consideration is such that a fan, once acquired, would be used throughout the year, while in every country the summer months would be much more enjoyable with one or more in the house. The old conservatism which has up to now been set against the electric fan is breaking down, and any efforts expended in this direction should in the long run reap a good reward.

Especial attention must be paid to the manufacture of fans, as well as other small apparatus, for operation on 220-volt circuits. They should be of all types, oscillating and stationary, for mounting on walls and desks. Ceiling fans also have a large degree of popularity for offices and restaurants. The finish is important, nickel being preferred to the all black which is so commonly put out.

Heating and Cooking Devices

Few household devices have taken a strong grip upon these markets, and the reasons ascribed is the manner of living to which the people are accustomed. However, flatirons and small stoves are in good demand, and toasters, coffeepots and hot-water heaters show unmistakable signs of growing in use from year to year.

In Argentina, Brazil and Spain there is considerable competition from local manufacturers of heating and cooking devices, whose product, although better than some of European origin, is not so good as the American either in appearance or quality. It finds a market among the middle-class trade on account of the lower prices at which it is sold, but the more well-to-do purchasers prefer the imported devices in appreciation of their superior operating characteristics.

Cooking untensils are not especially popular as yet, but small-space heaters ought to have a good field both in Spain and the southern countries of Latin America, as well as in Mexico and the tropical countries of Peru and Bolivia, for climatic conditions in these countries render some heat in the winter months very desirable.

The market for labor-saving appliances, such as vacuum cleaners, clothes washers, dishwashers and ironing machines, is not at all favorable at present. Because of the cheapness of domestic labor the South American shows but small desire for household equipment of this kind and the Spaniard is little more accustomed to it and the market will develop slowly.

AN ELECTRIC SHOP IN SAO PAULO, TYPICAL OF THE BETTER CLASS OF STORES ON THE SOUTHERN CONTINENT

Flashlamps and Batteries

Flashlamps and dry cells are universally used in both Latin America and Spain. Those made in the United States have been much more successful than any others, with the single exception of one well-known type of European dry cell. This type, which is of undisputed quality, is also relatively high in price and consequently finds its sales confined to a small proportion of the total.

Local competition is present again in the sale of these articles, but the domestic product seen thus far has proved inferior in every way and much is not expected from it under the present conditions of manufacture. It seems possible that improvements will be made in the appliances and that they may at some time really compete for first place in the local markets. Until then American makes will continue in the lead.

The Matter of Design

The question is often asked whether an American manufacturer should make up goods especially for foreign trade without regard to the standards existing in the United States. There are several such articles—notably light-weight iron conduit, wire with special insulation and a cheap type of lamp socket—which now enjoy a large sale in South America because the users want them. Whether or not these lines are to be made in the United States would seem to depend upon whether they can be produced at a cost as low as the cost in other countries. If not, then there is no advantage to be gained from their manufacture, since the product would have no particular merit to justify a higher selling price, whereas with the standard design the better quality can be urged in support of the higher price. Each manufacturer must decide for himself on this basis how far he wishes to go in the direction of special export design where it is a factor in this market.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Voltage Regulation of Long Lines

To the Editors of the ELECTRICAL WORLD:

In Frank G. Baum's article in the August, 1921, *Journal of the American Institute of Electrical Engineers* on the subject of "Voltage Regulation and Insulation for Large-Power Long-Distance Transmission Systems" the claim of novelty is advanced. The writer believes that a reference to his paper in the ELECTRICAL WORLD for Aug. 10, 1912 (Vol. 60, pages 311-313), entitled "The Propagation of Electric Energy by Standing and Traveling Waves," will show that in several points his work anticipates that of Mr. Baum. In particular, the writer's Fig. 8 and the formula near the end of page 313 should be compared with Mr. Baum's Fig. 5 and the tabulated data of line constants.

It is not claimed that the system of power transmission proposed by Mr. Baum is the same as that proposed by the writer. It is claimed, however, that the prior article shows the equation between loading, current and voltage which gives a traveling wave, and that a traveling wave results in substantially constant voltage the whole length of the line.

Mr. Baum advances the claim that the natural periodicity of the line may be neglected. This may be conceded so long as the synchronous regulators remain on the line. However, if these regulators hunt, or if the breakers connecting them to the line open, and the line is not sectionalized, then there would be a resonant condition that would be dangerous. The line discussed in Mr. Baum's paper is only 50 miles longer than a "quarter-wave line," and Dr. Steinmetz proves in his "Transient Electric Phenomena," pages 306-319, that such a line regulates for a constant current at its distant end. Therefore, at light loads, either the synchronous regulators must be kept on the line or the line must be sectionalized, otherwise the far end of the line will be subjected to excessive voltage stress.

These abnormal voltages are due to the reflection of the outgoing electric waves at the far end of the line, which form standing waves, in combination with the outgoing waves. There are in reality only two remedies: (1) Load the line at all times in such a manner that the characteristic impedance of the line is equal to its terminal impedance; (2) load the line in such a manner that the surge is harmless—*i.e.*, make it a half-wave line. The first is Mr. Baum's proposal, the second was that of the writer.

The cost of synchronous-regulator loading (for traveling-wave propagation) increases with the length of the line and with the voltage. The cost of half-wave loading should decrease with these factors, being zero for a 1,500-mile line at 60 cycles. For 220,000 volts and 800 miles the writer believes that Mr. Baum's proposal is the cheaper, with a rather close margin.

Since the issue of safety has been raised, it should be stated that the writer has no doubt that proper precautions will solve the difficulty. The natural attenuation in 1,600 miles of line will help, corona will help, and sectionalizing should remove the danger. There is no positive reason why synchronous regulators should not run stably on the line except a possible defect in synchronizing power.

The following curious application of the theory of wave propagation may or may not have a bearing upon the question:

The velocity of propagation of a wave is given by the following formula, where L and C are the line constants including loading: $V = 1/\sqrt{(LC)}$. When the line is unloaded the velocity is aproximately 180,000 miles per second. When series inductive and parallel capacity loading is used the velocity is less than the above. However, with parallel synchronous regulator loading, operating inductively, as in Mr. Baum's proposal on light loads, the velocity appears to be greater than that of light itself.

JOHN F. H. DOUGLAS.

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Grounding Chains Burned at Links, but Carried Short-Circuit Current

To the Editors of the ELECTRICAL WORLD:

I have read with great interest the article by Alfred Herz on grounding chains appearing on page 177 of the ELECTRICAL WORLD for Jan. 28, and also your editorial comment in the same issue on page 169. Possibly some of the experiences which I had with grounding chains while attached to the Royal Engineers in France during the world war may be of interest to the readers of your paper.

On one occasion a mistake was made as to the particular section of line which should be "killed," and a grounding chain was thrown over a live 13,500-volt, three-phase line, the bottom end of the chain being well earthed before throwing. The chain, which was made of brass, stood up well under the short circuit, showing signs of burning only at a few links. The fuses in the nearest substation "blew" almost immediately. The man who threw the chain was badly scared but not killed.

On another occasion some line work had just been completed alongside the main substation, in which I was doing some work. I asked the line gang to leave the grounding chain on the line, saying that I would clear it when finished. This I forgot to do, and closed the main oil switch feeding the shorted and earthed line. One set of high-tension feeder fuses blew, and the main oil switch opened. I reached the outside of the substation in time to see a shower of sparks from the grounding chain, which this time was badly burned at several links and almost fused through where it crossed the live wires.

The chain was known as "heavy brass plumbers' chain" and had links $\frac{3}{4}$ in. long of about No. 16 gage brass. It is flexible, portable and easily thrown, and in the instances mentioned it certainly had enough current-carrying capacity to clear the line at any rate.

NELSON JONES,
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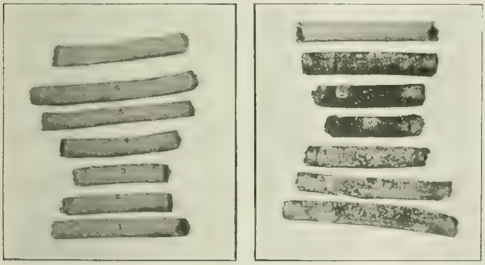
Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Station Wiring Adequately Protected by Fireproofing Liquid

THE successful fireproofing of substation wiring by applying a liquid to the insulation was recently demonstrated in a series of tests made by the Puget Sound Power & Light Company on a number of samples of cables. The results were very satisfactory and prove that the expensive method of applying asbestos covering to wiring for protection against fires can in most cases be dispensed with.



ADEQUATE PROTECTION AFFORDED STATION WIRING BY FIREPROOFING LIQUID

Left—Specimens before tests. Right—Appearance of cables after tests made with arc and flaming transformer oil.

The principal objects of the tests were (a) to determine if the ordinary flame-proof braiding on cables would prevent the destruction of insulation when subjected to an electric arc, (b) to determine the effect of an arc on oil-saturated untreated flame-proof braiding over varnished-cambric insulation, (c) to determine the degree of protection against fire from flaming oil that would be obtained by applying fireproofing solutions now on the market to flame-proof braiding.

The tests were made on specimens of large cables having $\frac{7}{32}$-in. and $\frac{13}{32}$-in. varnished-cambric insulation and two layers of white flame-proof braid. To each of the treated samples before being tested were given two coats of fireproofing fluid and one coat of finishing fluid. Arcs were established with the conductor through holes bored in the insulation.

In the case of the untreated samples each time the arc was established the flame-proof braid and insulation near the hole would burn slowly for periods varying from one to two minutes, but it was not possible to establish an arc that would consume the insulation. Cold transformer oil was then poured over the entire surface of the specimen and the arc re-established. It immediately burst into flame and the fire consumed the entire insulation.

When an arc was established in the hole of a treated sample practically no carborization took place. The specimen was then saturated with oil. When the arc was established the insulation around the hole burned less than two minutes, after which time the flame extinguished itself, with very little resulting damage to the insulation.

A specimen of untreated cable was mounted on supports several inches above the floor, and transformer oil was heated in a babbitt ladle until it flamed, and then poured over it. The entire specimen was immediately enveloped in flame and continued to burn at a rapid rate until it was seen that the insulation would be completely destroyed. A treated specimen was then tested in a similar manner, and even on three applications of the flaming oil no combustion of the insulation took place. A gasoline blowtorch was then applied to the oil remaining on the cable near each end, but no combustion took place. The braid was scarcely injured at all.

The tests showed conclusively that station wiring having two flame-proof braids can be effectively fireproofed against flaming oil by the application of fireproofing fluids. They also show that it is not necessary to resort to the expensive methods of wrapping asbestos tape over the braids and applying the fireproofing fluids to the tape.

There are, however, some situations where the asbestos tape is highly essential, and when these are encountered it should be used.

S. C. LINDSAY,
Electrical Engineer.
Puget Sound Power & Light Company,
Seattle, Wash.

Characteristics of Rural Load Fed by 6,600-Volt Line

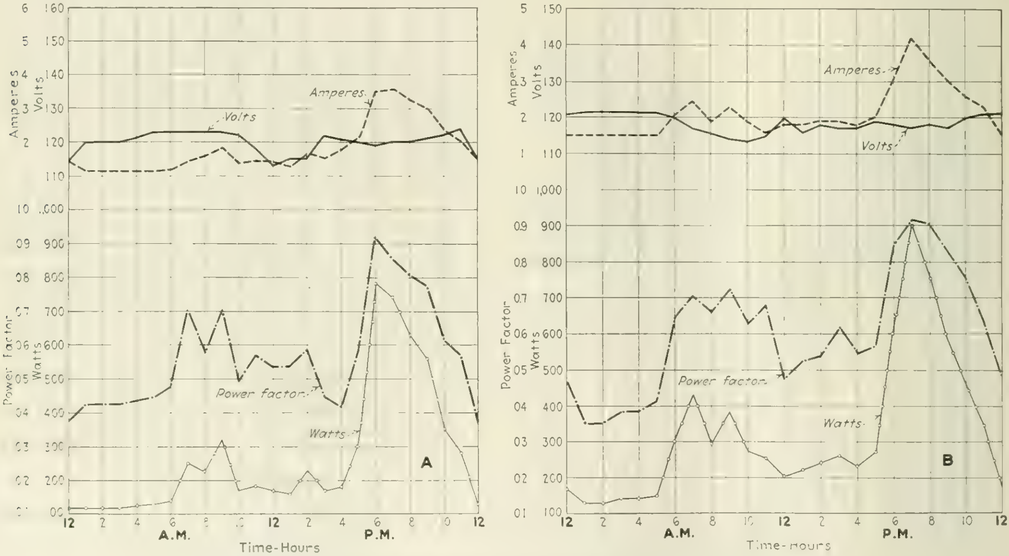
OPERATING conditions on an Iowa farm line were studied in the early part of 1921 by the engineering extension department of the Iowa State College at Ames to note the variation of load, voltage and power factor over a twenty-four-hour period.

The testing equipment was placed at Adel, Iowa, on a 6,600-volt, 60-cycle line of the Adel Light & Power Company. The line is 22 miles long, including branches. No. 6 hard-drawn copper is used throughout. Thirty-nine farm installations are connected, including the county farm, besides the town of Minburn, farthest away, with a population of about 450. Readings were taken from Jan. 1 to April 21, with some short interruptions. There are in all thirty-two transformers connected, representing a connected capacity of 165½ kva. Fifteen of these are of 5-kva. capacity, besides two of 15 kva. and one of 25 kva. which serves Minburn. Motors connected represent approximately 50 hp. or 60 hp., with about 20 hp. used for grinding and sawing purposes.

A continuous fluctuation of almost 1 amp. and lasting from fifteen minutes to one hour shows at several places on the ammeter chart. This was caused by a 15-hp.

motor at the county farm used for sawing wood. It may be of interest to know that the ratio of the current transformer was one to one, so that there was the same fluctuation on the 6,600-volt side. According to figures obtained from the company, there were 3,684 kw.-hr. consumed monthly at Minburn during the test. This, estimating thirty days a month, represents a constant load of 5.116 kw. With 25-kva. transformer capacity connected the capacity load factor is 20 per cent. With the above consumption representing roughly 60 per cent of the total, a 20-kva. transformer would safely take care of the load.

The average current during the test was 2.3 amp. and the average voltage was 116.8 volts, while the average power factor was 0.583. The transformer core loss and line loss represented a total monthly loss of approximately 1,504 kw. With the watt-hour meter indicating a monthly consumption of 6,320 kw.-hr., this is a loss of 23.8 per cent. The load factor for the line is 39 per cent, taking the maximum power for fifteen minutes each day during the peak load.



CURVES SHOWING LOAD CONDITIONS ON RURAL DISTRIBUTION SYSTEM IN IOWA

A—Typical Saturday load. The Sunday load is very similar to this. B—Typical weekday load.

The variation in power factor follows very closely the variation in load. In the early hours of the morning, when the load is practically all losses, the power factor drops to 0.3 in some cases. As additional load comes on in the morning the power factor rises and varies with the load, falling off again during the noon hour. One interesting fact which, of course, will be more striking in the winter time is that a dark, cloudy day can be readily distinguished, especially in the morning, for the power factor will be much higher owing to the lighting load. The peak load will, of course, come on earlier in the morning and be greater on a cloudy day.

These data were submitted at a meeting last summer of the Iowa Section of the National Electric Light Association. FIELD EDITOR ELECTRICAL WORLD.

Chicago, Ill.

Old Defective Tie Switch Gives Peculiar Trouble on 66,000-Volt Line

WHEN testing out a 66,000-volt line after a very severe storm last summer an unusual trouble was encountered. Although it was thought that all defective insulators had been replaced, a surging current resulted when voltage was built up on the line.

The system at the time of the trouble consisted of two 66,000-volt, three-phase lines, approximately 40 miles long, both circuits being on the same tower. The lines were connected delta-delta throughout and ungrounded. At the far end of the system there was a set of disconnecting switches which allowed tying both lines together. These disconnecting switches are of the strain type, supported entirely by suspension insulators; one vertical string of insulators supports each end of a switch, and a horizontal string in the line of pull holds the hinge end of the switch at the proper distance from the jaw end. This last string of insulators is parallel with the switch blade when in the closed position. The disconnecting switches are usually open and were open at the time that the trouble occurred on the system.

During a severe electrical storm one of these lines developed considerable insulator trouble, and after the storm it was repaired. The usual method of testing a line after a repair is to connect a generator and transformer to the line without voltage on the generator and then gradually building the voltage up to about 110 per cent of normal. In case the line still shows bad performance, this does not cause a disturbance on the rest of the system.

This method was followed in the case in question. On raising the voltage of the generator it was noticed that the ammeters on the transformer and generator were swaying badly. This applied to only one phase. As the voltage was not above 20 per cent of normal and the ammeter on only one phase showed a reading, it was realized that the trouble was not a short circuit. The voltage was reduced to zero and built up to 20 per cent of normal with the same result every time it was done.

At this time a message came in over the telephone from the substation operator at the end of the line, stating that the trouble was caused by the breaking down electrically of one string of insulators across the open tie switch in his yard, allowing the live 66,000-volt line to feed through this string of insulators back to the line under test. The attention of the operator was called to the trouble by the flashing of the arc through the insulator. As the generator would swing into phase with the rest of the system, this phase of the winding would tend to oppose the line voltage. As it swung 180 deg. out of phase the current would read its maximum, owing to the capacity effect of the generator and transformer windings and line wires and to the leakage loss over the insulators of the other phase wire. After this trouble was discovered the insulators on the disconnecting switch were replaced and the line was tested "O.K." at 10 per cent overvoltage.

If this line had been thrown on the system, there would have been no indication of trouble on this string of insulators as the voltage on each side of the insulators would have been the same. L. A. Fitts.
Turners Falls, Mass.

Peculiar Behavior of Rotary Converters

The suggestions by T. F. Barton published on page 385 of the Feb. 25 issue of the Electrical World as to the causes of the rotary-converter trouble, described in my recent article (page 289 of the Feb. 11 issue) are very much to the point. However, the following are the facts in the present case:

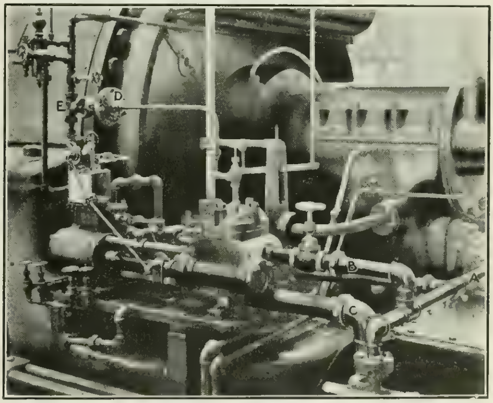
The brushes used on these machines were "prescribed" by a brush engineer about nine years ago and were very satisfactory, never giving trouble, until about three years ago, as described in my article of Feb. 11. The commutation on these machines is so nearly perfect that no sandpaper, oil or lubricant of any kind is ever used, and there is a total absence of sparking at all loads. Neither is there any oil on the commutator or brushes from any source. The slots are standard width, about 0.028 in. to 0.030 in.

The most puzzling fact is that the machines will operate indefinitely at full load, or the direct-current load can be taken off and the machines run idle, faultlessly in either case, as long as they are kept rotating by the supply of alternating-current energy. But if alternating-current energy is interrupted and the machine is allowed to slow down even enough to let the direct-current voltage drop to zero, and then is again brought up to speed, it will develop "shorts" in the commutator slots. In most cases this occurs after machines have been standing still for from five minutes to two hours, but in some cases it happens before rotation has stopped.

A rotary-converter expert sent by the makers of the machines, after seeing their action, admitted that he had never seen or heard of anything like it and could give no explanation whatever of the cause of the trouble, and the only remedy suggested was to chamfer off the edges of the bars—what Mr. Barton terms "V-ing." This, coupled with great care in starting, has enabled us to avoid hot coils, but we are still unable to determine the real cause of the trouble. E. C. Channing.
Niagara Falls, N. Y.

Automatic Lubricating Auxiliary Pump for Safe Turbine Operation

The insurance of constant lubrication for high-speed turbine bearings is of the utmost importance as the turbine will not operate for more than a minute without pressure lubrication. In modern turbines an auxiliary oil pump is included as standard equipment, but in some types of turbines proper lubrication depends entirely upon one rotary-pressure pump. In order to increase the factor of safety of two 1,500-kw. turbines made by the General Electric Company, the Galveston & Houston Electric Railway Company at its Webster power station so connected the auxiliary pumps which are mounted on the frame of each turbine convenient to the discharge gear pump as constantly to have the main pump pressure on the oil cylinder of the auxiliary.



AUXILIARY PRESSURE PUMP AFFORDS ADEQUATE PROTECTION TO TURBINE BEARING

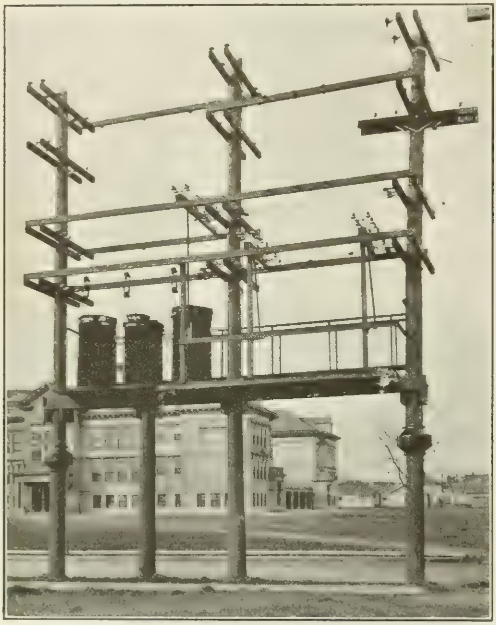
The piping for this layout is shown in the accompanying illustration in which *A* is the discharge of the main pump, *B* the discharge of the auxiliary, *C* the auxiliary intake and *D* the diaphragm governor. Under normal operation the pressure on the diaphragm governor is the same as at *A*, and the spring of *D* is set at a pressure slightly less than that of the oil. In case of failure of the gear pump, the pressure on the diaphragm cylinder falls off and allows the spring to operate the steam-inlet valve *E*, and start this auxiliary pump, which maintains the pressure on the bearings.

The diaphragm governor is usually set so as to keep the steam entirely cut off at normal operation, though it is good practice to have the steam valve slightly open and keep the auxiliary moving just fast enough to keep the cylinder hot and get rid of the condensate.

This method of putting an auxiliary oil pump into service is not necessarily restricted to turbine lubrication but may be used wherever pressure lubrication is employed. J. F. Usener.
Galveston & Houston Electric Railway Company,
Houston, Tex.

Pole Guards Bar Mischievous Boys

IN ORDER to prevent the inquisitive small boy from climbing the poles which support the transformers and other apparatus of the outdoor substations of the Northwestern Electric Company, an unusual device called a safety door has been evolved and has proved effective. The doors are built of sheet iron with a swinging door which may be locked shut or opened to permit a lineman to ascend the pole.



SMALL BOYS FIND IT IMPOSSIBLE TO CLIMB PAST THE GUARDS ON POLES

Northwestern Electric Company,
Portland, Ore.

E. F. PEARSON,
Engineer.

Cost of 1921 Extension $100 per Kva.

COST data available upon a 12,500-kva. addition to a steam-driven central station in eastern New England are given below, the total outlay being approximately $1,251,000, excluding land. Two 755-hp. water-tube boilers, piping, condensing equipment, building extensions, steel stack and electrical apparatus necessary to the above increase in plant capacity are included. Cents are omitted.

Engineering cost	$43,423
Services of construction engineers	91,926
Office at works, etc.	15,192
Insurance	9,113
Temporary construction	27,427
Shrinkage in construction equipment	1,267
Station yard	15,757
Building	226,794
Equipment foundations	18,505
Boiler plant	76,457
Draft system	30,157
Condenser system	125,762
Piping and covering	56,431
Coal and ash-handling installation	85,159
Turbo-generator equipment	215,649
Station transformers	20,502
Switchboard and wiring	97,531
Auxiliary equipment	24,999
Machine shop	1,256
Machine-shop equipment	8,596
Testing and preliminary operation	7,362
Local expenditures on job	15,239
Interest during construction	36,774
Total	$1,251,288
Cost per kva.	100

Boston, Mass. **FIELD EDITOR ELECTRICAL WORLD.**

Water-Tube Type of Arrester Compares Favorably with Others

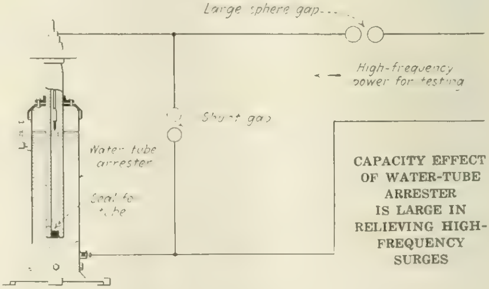
THE water-tube type of lightning arrester compares most favorably with other standard types of protective devices for relieving high-frequency discharges on transmission lines. The results of tests made under the personal supervision of the writer also indicate that with this type of arrester the capacity effect in relieving high-frequency surges is greater than anticipated.

The object of these tests was to determine as accurately as possible with the available equipment the comparative impedance to high-frequency and high-voltage surges which is imposed in the discharge circuit by the standard makes of lightning arresters. Three different types of arresters were tested, two of the electrical valve type and one of the water-tube type. The testing equipment provided a potential estimated at 350,000 volts at a frequency of about 270,000 cycles per second.

Each arrester was in turn connected in series with a large sphere, as shown in the accompanying illustration. The voltage was then brought up to such a value that 0.5 amp. would flow through the arrester. In order to measure the voltage drop across the arrester under this condition another gap of 3-in. spheres was shunted across it. This gap was adjusted until it would just arc over when 0.5 amp. was flowing through the arrester, and the length of the gap under this condition indicated what the voltage was across it. The equivalent setting of this gap for each arrester was:

A. Valve type, oxide film, 0.44 in.
B. Valve type, aluminum cell, 0.25 in.
C. Water-tube type, 0.25 in.

A further test was then made to determine the amount of condenser effect secured by the water-tube arrester. The lower end of the porcelain tube was completely sealed so that no current could pass directly through the apparatus. The tube and tank were then filled with water to the usual levels, as shown in the illustration, and with 34 in. of tube submerged. The tests were then repeated. The shunt gap in this case was 0.44 in., indicating a capacity effect in relieving high-frequency surges that was greater than expected.



CAPACITY EFFECT OF WATER-TUBE ARRESTER IS LARGE IN RELIEVING HIGH-FREQUENCY SURGES

Alabama Power Co.,
Birmingham, Ala.

GEORGE H. MIDDLEMISS,
Superintendent of Distribution.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Some Significant Attendance Data on Cleveland's Electrical Homes

Detailed Figures Covering the Number of Daily Visitors at Three Different Homes Indicate the Keen Public Interest in This Countrywide Movement

CONCLUSIVE proof of the far-reaching educational value of electrical homes and the ready sale of the houses used for the demonstrations are seen in the statistics covering the three homes opened in Cleveland during 1921.

The first house, which was valued at $37,000, was open from May 15 to June 15 and was visited by 34,354 persons, an average of 1,673 per day. It was sold in the last week of the exhibition. The second house was valued at $48,000 and was in a more exclusive neighborhood. Between Sept. 11 and Oct. 9 it received 34,790 visitors, or 1,199 per day on an average, and the home was sold in the second week. The third home, in a more modest residential section of the city, was valued at $17,000, and from Oct. 16 to Nov. 13 was shown to 13,965 persons—a daily average of 481. This home was also sold in the second week. The accompanying record gives some interesting insight into the way in which this attendance was distributed according to the day and the weather.

CLEVELAND ELECTRICAL HOME VISITORS

No. of Days	Day	First Home Open 32 Days, May 15-June 15	Second Home Open 29 Days, Sept. 11-Oct. 9	Third Home Open 29 Days, Oct. 16-Nov. 13
1	Sun.	3,004	2,755	1,648
2	Mon.	752	1,387	502
3	Tues.	786	1,390	451
4	Wed.	749	1,365	360 R
5	Thurs.	1,139	1,246	253 R
6	Fri.	860	1,258	376 R
7	Sat.	509	687 R*	383
8	Sun.	1,805	2,666	1,691
9	Mon.	520	942	437
10	Tues.	698	926	475
11	Wed.	704	825	422
12	Thurs.	698	1,190	315 R
13	Fri.	482 R	1,160	380
14	Sat.	275 R	678	555
15	Sun.	2,179	2,621	1,537
16	Mon.	1,276	798 R	251
17	Tues.	414	1,045	15 R
18	Wed.	620	1,054	321
19	Thurs.	770	1,126	225
20	Fri.	591	660	264
21	Sat	649	848	190
22	Sun.	2,902	2,116	726
23	Mon.	728	543	249
24	Tues.	868	468	359
25	Wed.	814	932	78 R
26	Thurs.	903	1,247	346
27	Fri.	703 R	186 R	341
28	Sat.	492	390 R	245 R
29	Sun.	3,300	2,281	570 R
30	Mon.	1,215		...
31	Tues.	1,656		....
32	Wed.	1,442		....
	Total	34,354	34,790	13,965
	Average per day	1,073	1,199	481

* Rain. (Total for three homes, 83,109)

These guests were all invited to fill out a registration card and an appliance was awarded as a prize each night to the visitor whose card was drawn. At the second home 29,256 out of 34,790 guests signed cards and interesting data were obtained. After throwing out duplicate cards, cards from non-residents and those lacking in information, there remained 13,550 cards, representing the same number of different addresses and families. These cards gave the following facts:

		Per Cent
Number who own home in which they live	6,775	50
Number who plan to build	4,485	33
Average number of convenience outlets per home	3½	...
Appliances owned:		
Ranges	367	2.7
Dishwashers	180	1.3
Electric refrigerators	129	0.9
Clothes washers	4,908	36
Sewing machines	2,120	15
Vacuum cleaners	9,703	71

The character of the attendance in itself was interesting. To the second home alone visitors came from 1,243 streets in Cleveland, from 133 other cities in Ohio and from 146 cities in twenty-five other states and foreign countries. Pennsylvania sent the largest number of the latter, registering 105 guests, but there were six from California, seven from Florida, one from New Zealand and one from the Argentine.

Central Maine Company's "Ten Points" for Employee Stock Salesmen

CENTRAL-STATION employees sometimes feel that they, individually, are not qualified to sell stock in a customer-ownership campaign. They think they lack the necessary sales experience or have not sufficient knowledge of the company's affairs or the value of the securities. To meet this situation the Central Maine Power Company has used successfully what it calls the "ten-point" plan. The employees who are not regular salesmen are asked to call on ten prospects and tell each one these ten points:

1. Our company is offering for sale a 7 per cent preferred stock. That is, this stock pays $7 a year a share, or $6.50 a year on each $100 you invest. It pays its dividends quarterly.

2. The company is offering this preferred stock to its customers in the first place because it has use for investment money, and because it believes in customer-ownership.

3. I believe this stock is safe and that it will always pay dividends. I believe this for a good many reasons. First, it is a legal investment for Maine savings banks, and is owned by three and by quite a number of banks and trust companies. Secondly, because the company is growing steadily and its earnings are increasing. Third, because the company owns property that would cost, it is estimated, considerably over $25,000,000 to replace. Fourth, the company is under the jurisdiction of the Public Utility Commission of the State of Maine. Fifth, the company has paid dividends on its preferred stock for over eighteen years—sixty dividends without interruption. Sixth, the company is managed and owned by Maine people. Seventh, the company has 41,000 customers, and takes in over $3,000,000 a year in gross earnings.

4. If you put your money in this stock, it is not only safely invested, but it is set to work developing Maine. It is largely used to develop and distribute power. This development of power tends to bring factories to Maine, and this helps us to get lower taxes and greater prosperity.

5. All of the money you put into this stock stays right here in the State of Maine.

6. Every cent of its goes directly or indirectly into property; dams, power houses, and pole lines, all right here in the State of Maine.

7. The stock is exempt in Maine from all state, county, city and town taxation. It is exempt from the federal income tax up to the surtax.

8. This stock is no trouble at all to the man who owns it. He gets a dividend check four times a year. The rest of the year he doesn't even have to think about it. If you own our stock you don't have to put your certificate in the safe deposit box. If it burns up you go right on getting the dividends. By going through certain formalities, you can get a new certificate.

9. If you need to get your money out of this stock the company will help you.

10. Stock bought now should steadily go up in value. If your prospect is a person who might want to buy on easy terms, tell him: You can buy on divided payments if you wish, $10 down and $10 per month per share. If you own stock yourself, or if you are buying it, say: I am one of over 220 employees of the company who now own this stock or are buying it. We all believe in the stock and the company.

High Rates Caused by Hostile Valuation of Utilities

SQUEEZING the physical value of electric light and power companies down to the lowest possible terms fosters high rates and poor service, declared John W. Shartel, vice-president and general manager of the Oklahoma Railway Company, before a recent convention of the Southwest Political Science Association at the University of Oklahoma. Valuation of public utilities in a spirit of hostility is injurious to the communities, and for rate-making purposes it should be carried on in a safe, sympathetic manner such as would induce others to invest money in these enterprises. Mr. Shartel said:

"There are hundreds of plants where the addition of 25 per cent to the capital invested would double the revenues of the institution and cut its operating expenses in two. In fact, this is the rule today and not the exception. There are plants, doubtless, where the value has been depressed by the utilities commission to the least possible point and then confined to a money-lending rate of income on that valuation. The community served by that utility is doomed to exorbitant rates, poor service and a denial of the full benefit it should derive on account of a prohibitory cost.

"On the contrary, a liberal valuation and a liberal income, which measurably fulfills the expectation of the founders of the enterprise, at the outset will insure the expenditure of sufficient capital to attain the highest efficiency, the latest and best apparatus in line with the march of improvements, furnish better service at half the price and still pay a good rate of income to the investor. The ability of an electric light and power company to put electricity on its switchboard at a cost of 1 cent or 3 cents per kilowatt-hour speaks to its consumers in the language of ten-dollar bills. Whether it shall earn 8 per cent or 10 per cent on a narrow value of $800,000 or a liberal value of $1,000,000 speaks to the consumer in the language of dimes. That example discloses the real perspective of the whole utility situation."

Louisville Gas & Electric Entertains Local Electric Club

THIS picture shows one of the "get-together" meetings of the electrical men in Louisville Ky., when members of the Electric Club were luncheon guests of the Louisville Gas & Electric Company at the company's Waterside station. About 150 members of the club attended the luncheon, after which an inspection trip through the plant was made. George M. Miller, superintendent of electric distribution of the Louisville Gas & Electric Company, is president of the Electric Club.

LOUISVILLE ELECTRIC CLUB'S LUNCHEON IN WATERSIDE BOILER ROOM

What Other Companies Are Doing

Newark, N. J.—The first of a series of special stockholders' meetings was held here recently by the Public Service Corporation of New Jersey. Thomas N. McCarter, president, stated that this would be the first of about fifteen meetings to be held in various cities of the state to acquaint the customer-shareholders with the importance and stability of their property.

Worcester, Mass.—To encourage employee partnership in the company, men and women employees of the New England Power Company have had opportunities to purchase stock in this utility during the last five years. Eight hundred and sixteen subscribers have taken stock of $323,000 par value on the deferred-payment plan.

Portland, Maine.—Thirty washing machines were sold recently in eight weeks by the Cumberland County Power & Light Company, chiefly through newspaper publicity, notwithstanding a reduction of about 50 per cent in display area at the local traction waiting room. R. E. Holden is manager of the appliance department.

St. Paul, Minn.—The Nostpoco Club, an employees' organization of the St. Paul Division, Northern States Power Company, will include in each monthly program a short talk under the general subject "Know Your Own Company." The first talk in the series was given by Garrett O. House, manager of the division, at the last meeting of the club. At future meetings the different department heads will give fifteen-minute talks on the organization and functions of their respective departments.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Need for Organization in the Radio Business

By Christian J. Litscher
President C. J. Litscher Electric Company, Grand Rapids, Mich.

RADIO sales have developed with such speed that the distribution machinery has had to be thrown together pretty much on a basis of catch as catch can. It is very much in the mind of dealers, jobbers and manufacturers, therefore, to find the way to guide this business into clear channels and secure not only a safe but an economic distribution. For any merchandise should be handled between the manufacturer and the consumer at the least possible expense in order that a large volume of business may be obtained and that each factor in the path of distribution shall be adequately compensated for services rendered.

In order that this may be accomplished a careful study should be made to insure that a fair profit shall be earned by each factor so that there will be no failures in the scheme of distribution. In a business as new as this errors are bound to occur, but if we all study our own parts with the view to functioning economically, these errors can be minimized and little harm need result. It, therefore, may be helpful to define the function of each factor, and I give you my views for what they are worth.

First: The manufacturer or his selling agency must: (a) Manufacture a high-grade quality article on which he will build his reputation. (b) Put a fair price on his merchandise so as to be able to compete with other high-grade apparatus. (c) Select distributers of unquestionable reputation in each territory so he may feel that the dealers, who are the next step in the distribution, will respect the merchandise manufactured. (d) Set up a differential made by the manufacturer in the compensation allowed to those whom I term creative jobbers and to those jobbers who are only order takers. (e) Co-operate with each branch in the distribution to build that unpurchasable asset in any business, good will.

Second: The distributer or jobber must undertake as his duties to: (a) Select a manager for his radio department who has merchandising sense plus technical knowledge. If this combination is not available, then two men must be engaged—one a merchandiser and one a technical expert. (b) Purchase a well-balanced stock with extreme care so that the turnover which is so necessary to economical distribution shall be obtained. (c) Procure a list of reputable dealers and teach them how to study the business in order properly to exploit the merchandise to the ultimate consumer, who, after all, is the goal all other factors are striving to reach economically. I use the word "reputable"—too much stress cannot be laid on this particular point because we shall all stand or fall in a given locality in direct response to the service the dealer renders.

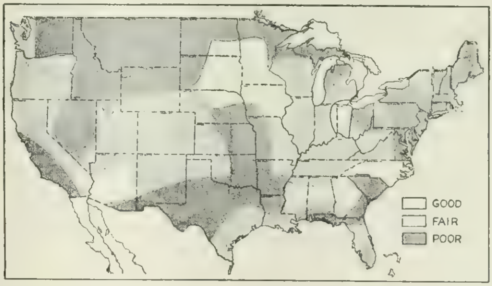
Third: The dealer, as his function: (a) Must have the confidence of his home people and his jobber. (b) Must be well located. (c) Must have in his organization a radio service man and for the first year or two make "policy" service calls at little expense to the consumer to see that the business is not retarded owing to large service expense. (d) Must maintain a representative stock, well displayed. (e) In addition he should do the ordinary things, such as advertising, etc., which are so necessary to the successful upbuilding of any business.

To establish ourselves in this business we have engaged a man who has been in the radio field for several years past, having entered the field as an amateur after constructing his own apparatus. He was for three years connected with the design section, Radio Division, Signal Corps, U. S. A., as lieutenant in charge of that section, and he has also had three years' sales experience in general mechanical and electrical lines. We have placed an order for merchandise which this man thought was a proper stock. We are in a virgin field. Radio is newer to us by three months than it is to New York or Pittsburgh territory. So we have sent out letters to ninety dealers in western Michigan inviting them to a first Radio Congress, at which we will explain to them the opportunities in the business and educate them as much as possible collectively.

We are trying very hard to keep our feet on the ground, though there is so much activity in this line that one would think that the entire electrical business was circling around it. We are trying to be sane and leave the management of a department of this kind to a department manager and let him have all the grief and joy that there is in operating it.

There is, of course, danger that the jobber may be stampeded by the appeal of the opportunity and allow his business to be thrown out of balance, but the answer to that is, after all, organization, and it is important that that organization be well set up to operate through the entire process of distribution. The industry had plenty of experience during the war boom years in the pyramiding of orders and over-extension. It would be unfortunate if we should allow the radio opportunity to be demoralized by over-enthusiasm and under-organization. We must learn the business as we proceed.

Conditions of Engineering Employment



From the *Professional Engineer*.

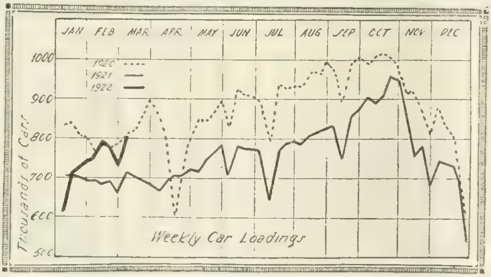
THIS map, showing the convalescence of engineering employment, is decidedly encouraging to the electrical industry for it means better business. The employment of electrical and mechanical engineers depends largely upon industries and business conditions, which are rapidly improving.

The Impossibility of Jobber Representation in Every Town

By W. R. Herstein
Vice-President and General Manager Electric Supply Company, Memphis, Tenn.

A GREAT many manufacturers feel that unless they are getting business from every town they are not doing their full duty to themselves and their business. In the large centers it is easy for every manufacturer to secure an outlet, but in the smaller towns, where there are only a few jobbers, these jobbers are constantly beset by manufacturers' representatives with the very plausible argument that they desire to do business through the jobbers, but that unless the jobbers will buy from them they will be compelled to pass over the jobbers' heads and solicit business direct from the jobbers' customers. Of course, it is apparent that there are not enough jobbers in these smaller towns to satisfy every manufacturer, and many manufacturers believe that they are fully justified, where the jobber is unable to represent them, in thereupon soliciting business direct from the jobbers' customers.

Rapid Increase in Car Loadings



From *Forbes' Magazine.*

MUCH improvement in the general business situation is indicated in this chart showing weekly car loadings for 1920, 1921 and 1922 to March 12. The 1922 record, shown by the heavy line, starts far down at the left, rapidly crosses 1921 and is now up to the 1920 level.

This creates a situation where a manufacturer is distributing through jobbers in one section of the country but is not doing so in other sections. The jobber says to these manufacturers frankly that they cannot expect to get business in every town. It would be much better for the manufacturers if they would endeavor to secure an outlet for their available capacity in sections where they can do it through jobbers, rather than to break in on established jobbing practices in points where they are not represented. A manufacturer can do only a certain volume of business, and it seems that he should be willing to secure this through established channels, regardless of locality, rather than to make an effort to get business in every town. In other words, if he can sell his entire output, he should be satisfied to do so through his regular jobbers and to "pass up" towns where he can obtain no jobbing representation because there are not enough jobbers to go around.

The same principle applies to jobbers as well as manufacturers. There are towns where we can get no business because the local dealers are already tied up with other jobbers from whom they prefer to buy. In cases of this kind we do not seek to disrupt the dealer's relations with his customers, but we simply leave the town out of our calcuations and try to get business somewhere else, realizing that our capital permits us to do only a certain volume and that we shall make more money if we secure this business where it is easiest to get rather than continue to direct our sales efforts against a stone wall.

If manufacturers and jobbers would simply realize that they cannot get business in every locality and would direct their efforts toward increasing its volume in favorable localities, we believe many of the problems of adequate and satisfactory distribution would soon be capable of solution.

Prevention of Price Cutting Essential to Jobbers' Prosperity

By an Eastern Jobber

PRICE CUTTING among jobbers serving the market for electrical supplies is a most unwise and undesirable practice. Even representatives of long-established houses are tempted to engage in this occupation under stress of severe competition for business. Not only are quotations shaded to secure the order on materials wanted in published quantities and at so-called standard prices, but prices are "open" all too frequently on quantities which used to be pretty well established as fixed for regional selling figures. While the volume of business is increasing gradually, trade is so eagerly sought that a large volume of business flows at little or no profit. This is clearly most unsatisfactory.

The difficulties of the price situation are well known and need not be enlarged upon. The real problem is how to get upon a better plane of price activities. Fundamentally, it is hard to see why the jobber should not be accorded a larger percentage of the "spread" between the manufacturer's price and the price the ultimate consumer pays the wiring contractor. Why, for illustration, should the jobber be obliged to sell pull sockets at only 33 cents each for which he pays 29 or 30 cents, when the home builder pays 60 or perhaps even 70 cents each for these products? Quantity purchases do not explain this spread, and the jobbers in a given district should stick to their established "going prices" and put these lists and hold these prices at a level obviously more than sufficient to meet the overhead and operating expenses of handling this sort of materials. In my opinion, the contractor-dealer would still make a satisfactory profit if the jobber sold him pull sockets at, say, 35 or 38 cents each, and if this price could be maintained, the jobber's service in maintaining stocks and giving prompt deliveries would be fairly well compensated.

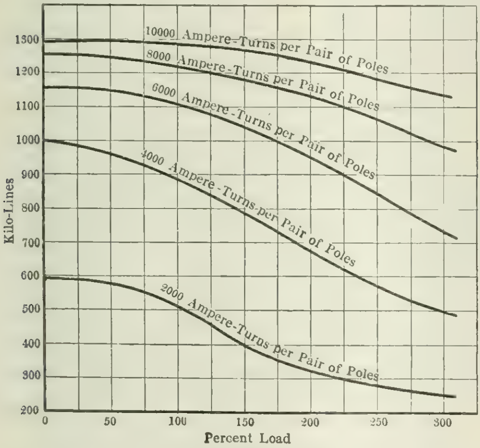
How can prices be maintained? If the United States Supreme Court in the pending Colgate case decides that the manufacturer has the right to fix and to maintain resale prices, a new day will dawn for the jobber. The lower courts have sustained this view, and it is hoped that early this spring the ultimate tribunal will hand down its finding. Should the right to fix and maintain resale prices be established, jobbers will have to live up to a plane of price standardization which should insure a fair profit to all concerned in distribution. Why can we not have more price-courage now?

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Speed Regulation and Stability of Direct-Current Motors.—SCOTT HANCOCK.—An analysis of the elements affecting the change of speed of direct-current motors upon loading will show (a) why the slight series is used, (b) what should be expected in the speed regulation curve, and (c) how the shape of this curve can be changed. In discussing this problem of speed regulation the author takes up the shunt-field excitation, the armature distortion, the series fields, the position of the brushes and the commutating-field strength. The calculated saturation curves of a 10-hp., 500/1,500-r.p.m. motor at various loads is shown in the accompanying illustration. Regulation curves and curves showing how the flux varies with the load for several constant-field excitations are also given.—*Electrical Journal*, February, 1922.



VARIATIONS OF SATURATION CURVES OF A 10-HP. MOTOR WITH DIFFERENT LOADS

Generation, Transmission and Distribution

Application of Electric Power in the Iron and Steel Industry.—W. S. HALL.—The general problem of power generation in the steel industry for continuity and reliability of service is considered.—*Paper presented before Association of Iron and Steel Electrical Engineers*, March, 1922.

Determination of the Sag of Overhead Lines with Heavy Insulator Chains.—K. GUERNDT.—A simplified method is given to calculate the tension and the maximum sag of overhead transmission lines for very high voltages, using heavy chains of suspension insulators. The weight of these chains is considered as a part of the weight of the conductors between adjacent towers. The mathematical derivations are illustrated by two concrete examples.—*Elektrotechnische Zeitschrift*, Feb. 2, 1922.

Developments in Power-Station Design.—This article, which is one of a series, deals with power generation, with particular reference to the Bargoed station of the Powell Duffryn Steam Coal Company, Ltd., of England, a station having a capacity of 18,000 kw.—*Engineer (London)*, Feb. 24, 1922.

Increasing Capacity of Parnahyba Plant.—H. P. QUICK.—A description of how a hydro-electric plant originally laid out for 16,000 hp. was modified to develop double this capacity. The station is on the Tiete River, about 20 miles from São Paulo, Brazil. An interesting feature is the combination of two 2,000-hp. generators to operate on one turbine wheel, which is made necessary by replacing the old turbine by wheels of double capacity.—*Power*, Feb. 7, 1922.

Traction

Electrification of the Gotthard Road.—K. SACHS.—The electrification of this important Alpine road, connecting Switzerland and the north with Italy and the south through the famous Gotthard tunnel, has been completed, and, as representing the most up-to-date European single-phase electrification, much has been written about it. The article under notice gives an elaborate and complete description of the entire system, comprising eight installments with a large number of illustrations. The power supply for the road comes from the Amsteg and Ritom hydro-electric stations, which have at present a capacity of 36,000 kva. in four single-phase 9,000-kva. generators, wound for 15,000 volts and 16⅔ cycles. The machines are of Swiss manufacture, but are designed to meet American heating guarantees. Four 10,000-kva. forced-oil-cooled single-phase transformers step the voltage up to the transmission tension of 60,000 volts. The high-voltage oil switches have a rupturing capacity of 250,000 kw. each and have eight breaks per phase. The middle of the high-voltage winding of the transformers is permanently grounded over an air-core reactor. Horn gaps with series water resistances are used as overvoltage protection. Two overhead and two cable lines for 60,000 volts connect the power houses with each other and the road substations, of which there are at present five. Each of these contains two single-phase, 5,000-kva. oil-cooled transformers. The oil switches in the substations can break safely 150,000 kva. each and are equipped with auxiliary contacts. A catenary suspension system is used on the entire road, with a "figure 8" copper conductor and two carrier cables of galvanized steel. Zinc-coated (Schoop process) structural steel poles support the power line in the open stretches, while a special roof suspension is employed in the tunnel. To avoid encumbering stations with too many poles a light bridge construction is held up only by two outside towers, crossing several tracks. An electrically interlocked blocking system, similar to the Mertz-Price differential cable protection method, is used for the entire line. A minute description is given of the different types of freight and passenger service locomotives operating on the road. Their weight is almost uniformly kept to 6.75 tons per over-all meter length. All motors are geared, high-speed commutator motors not exceeding 700 hp. per motor, driving the wheels over a jack shaft and rods. Special attention is called to several very ingenious methods of obtaining an elastic drive between the power shaft and the wheels. Assembly drawings of the locomotives and complete wiring diagrams conclude the paper.—*Elektrotechnische Zeitschrift,* Jan. 5, 12, 19, 26, Feb. 2 and 9, 1922.

Installations, Systems and Appliances

Electric Driving in Scottish Woollen Mills.—A. W. Stevenson.—The author considers conditions prevailing in the machine drive of the Scottish woollen mills. This is a localized industry where water power is often available in sufficient quantities or can be economically supplemented by the public electricity supply. The claims of steam driving under these conditions are considered, and the various processes necessary to produce the finished wool product are described in detail.—*Electrician* (*London*), Feb. 24, 1922.

Electric Trucks for Cargo Handling.—G. H. Rae.—The author gives a description of cargo handling with electric trucks such as are now being used on English docks. Operating data with fixed charges and investment cost are given, showing the annual saving made possible.—*Electric Vehicle,* February, 1922.

Electrophysics and Magnetism

Theory of the Intrinsic Field of a Magnet.—J. R. Ashworth.—This is a treatise on the theory of the intrinsic field of a magnet and the relation of its magnetic to its characteristic electric and thermal properties. The inconsistencies of the ferro-magnetic equation based on the kinetic theory of magnetism disappear if the intrinsic field is treated as a combination of two fields, one a molecular field and the other a true magnetic field. This view of a twofold field explains why the critical temperature is lowered by an alternating magnetic field, while the temperature at which the specific heat changes is but slightly affected. This view also gives a reasonable account of the relations of mechanical and magnetic forces and shows why elastic and magnetic qualities tend to disappear at the same high temperature. It removes a serious defect in the former statement of the kinetic theory of magnetism and now allows consistent values to be calculated from the ferro-magnetic equation. The abnormal rise of specific heat and the abnormally large temperature coefficient of resistivity found in these metals are also explained by the theory of two fields—*Philosophical Magazine* (*London*), March, 1922.

Units, Measurements and Instruments

Distribution of Voltage Along Disk-Type Insulators.—G. Viel.—The various methods devised and actually carried out to measure the voltage gradient experienced with chain-type insulators differ in their results as much as 30 to 55 per cent. Most of these methods are strictly laboratory measurements, and it would be difficult, if at all possible, to duplicate them outdoors along an energized line. The author has devised apparatus for measuring this gradient which is suitable for use in the field. To determine, for example, how much of the total line voltage is taken up by the disk next to the line, he connects the terminal of a static voltmeter to the connecting cable or other metal part between the line disk and the next disk. Energizing the line after the voltmeter is grounded will cause a certain deflection of the voltmeter. Then the ground connection of the casing is removed, and the line itself is connected to the voltmeter casing. The line voltage is now so regulated that the deflection on the voltmeter will be the same as before. From the line voltage and the voltage indicated on the meter can be obtained the percentage of line voltage upon the first chain link. This method assumes that the percentage of voltage gradient along the chain does not change with the applied voltage, which is actually the case for voltages above 50 kv.—*Revue Générale de l'Electricité,* Feb. 25, 1922.

Telegraphy, Telephony and Signals

Shape and Phase of Waves from Tube Senders.—E. Alberti and G. Zickner.—With the aid of the Braunian tube a qualitative investigation of the theoretically derived shape and phase of waves of extremely excited tube senders has been made, and it is described in this paper. All tests were made with high frequency, corresponding to wave lengths of between 1,000 m. and 18,000 m., according to the method of Lissajous' figures, using sinusoidal auxiliary fields to deflect magnetically and electrically the cathode rays of the Braun tube. The obtained photographic images are all of the closed polar form and have been reconstructed into the more familiar co-ordinate form.—*Jahrbuch der Drahtlosen Telegrafie und Telefonie,* January, 1922.

Decisions of the Paris International Conference on Radio Communication.—G. Vallauri.—The author tells how the decisions of this conference affect the characteristics of radio transmitting stations in respect to their emissions and nominal range. The recommendations of the committee for the distribution of various wave lengths are given.—*Radio Review,* February, 1922.

Miscellaneous

A Review of Hydro-Electric Progress in Canada.—A résumé shows that the progress in hydro-electric development in Canada last year was very satisfactory. Reports indicate that 300,000 hp. was installed. The most important of these additions is the Queenston-Chippawa plant of the Hydro-Electric Power Commission of Ontario, involving the installation of two 60,000-hp. units. The new installations in the individual provinces have been approximately: Nova Scotia, 13,000 hp.; New Brunswick, 9,000 hp.; Quebec, 90,000 hp.; Ontario, 174,000 hp., and Manitoba, 14,000 hp.—*Canadian Engineer,* Feb. 21, 1922.

DEVELOPED AND AVAILABLE WATER POWER IN CANADA

Province	Turbine Installation in Hp., to Jan. 1, 1922	Available Twenty-Four Hour Power at 80 per cent Efficiency At Ordinary Minimum Flow, Hp.	Available Twenty-Four Hour Power at 80 per cent Efficiency Dependable for Six Months, Hp.
British Columbia	305,315	1,931,142	5,103,460
Alberta	33,187	475,281	1,137,505
Saskatchewan	..	513,481	1,087,756
Manitoba	97,247	3,270,491	5,769,444
Ontario	1,212,650	4,950,300	6,808,190
Quebec	1,015,385	6,915,244	11,640,052
New Brunswick	30,180	50,406	120,807
Nova Scotia	46,948	20,751	128,264
Prince Edward Island	1,869	3,000	5,270
Yukon and Northwest Territories	13,199	125,220	275,250
Total	2,755,980	18,255,316	32,075,998

News of the Industry

Chronicle of Important Events and General Activities in the
Technical, Commercial and Manufacturing Fields With Announcements and
Reports of Association Meetings and Conventions

Senate Opposed to American Valuation Plan

INITIAL discussion of the tariff bill in the Senate reveals that there is practical unanimity of opinion in that body that the ad valorem rates in the bill should be based on a valuation made in the country of origin. Sentiment in the Senate seems to be as strongly opposed to American valuation as that of the House is in favor of it. Approximately 60 per cent of the commodities covered by the dutiable list take ad valorem rates. The remainder of the articles on the dutiable list are covered by specific rates.

The Government Would Control the Colorado River

A BILL providing for the protection and development of the lower Colorado River basin was jointly introduced by Representative Swing of California and Senator Johnson of that state on April 26. The measure is said to have the backing of Secretary Hoover, the American Federation of Labor and other national organizations. It provides that the United States shall have the exclusive right to construct, provide and control dams, reservoirs or diversion works upon the main trunk of the Colorado River below the mouth of the Green River.

Authorization is given to the Secretary of the Interior to construct a dam and incidental works for the purpose of providing a reservoir at or near Boulder Canyon and to acquire by proceedings in eminent domain all lands and rights-of-way necessary. A main canal and the pertinent structures located entirely within the United States will connect the Laguna dam on the Colorado River with the Imperial Valley and vicinity in California. Applications for the right to use portions of the water discharged from the reservoir for the generation of electricity may be made to the Secretary of the Interior, who, after hearings, may allocate to applicants such portions of the power privileges as in his judgment may be consistent with an equitable distribution among interested states and communities.

The leases for power privileges so allocated are limited to fifty years, and preference must be given to applications made by political subdivisions. It is provided in the bill that the Secretary shall give consideration to the plans of the various applicants, having regard to their relative adaptability to use such power privileges in the public interest and at reasonable cost to the communities served. If so desired, political subdivisions may, in lieu of a lease, pay to the United States in annual installments for a period not exceeding twenty-five years a sum proportional to the cost of the undertaking plus a like proportion of the annual expense of operation and maintenance, with interest at 5 per cent per annum on the unpaid portion of such proportionate part of the cost.

It is stipulated in the measure that the dam and reservoir are to be used first for river regulation and flood control, second for irrigation, and third for power. Veterans of the world war and the Spanish-American war are to have the exclusive preference to acquire home sites on the irrigated lands.

Senate Committee to Hold Hearings on Trade Association Regulation

THE Senate judiciary committee has appointed a sub-committee consisting of Senators Cummins of Iowa, Nelson of Minnesota and Walsh of Montana to give hearings and report on the bill of Senator Edge, New Jersey, defining the status of trade associations and placing them under jurisdiction of the Federal Trade Commission.

St. Lawrence Seaway Project Criticised at A. I. E. E. Convention

STRONG criticism of the plan of development of the St. Lawrence seaway proposad by the Joint International Commission was voiced by Hugh L. Cooper, consulting engineer of New York, in the discussion of the subject before the spring convention of the American Institute of Electrical Engineers at Chicago on Friday of last week. The development as proposed in the report was criticised as having too many dams and too many miles of canal, while the means of handling the ice problem were characterized by the speaker as absolutely inadequate. By a scheme of development proposed by Mr. Cooper it was claimed that there would be an increase of 850,000 hp. over that in the plan of the joint commission. The speaker asserted that the development could never be carried out under the plans of any one man, but because of its size must be finally constructed from plans reviewed and approved by a commission of the best engineering talent available.

Representative Dempsey, chairman of the committee on rivers and harbors of the House of Representatives, characterized the project as a vision, while Henry I. Harriman, chairman of the Massachusetts Commission on Foreign and Domestic Commerce and president of the New England Power Company, spoke in favor of it.

The paper by H. C. Louis, Consolidated Gas, Electric Light & Power Company of Baltimore, and C. T. Sinclair, Pennsylvania Water & Power Company, on the effect of high currents on disconnecting switches brought out an interested discussion. The tests were directed particularly at the determination of the stresses which under high-current conditions tend to force the switch blades open and those stresses that tend to spread the supporting insulators apart and thus aid in breaking the switch contacts and causing destructive arcing. Results of the tests showed that a type of switch in which the conductors and the switch blades are in the same plane is less liable to serious difficulties than other types. Conductors coming in from below the level of the switch blade and paralleling the supporting insulators of the switch before connecting to the lugs, it was contended, produce undesirable reactions under heavy current flows, and buses installed close to the switches tend to produce additional strains. It developed from the test that many types of locks used to keep disconnecting switches closed are inadequate and may be partly or totally destroyed by the mechanical strains imposed on them under short-circuit conditions. The tests were made with peak ampere values of from 34,000 to approximately 150,000, with corrections running in some cases up to approximately 200,000 peak amperes owing to the arrangement of the conductors leading to the switches.

Practice of Cleveland Company

In the discussion B. G. Jamison emphasized the need of considering the arrangement of other conductors in the design and installation of disconnecting-switch installations so as to prevent imposing unnecessary strains. It has been the practice of the Cleveland Electric Illuminating Company, H. L. Wallau said, to place locks on main circuit switches, but not on the disconnecting switches in potential transformer circuits, as it had been found that the wire used in these circuits because of its small size would burn off before the current values became sufficient to affect the switches. The danger involved in the failure of operators to close switches properly, so that the locks are latched, was pointed out, and it was asserted that switches equipped with locks that must be latched before the operator can remove the pole or other device with which the switch is closed have been developed but have not so far proved very popular. It was also asserted in the course of the discussion that the difficulties that had developed with the locks in the tests were not so serious as might be thought, because in many tests the peak currents were, owing to insufficient plant capacity, not of a degree that would be serious to the switches. In closing the discussion the authors stated that, while the tests were incomplete in many particulars, good progress had been made.

On Thursday morning Dr. Karl W. Wagner, head of the insulator research division of the Post Office Department of Germany, presented a discussion of the characteristics of insulation.

A report on the symposium held Thursday afternoon on the transmission of energy from coal mines to large centers of distribution, to which prominent electrical engineers contributed, has been withheld for correction of possible stenographic errors.

Karl B. McEachron, Purdue University, presented the results of his experiments to determine the position of the main and leakage fluxes in transformers. Using belt exploring coils under both the primary and secondary windings, the oscillographic curves showed that the leakage fluxes are not found as separate fluxes. In discussion, J. E. Clem of Pittsfield said that while the presentation of these fluxes to students had been clouded, analogies should not be proposed unless the conventional terms were clearly explained. The entire subject, he felt, should be considered from the point of view of the value of the main flux in the core necessary to maintain the secondary induced voltage, and not so much from a leakage standpoint.

In the discussion of the paper by J. F. Tritle, General Electric Company, on air-break magnetic blow-outs, H. D. James of Covington, Ky., favored the use of transverse barriers because the arc stream was much better controlled. With the addition of copper tips on these barriers the cooling effect is increased. Without these barriers it was found that greater flux densities were required to snuff the arc. Mr. James considered the proper design of the gas vents an important one. E. E. F. Creighton of Schenectady, N. Y., spoke on the effect of inserting a group of parallel barriers perpendicular to the path of the arc and stated that the points offered very excellent means for cooling and quenching the arc.

The Friday morning session was devoted to the question of selection of electrical apparatus for cranes and controllers on both passenger and freight elevators. D. L. Lindquist, Otis Elevator Company, in the discussion of the paper by H. P. Reed, Cutler-Hammer Manufacturing Company, on electric elevators listed four important factors to be considered by designers. Primarily, he said, the service should be adequate for a particular type of operation. Then reliability of this service must be maintained by the proper selection of equipment and controllers. Next the question of operating costs should determine the selection of economical equipment. Finally comes the quality or smoothness of the service. This quality is variable since more care must be exercised along these directions if the service is intended for a hospital than if it is for office buildings and high speed is required. Mr. Lindquist insisted that every new installation is a distinct new problem in itself and must be treated accordingly. He predicted that for certain installations schedule speeds would soon be as high as 1,000 ft. per second.

H. D. James drew attention to the introduction of suitable inductance in the control circuits in order to obtain a smoother rate of acceleration.

University Student Invents Average-Kva. Demand Meter

George Sperti, Jr., a fourth-year student in the co-operative course in electrical engineering at the University of Cincinnati, has just disposed of the United States rights covering a new meter for which a patent is being sought. The development of this new meter is the direct result of his co-operative experience with the Union Gas & Electric Company. He is employed in the meter department of the company and naturally has come into direct contact with metering problems enough to appreciate the importance of determining the kilovolt-ampere demand. It is only a little more than a year since he studied the theory underlying the various meter connections proposed and in use for metering power installations.

The new device, which is remarkably simple, involves the use of two standard polyphase meters, one connected to read kilowatt-hours and the other to read reactive kilovolt-ampere-hours. By connecting the two meters together by means of link work, Mr. Sperti has been able to indicate the following values: (1) Kilowatt-hours; (2) reactive kilovolt-ampere hours; (3) average power factor for any interval; (4) average reactive-kilovolt-ampere demand for any interval; (5) average kilowatt demand for any interval; (6) average kilovolt-ampere demand for any interval. Any combination of these can be shown. The usual combination will probably be of (1) and (6). The original model built by Mr. Sperti and tested by the Union Gas & Electric Company was made with this combination.

One interesting feature of the meter mechanism is the provision made for obtaining positive rotation of the reactive element under all conditions. A reversing-gear combination was built into the original model so that the reactive kilovolt-ampere-hours will always be indicated. While Mr. Sperti deserves entire credit for the idea involved, as soon as its value became apparent he received valuable assistance from his foreman, Mr. Blecksmidt, and from Mr. Freyer, the head of the meter department of the company.

Public Hearings on 660-Watt Rule Being Held by N. F. P. A. Committee

MORE than thirty delegates from various national and local organizations appeared at the public hearing given in Chicago on April 18 by the electrical committee of the National Fire Protection Association on the regulation known as the 660-watt rule. Many suggestions were offered, the majority of which assumed recognition by the committee of a general demand for a change in this rule (23d) of the National Electrical Code that would permit a greater current load on the ultimate branch-lighting circuit.

It has been decided to hold a second hearing in New York City on Friday, May 19, beginning at 10 a.m., in the assembly rooms of the New York Board of Fire Underwriters, 123 William Street. In particular it is suggested that those who feel that the 660-watt limit should be continued attend this hearing and express their views.

Advocates of Bacharach Bill Are Heard by House Judiciary Committee

ANOTHER hearing was held in Washington before the House judiciary committee on Tuesday to consider the Bacharach bill, which would limit the jurisdiction of federal courts as to injunctions in matters pertaining to state public utility orders. The hearing was held before the whole committee, the time being given to the advocates of the measure. Another hearing will be held May 23. Mayor Hylan of New York, Ledyard P. Hale, counsel for the New York State Public Service Commission; John P. O'Brien, Corporation Counsel of New York, and John E. Benton, representing the National Association of Railway and Utilities Commissioners, were among those who appeared before the committee. Among those who listened to the testimony offered at the hearing were E. A. Harriman, member of the legislative committee of the American Bar Association, and Senator Charles S. Thomas of the Bar Association of Colorado.

The witnesses in behalf of the bill voiced the complaint that state commissions are interfered with by the federal courts. They claimed that as exact justice can be had from the state administrative bodies and the state courts as from the federal courts. The indicated answer to this contention is that, while it is doubtless true in local matters, non-resident investors very naturally look to the federal courts for protection.

Mayor Thompson of Chicago is to be heard on May 23, when the hearings on the measure will probably end. It was evident at the hearing that the opposition to the bill is very strong, especially in states where money is wanted for the extension of railroads and the development of natural resources. It was announced at the hearing that the committee had received telegrams from a number of state commissions opposing the bill on the ground that it would have a tendency, if enacted into law, to exclude capital from public utility enterprises.

Congress May Put Muscle Shoals' Disposal Up to Secretary Weeks

EXCEPT for a brief hearing on the Engstrum offer, no public hearings on Muscle Shoals were held before congressional committees this week, but behind the closed doors of the committee rooms developments which have brought the negotiations further along took place. As this is written it is indicated that the net result of the investigation by the House military affairs committee will be that the committee will find itself unable to recommend to the House the acceptance of any proposal and will advocate general legislation empowering the Secretary of War to act as he deems best in regard to the whole series of questions involved in the Muscle Shoals development.

One of the most important developments was the appearance before the military affairs committee of representatives of Mr. Ford to make additional modifications and alterations in his offer. This conference, which was in executive session, confirms recent dispatches to the ELECTRICAL WORLD to the effect that the Ford offer could not possibly be favorably reported by the committee in the shape in which it was submitted and argued.

What Mr. Ford's new modifications are had not been made public at the time this was written, but it is understood that a number of members of the committee feel that Mr. Ford in the final analysis will not be willing to undertake all the requirements the committee will probably attach to new negotiations. Some of these requirements were outlined in the ELECTRICAL WORLD in its recent report of the "informal conversations" of the committee. These conversations are continuing. Some members of the committee feel that, irrespective of Mr. Ford's new modifications, the requirements of the committee will be such that Mr. Ford may decide to withdraw his offer. The members of the committee in large number, in fact, think that its final requirements will make additions that it will not be possible for any bidder to accept, and they are turning toward general legislation as perhaps in this case the only solution of their problems. This solution is not likely to come for at least three weeks, in the opinion of Chairman Kahn.

Some members of the committee are pressing for the inclusion in its requirements that the power to be developed at Dam No. 2 and Dam No. 3 not required or used for nitrate manufacture shall be disposed of only under the terms of the federal water-power act, except that any purchaser or lessee agreeing under satisfactory guarantees to operate Nitrate Plant No. 2 at its capacity of approximately 110,000 tons of ammonium nitrate per annum during a period of a hundred years may receive a license for the same period, all the other terms and conditions of the federal water-power act to apply in such case.

Other members of the committee are urging that the government shall not guarantee to transfer clear title to any property which might become the subject of litigation as the result of any outstanding agreement executed by the contract officers of the government, whether such agreement is deemed valid or invalid, and that the government shall transfer only its right, title and interest in such property.

Still other members declare that if any bid requires the expenditure of additional government funds all new expenditures by the government must be included in the amount upon which interest must be paid and which must be returned to the government through amortization payments during the term of contract, and that each such bid must also contain suitable guarantees that all expenditures over and above a sum fixed in the bid shall be assumed and paid by the bidder and not by the government.

All three of the stipulations just mentioned are, of course, anti-Ford propositions. Naturally they do not receive the support of the Ford men on the committee, but it is stated in Washington that there is a growing sentiment among members of the committee that Mr. Ford should be required to come under the federal water-power act. Mr. Ford has heretofore refused to come under this law, largely, it is believed, because of that feature of it which provides for the expropriation of excessive profits. The point regarding the guaranteeing of clear title refers to the Gorgas plant on the Warrior River, part of which belongs to the government and part to the Alabama Power Company, and Nitrate Plant No. 2, at Sheffield, Ala. In the first case the Alabama Power Company has a contract to purchase the government property, and in the second the Air Nitrates Corporation has a contract to purchase the plant.

Mr. Ford's representatives during the week obtained a delay as regards appearing before the Senate committee, and its hearings were adjourned until next Monday.

Census Data on 1919 Industrial Power Requirements

CENSUS figures grouped a special way for use by the Senate in its study of the tariff indicate that in 1919 68.2 per cent of industrial power requirements was supplied from isolated plants while 31.8 per cent was supplied by central stations. When the 1919 census was taken there were 290,105 industrial establishments being operated in the United States, with an aggregate horsepower rating of 29,575,242.

At 237,855 of these plants 116,158 steam engines furnished 13,839,744 hp.; 6,472 steam turbines furnished 3,258,235 hp.; 33,407 internal-combustion engines furnished 1,259,394 hp.; 13,244 waterwheels furnished 1,753,548 hp., and 817 water motors furnished 22,165 hp. In addition to the foregoing equipment, which is owned by the establishment, 9,442,156 hp. is furnished by rented equipment. Of that amount 9,347,556 hp. is furnished to 996,000 electric motors. The total number of electric motors in use in these plants is 1,483,039, with an aggregate rating of 16,317,383 hp. The number of motors run by energy generated in the establishment is 487,039. Their combined horsepower is 6,969,827.

The capital invested in the industrial plants of the country in 1919 was $44,688,093,771. They employed 10,160,107 wage earners and 1,447,227 salaried employees.

The amount of fuel used by these industrial plants is as follows: Bituminous coal, 203,452,724 short tons; anthracite coal, 14,545,300 long tons; coke, 142,764,287 short tons; oil, 92,608,186 barrels; gasoline, 2,344,469 barrels; natural gas, 305,768,321,000 cu.ft.; manufactured gas, 38,522,330,000 cu.ft.

First of Business Development Campaign Booklets Circulated

AFTER many weeks of preparation and planning the business development campaign of the electrical industry inaugurated by the National Electric Light Association is now under way. The first two of a series of instructive booklets were circulated this week and others are about to follow.

First, as a guidebook, a sixteen-page pamphlet on organization, or "how to get started," was issued. The second booklet is devoted to lighting and is sent out merely as a guide, telling in a general way of sixteen methods of interesting the public in more and better lighting.

The Probabilities of State Ownership in California

WHETHER or not California will vote $500,000,000 at the November election for state ownership of water power is of vital concern to that state and of interest to the country as a whole. The ELECTRICAL WORLD has accordingly made a poll of the principal newspapers of California to ascertain their editorial position on the proposed measure. Editors were asked whether they favored the passage of the bill, whether they opposed it, or whether any definite policy had been announced. Of the 102 papers replying, only eleven favored the passage of the act, while forty-nine opposed it. Forty-two papers have thus far adopted no definite policy on the matter, but of these eight or ten indicated that they would probably oppose the bill. The total circulation of the eleven papers which favor the passage of the act is 111,593, and of the forty-nine opposing the proposed bill 522,542. The circulation of the forty-two papers which have not as yet announced a definite policy is 558,354, and that of the several papers which may later come out against the passage of the bill 248,646. Thus the total circulation of those papers opposing the passage of the bill will be 771,000 as compared with 111,593 the circulation of the papers favoring the bill. Although the poll did not cover all of the papers of the state, it did cover all of the principal papers and it represents all parts of the state.

In addition to the majority of influential papers opposing the bill are a large number of security holders residing in the state who have investments in the public utilities of the state. These total more than 75,000, and it is estimated that each will also influence the votes of close acquaintances. Added to this are the employees of the utilities of the state, who are in general also investors in the securities of their companies.

At the last presidential election the total vote cast in California was 918,000, but it is not anticipated that the vote at the coming election will exceed 600,000.

Federated Engineering Societies' Officers Confer with President

THE work of the Federated American Engineering Societies was discussed recently when Mortimer E. Cooley, the president of the federation, and L. W. Wallace, its executive secretary, conferred with President Harding. The President showed keen interest in the organization and recalled the part which Secretary Hoover took in its formation.

Dean Cooley told the President that the organization would concentrate attention in the immediate future on reforestation, elimination of waste in American agriculture and industry, and on the reorganization of the executive departments of the federal government.

Conference Called on Colors for Traffic Signals

A CONFERENCE has been called for May 23 at the Engineering Societies Building, New York, by the American Engineering Standards Committee in accordance with requests received from the Illuminating Engineering Society and from the International Traffic Officers' Association to determine the desirability of standardizing the colors used for traffic signals.

The status of the subject and the facts bearing on it as they exist in the automobile, steam railway, electric railway and regulatory commission fields will be outlined in a few brief papers in order to lay a proper foundation for discussion of necessity for and feasibility of developing standard colors for traffic signals.

New Jersey Company Plans Heavy Construction Program

THE Public Service Electric Company, which serves the major part of New Jersey, is planning some extensive additions to its system this year and next. This is a development made necessary by the cessation of construction work during the war. The construction program contemplates an addition to the Essex station which will practically double its size. The new equipment planned includes three 33,000-kva. generators, two of which are to be installed this year; one 25,000-kva. unit for the Marion station and one 12,500-kva. unit for the Burlington station, both to be installed this year. In addition, two new substations are to be built and the transmission lines reinforced. The company has also started the establishment of a four-wire, three-phase distribution system. Provision is made for additions and improvements to existing substations. Contracts have already been let for four of the five generating units and the auxiliary apparatus.

State Department Inclined to Revive German Patent Convention

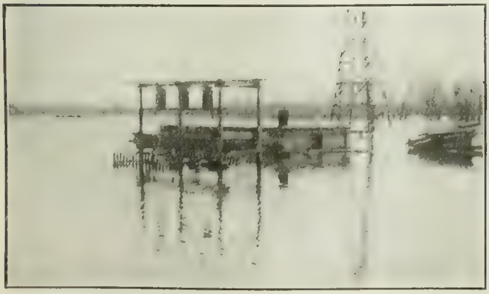
AFTER having reviewed the arguments for and against the revival of the patent convention with Germany, the State Department is understood to be inclined to revise the treaty under the authority conferred by the Senate. The Senate committee on patents will reopen its hearings on the working-clause bill on May 1.

Report of Engineering Standards Committee Shows Great Progress

DURING 1921 the activities of the American Engineering Standards Committee developed to such an extent that work is now under way on seventy-nine distinct projects which have reached an official status. The report of the committee for last year is now available in printed form. In its work 160 bodies of national importance are co-operating, these having designated more than 500 individuals as official representatives to serve on sectional committees.

During 1921 the committee approved fifteen standards, among which were a standard method for sampling of coal, the National Electrical Code specifications for soft or annealed copper wire, and the industrial lighting safety code. Seventeen standards were formally before the committee for approval on Dec. 31.

Middle West Floods Bring Operating Difficulties



HIGH water occurring simultaneously on a number of streams entering the Mississippi River have brought about some unusual flood conditions. Levees have gone out here and there, and at one place land as far back as 10 miles from the river was covered. Reports from the big Mississippi River Power Company project at Keokuk state that the high water is causing no difficulty there.

The accompanying pictures show the situation at places on the Canton (Ill.) Gas & Electric Company's system due to breaking of levees along the Illinois River. The transformers were raised 4 ft. above the concrete base in anticipation of high water. But this precaution was not enough, as will be seen from the pictures. At the points where these transformers stood the water was about 10 ft. deep. In order to save them it was necessary to take them out and load them on the barge that is seen moored beside the substation. We are indebted to E. H. Negley, secretary and manager of the Canton Company, for the pictures used.

Five Pacific Coast Water-Power Projects Licensed by Commission

THE Federal Power Commission has granted a license to the Southern California Edison Company covering that part of its proposed power project on the Kaweah River lying outside the Sequoia National Park. The entire project was covered by the permits granted to the Mount Whitney Power Company by the Department of the Interior and by the Department of Agriculture. The Interior Department's permit covered that part of the project lying within the national park. The Southern California company purchased the rights of the Mount Whitney company and applied to the two departments for a transfer of the permit. This transfer was approved by the Department of the Interior in August, 1920, but the Secretary of Agriculture declined to approve the transfer granted by his department on the ground that the passage of the federal water-power act rendered him without authority to act in such a case. The Attorney-General then decided that the matter now comes under the jurisdiction of the commission.

Another license has been granted to the Southern California Edison Company covering its thirteen-million-dollar project on the San Joaquin River in Fresno and Madera Counties, Cal. The primary power available is 112,000 hp. Construction will include a concrete arch dam 100 ft. high and a tunnel 21 ft. x 21 ft. and 28,000 ft. long. The power house will contain six turbines which will operate with a mean static head of 825 ft. They will be capable of developing 195,000 hp. There will be two parallel 220,000-volt transmission lines, 1½ miles long, which will connect the power house with the double transmission line to Los Angeles.

The Southern Sierras Power Company of San Francisco has obtained a license from the commission to cover two developments on Snow Creek and its tributaries in Riverside County, Cal. The projected construction in one case includes 3 miles of 18-in. conduit and a 2,000-kva. power house operating under a head of 1,838 ft. In the other case it is planned to install a mile and a half of 30-in. conduit and a 1,500-kva. power house operating under a head of 868 ft.

A license has been issued to the California-Oregon Power Company of San Francisco covering three short sections of a constructed transmission line from Cantella to a substation near Delta, Cal., where connection is made with the system of the Pacific Gas & Electric Company. National Forest lands are crossed.

To the Portland (Ore.) Railway, Light & Power Company a license has been granted covering a power development on the Clackamas River, Oak Grove and Three Link Creeks in Clackamas County, Ore. A diversion dam on Oak Grove Creek, a conduit 8½ miles long, a 20,000-kw. power house, a small diversion dam on Three Link Creek, and 24 miles of transmission line are the main features. The transmission line will connect with the existing system of the company. The company requested that its license cover a reservoir site at Timothy Meadows on the headwaters of Oak Grove Creek, but as no permit had been issued by the state covering that part of the project, it was not included in the license. The commission, however, authorized a preliminary permit covering a reservoir in the Clackamas River above the power house. Water from that reservoir will be diverted to the intake on Oak Grove Creek, which will lead to the power house.

Preliminary permits have been issued to Frank G. Baum of San Francisco covering two projects on the Little Colorado River, and another to Mushen & Cronemiller of Lake View, Ore., to cover a proposed power development on Deet and Cammas Creeks in Lake County, Ore., a total of 800 hp.

Stay of Injunction in Langmuir Patent Case Denied

APPLICATION by counsel for the Continental Lamp Works for a stay of injunction from manufacturing gas-filled lamps covered by the Langmuir patent was argued before Judge Mack on Friday of last week and was denied. Formal orders have now been entered restraining the Continental Lamp Works and also the United Lamp Manufacturers' Corporation from infringing upon the Langmuir patent.

Intermountain Electrical Men Hold First Annual Conference

UNDER the auspices of the Rocky Mountain Electrical Co-operative League, the first annual conference of representatives of the various branches of the electrical industry in the Intermountain States was held at the Newhouse Hotel, Salt Lake City, April 6 and 7. Many of the problems confronting the contractor-dealer, the jobber, the manufacturer, the central-station company and the public in general were discussed.

L. B. Johnson of the General Electric Company, in a paper on "Fundamentals of Electrical Retail Merchandising," pointed out how increased sales and increased net profit could be obtained through better merchandising methods. "The Business Outlook" was the subject of a talk by C. E. Arney, Jr., of the Seattle Chamber of Commerce, who spoke of the psychological factor in the business depression.

P. L. Goddard, who has recently assumed the duties of secretary of the league, summarized its work since its organization and outlined a program of activities for the future. R. J. Dinwoodey of the Intermountain Electric Company of Salt Lake City urged that an electrical exposition be held in that city in October. A committee from the league will take the matter up. Edward H. Eardley, who represented the contractor-dealers' association of Salt Lake at the recent meeting of the national association in New York, spoke on the work of the national body.

"Industrial and Commercial Lighting" was the subject of an illustrated paper by E. A. Evans of the Salt Lake City office of the Westinghouse company. H. M. Ferguson, Salt Lake division manager of the Utah Power & Light Company, covered the subject of "The Modern Electrical Home" in a manner which brought out very forcibly the enormous possibilities of developing business through selling the electrical idea to the public. He suggested the organization of educational classes through the league, to be attended by meter readers, wiremen and others who come directly in contact with the public. Mr. Ferguson also recommended the appointment of an inspector by the league, whose duties would be to approach the owners of homes in course of construction or those who contemplated building homes and advise them as to proper wiring plans.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Kentucky & West Virginia Power Extends Facilities.—Improvements to the system of the Kentucky & West Virginia Power Company to cost $500,000 have been contracted for. These include an additional 12,500-kva. turbine and other equipment at Lothair, Ky.

Municipal Plant Wants to Increase Rates.—The city of Fairview has filed a petition with the Public Utilities Commission of Utah, asking permission to increase rates charged by the municipal power plant from 7 cents to 8 cents per kilowatt-hour for residence lighting and about 10 per cent for other uses. It is set forth that the city wishes to install a system of discounts for prompt payment, but is unable to do so on the present revenue.

France Has Ambitious Electrical Schemes.—The Superior Council of Public Works of France has prepared a program for the construction of electric generating stations with a total rating of 1,370,000 kw. and a high-tension transmission system extending between 9,000 and 10,000 miles. The cost is estimated at 15,000,000,000 francs, to be spread over fifteen years, but it is doubtful whether the execution of the plan in so short a period is seriously contemplated, despite the desire of the government to make France independent of imported fuels.

Drying Hay by Electricity.—A process of drying hay by electricity has been worked out successfully in Switzerland, according to advices to the Department of Commerce. The newly cut hay is packed in silos between metal sheets. The sheets are connected to an electric circuit so that an alternating current of from 200 volts to 500 volts is passed through the hay between them. The effect of the current is to kill the microbes which cause damp vegetation to decay. From 130 kw.-hr. to 200 kw.-hr. is required to complete the drying process.

District of Columbia Commission Seeks Way Out.—The Public Utilities Commission of the District of Columbia has requested the United States Supreme Court to set for hearing at an early date in its next term, beginning in October, 1922, the commission's appeal from the decision of the Court of Appeals of the District of Columbia reversing the action of the lower court in sustaining the valuation of the property of the Potomac Electric Power Company made by the commission. The case entered the courts after the commission reduced the domestic rate for electricity from 10 cents to 8 cents per kilowatt-hour, and there is now $2,500,000 impounded under the injunction obtained by the company. The commission asserts that it finds itself embarrassed in the exercise of its rate-making powers by the law's delay.

Hydro-Electric Development in Ceylon.—The government of Ceylon is seeking to have the British Colonial Office appoint an expert on hydro-electricity to act as chairman of the Laxapanar-Aberdeen project, from which it is hoped to derive 75,000 hp. The electrification of suburban railways is also contemplated, at a cost of £1,000,000.

India Has More than 400 Engineers of High Professional Standing.—The Institution of Engineers, which was founded eighteen months ago in India, imposed high professional qualifications on its members, but has, notwithstanding, already a roster numbering more than 400. Subsidiary bodies exist at Bombay, Calcutta, Madras and in other centers of population.

Direct Radio Communication with Sweden.—Direct radio communication between the United States and Sweden is said to be virtually assured through an agreement between the directors of the Swedish State Telegraph Board and the Radio Corporation of America as a result of which the board has proposed to the Swedish government that the building of the large radio station planned for the west coast of Sweden be immediately started. Radio messages between that country and the United States have hitherto mainly been transmitted and received via the station at Stavanger, Norway.

Federal Government Buys Electricity for Less than It Costs to Generate It in National Plant.—Testimony by the officer in charge of operations for the public buildings in Washington, given before the House committee on appropriations, has brought out the fact that in the summer months, when it ceases to be necessary to condense water for heating purposes in the State, War and Navy Building, electrical energy for this big structure has been purchased from the Potomac Electric Power Company, which has been able to supply electricity more cheaply than the government can generate it in its plant.

Forty Years' Growth of New York Edison.—On Sept. 4 next the fortieth anniversary of New York City's original Pearl Street generating station is to be celebrated. On that date the first central station and underground distribution system were completed and placed in operation according to plans conceived and executed by Thomas A. Edison. One square mile of territory was served, though for lighting only, and the customers, fewer than sixty in number, had a total of 1,200 lamps on the circuit. Today, says the *Edison Monthly*, the Edison system in New York supplies 296,560 customers, energy is used for lighting 9,000,000 lamps, and in addition motors rated at 688,000 hp. are operated by the company's service.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Detroit Engineering Society.—John Mills of the Western Electric Company will speak on "The Human Voice and Its Electrical Transmission" before the Detroit Engineering Society on Friday, May 5.

New England Division, N. E. L. A.—The fourteenth annual convention of the New England Division of the National Electric Light Association will be held at the Hotel Griswold, New London, Conn., on Sept. 5, 6 and 7.

Washington Association of Building and Construction.—An organization under this name has been formed at Seattle to be composed of electrical contractors, architects, building contractors, bankers and, generally, all those identified with the building industry. Already 150 applications for membership have been received.

May Meetings of A. I. and S. E. E.—On Saturday, May 6, the Philadelphia Section of the Iron and Steel Association will hold a session devoted to "general ideas and discussion," every active member being invited to contribute a paper. On Monday, May 8, the Chicago Section will discuss "Heat Utilization" and the Cleveland District Section will listen to a paper by Dr. C. P. Steinmetz on static electricity.

Coming Meetings of Electrical and Other Technical Societies

Missouri Association of Public Utilities—Columbia, Mo., May 4-6.

A. I. and S. E. E. Section Meetings—Philadelphia, May 6; Chicago, May 8; Cleveland, May 8.

A. S. M. E. Spring Meeting—Atlanta, May 8-11. (For program see issue of April 15, page 750.)

Florida Engineering Society—Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see issue of April 22, page 797.)

National Fire Protection Association—Atlantic City, N. J., May 15-19.

National Electrical Credit Association—Detroit, May 18-19.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.

N. E. L. A. Geographic Divisions—Southwestern, San Antonio May 3-6; Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Law Governing Damages for Failure to Serve.—In Arnold vs. Alabama Power Company the plaintiff sought damages because of discontinuance of electric service, claiming that his advance deposit with the company covered the amount of the bill for failure to meet which the company disconnected him. The Supreme Court of Alabama held that the complaint did not allege facts to show that the plaintiff had performed the stipulated conditions precedent to service, which included the payment of accrued bills; that a mere averment of failure to receive three days' notice of discontinuance was insufficient, and that where a contract for electricity provided that a consumer should deposit a certain sum before connection of service, which could be applied by the power company upon any unpaid bill, the company was not required to apply the deposit in payment of a bill due and still continue to give service. (90 So. 909.)*

Supreme Court on "Going Concern" Value.—Finding against the contention that the fare fixed by the municipal board of Commissioners of Galveston, Tex., for the local street railway (Galveston Electric Company vs. City of Galveston) was confiscatory and therefore in violation of the Fourteenth Amendment of the United States Constitution, the Supreme Court of the United States thus discussed an item of $520,000 for "going concern" value allowed by a master and disallowed by the trial court: "If the rule were that a prescribed rate is to be held confiscatory in case net earnings are not sufficient to yield 8 per cent on the amount prudently invested in the business, there might be propriety in counting as part of the investment such amount, if any, as was necessarily expended at the start in overcoming initial difficulties incident to operation and in securing patronage. But no evidence of any such expenditure was introduced, and the claim of the company does not proceed upon that basis. What were presented by the witnesses are studies, on various theories, of what past deficiencies in net income would aggregate if 4 per cent were allowed as a depreciation annuity and 8 per cent compound interest were charged annually on the value of the property used. The fact that a utility may reach financial success only in time or not at all is a reason for allowing a liberal return on the money invested in the enterprise, but it does not make past losses an element to be considered in deciding what the base value is and whether the rate is confiscatory. A company which has failed to secure from year to year sufficient earnings to keep the investment unimpaired and to pay a fair return, whether its failure was the result of imprudence in engaging in the enterprise, or of errors in management, or of omission to exact proper prices for its output, cannot erect out of past deficits a legal basis for holding confiscatory for the future rates which would on the basis of present reproduction value otherwise be compensatory."

Negligence Established Where Absence of Guy Wire Allows Pole to Sag.—An electrician was injured by contact with a secondary wire of the Indianapolis Light & Heat Company which was accidentally carrying a high voltage because a primary wire of the Merchants' Heat & Light Company strung on poles 4 ft. or 5 ft. higher than those of the Indianapolis company had been permitted to sag until the wires of the two systems were in contact. The trial jury found the accident to be due to the fact that a pole was not properly guyed and (in Hoffmeyer vs. Merchants' Heat & Light Company) returned a verdict for the plaintiff. This finding has been sustained by the Appellate Court of Indiana, which overruled the defendant's contention that because the plaintiff had been permitted to amend his complaint so as to allege failure to have a guy on another pole than that originally designated an error had arisen, and also another contention concerning alleged error in the refusal of an instruction requested by defendant. (134 N. E. 485.)

High-Tension Wires with Worn Insulation 20 Ft. Above Street Constitute Neglect.—In Thornton Brothers Company vs. Northern States Power Company the plaintiff sought to recover a sum paid, under the workmen's compensation law, to a laborer who while endeavoring to lift sagging electric wires over the top of a rigid boom 17 ft. high was shocked and seriously hurt. It was shown that the wires, which crossed the street, were 20 ft. above the ground at the point of attachment. The insulation had become frayed and worn, and portions of the wire were exposed, and it was held that the accident was due to this fact. The Supreme Court of Minnesota sustained the trial court in finding for the plaintiff on the ground that the power company was negligent in suspending its wires so near the ground and then failing to maintain them in a safe condition. The question of contributory negligence was not involved, the court held, and the fact that the workman had lifted one wire safely over the boom was cited as throwing doubt on the contention that insulation on power wires affords no protection to those coming into contact with them and is consequently a negligible factor. (186 N. W. 863.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Rate Decrease of 5 per Cent Ordered for Potomac Company.—The Potomac Electric Power Company having professed inability to forecast its income in the ensuing year, the Public Utilities Commission of the District of Columbia made its own estimate, concluding that a discount of 5 per cent from the rates fixed on July 29, 1921, would be fair and reasonable and should apply to each schedule except the heating and cooking schedule, that for minimum customers under Schedule A and that relating to street and park lighting. This order cannot take effect until it is ratified by the court, but the commission says: "Even with the impounding of the larger amount required by the terms of this order the company will be enabled to pay all operating expenses and taxes, meet the interest on its bonded debt and enjoy a fair and reasonable return upon the value of its property as fixed by this commission to the same extent as it has enjoyed it in the past. The company will be protected by the final decision of the courts should it be determined that it is entitled to any part of the final amount impounded, and at the same time the public is equally protected in case of a decision adverse to the claim of the company."

Unremunerative Branch of Utility Must Not Be Recouped by Paying Branch.—The electric and gas departments of the Lynchburg Traction & Light Company having been found self-supporting while the street-railway department was barely earning a return on account of franchise restrictions, the question of recouping the losses of the unremunerative department from the returns of the other branches came up and was thus dealt with by the Virginia State Corporation Commission: "There seems to be no principle in the entire field of public regulation more clearly or more generally recognized than that each division or department of public service performed by a person or corporation operating more than one kind of public service must be self-supporting. Courts and commissions have with almost complete unanimity held that the patrons of, say, the electric department of a utility cannot be made to pay more than a fair rate in order to recoup the losses sustained in street-railway operation. It seems that only an emergency, to save temporarily the electric service in such an instance from failure to serve the public, could justify an increase in the electric rates if already yielding an adequate revenue."

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*The left-hand number refers to the volume and the right-hand number to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

P. O. Reyneau has been appointed superintendent of the designing and estimating divisions of the transmission and distribution departments of the Philadelphia Electric Company. Mr. Reyneau comes to this position after sixteen years' experience in the operation of public utilities, particularly in the branch of distribution. He was graduated from Cornell University as a mechanical engineer in 1913. Prior to this, however, he had spent several years in electrical work, having been connected with the Telluride Power Company in Utah in 1906 and having spent four years in the West on various jobs connected with operating and constructing plants and transmission lines. Immediately after graduation he was employed in the overhead-lines department of the Detroit Edison Company. Later he was made distributing engineer and still later assistant electrical engineer of that company, holding the latter position until his resignation to become connected with the Philadelphia Electric Company. Mr. Reyneau is joint author with H. P. Seeley of "Economics of Electrical Distribution" and has contributed extensively to the technical press. He is a member of the national electrical engineering societies.

P. O. REYNEAU

Prof. Lockwood N. Street of Syracuse University has recently resigned as consulting engineer for the Bureau of Gas and Electricity of Syracuse, N. Y.

Oscar M. Frykman, the new president of the Western Association of Electrical Inspectors, has been chief electrical inspector for the city of Minneapolis since 1912. Prior to becoming electrical inspector he had extensive experience in the telephone field and for four years was an electrical contractor in Minneapolis. Mr. Frykman is a mem- of the Minnesota State Board of Electricity and has served as instructor in electricity for the Young Men's Christian Association for three years.

Paul M. Downing, vice-president of the Pacific Gas & Electric Company, has been appointed chairman of the industrial committee of the San Francisco Chamber of Commerce.

Frank J. Beavers, former distribution engineer with the Gary (Ind.) Heat, Light & Water Company, Gary, is now with the engineering department of the Scranton (Pa.) Electric Company.

Philip G. Gossler has been elected president of the Columbia Gas & Electric Company, Charleston, W. Va., in addition to his many other executive duties. Mr. Gossler was born in Columbia, Pa., Aug. 6, 1870, and was graduated from the Penn State College as an electrical engineer in 1892, taking a post-graduate course at Columbia University in 1893. His first engineering work was with the engineering department of the Chester (Pa.) Foundry & Machine Company and the Edison General Electric Company. While at Columbia University and subsequent to graduation he was employed as assistant engineer in the United Electric Light & Power Company, New York, and in 1895 was appointed assistant engineer of the Royal Electric Company of Montreal, Canada. In 1901 he became connected with the Montreal Light, Heat & Power Company as general superintendent and manager, a position he held until 1904, when he became connected with J. G. White & Company as vice-president, holding this position until 1909. In 1909 he was elected chairman of the board of directors of the Columbia Gas & Electric Company, and in March of this year he was also elected president of that company. Mr. Gossler is also chairman of the board of directors of the Union Gas & Electric Company; president and director of the Helena Light & Railway Company, Long Acre Electric Light & Power Company, South Carolina Light, Power & Railway Company, Virginian Power Company, Dominion Power Company of Virginia, Dominion Power Company of West Virginia, New River Power Company and West Virginia Power Company; president of the Georgia Construction Company; vice-president and director of the United Fuel Gas Company, Cumberland County Power & Light Company, Macon Railway & Light Company, Central Georgia Power Company, Central Georgia Transmission Company, Macon Gas Company and Charleston Industrial Corporation; director of J. G. White & Company, Portland (Me.) Electric Company. Easton (Pa.) Railways Company, South Covington & Cincinnati Street Railways Company, Cincinnati, Newport & Covington Railway and Union Light, Heat & Power Company. Mr. Gossler is the author of various contributions to the technical press. He is a member of almost all of the national technical associations and of numerous local associations and clubs.

D. E. Parsons was elected president of the Illinois State Electric Association at its annual meeting, held during the latter part of March. Mr. Parsons is general manager of the East St. Louis Light & Power Company and is also a past-president of the Illinois Electric Railways Association. He is a graduate of the mechanical engineering college of West Virginia University and of the two-year apprenticeship course of the Westinghouse Electric & Manufacturing Company. After serving in the sales department of the Westinghouse organization, Mr. Parsons was, in 1906, promoted to the position of head of the export division of the company's works. He was subsequently promoted to sales engineer in the railway, light and power department of the Pittsburgh district of the company. In 1916 he resigned to accept his present position.

D. E. PARSONS

Arthur L. Mullergren, consulting engineer, specializing in power plants and designs for public utilities, has opened offices at Kansas City, Mo., and New York City.

H. R. Stevens, formerly engaged as engineer in hydro-electric construction for the San Joaquin Light & Power Corporation, has recently sailed for Japan, where he will act as superintendent for Thebo, Starr & Anderton, San Francisco consulting engineers, on the hydro-electric plant they are building for the Daido Electric & Power Company at Nagaya.

Langdon Gibson, for twenty-three years manager of the production department of the Schenectady works of the General Electric Company, has recently resigned because of ill health and will retire from active business life. He is succeeded by H. L. R. Emmet, formerly assistant manager of the department. Mr. Gibson had been connected with the General Electric Company for twenty-seven years and was largely responsible for the growth and development of the department from very small beginnings. He has always been interested in Indian life and was a member of the first Peary expedition to the far North in 1891 and 1892.

LANGDON GIBSON

W. H. Campbell, for the past two years general sales manager of the Charleston Industrial Corporation, Nitro, W. Va., has opened offices at 30 Church Street, New York, under the firm name of W. H. Campbell, Inc., to handle the sale of new and used machinery.

Pierre E. Haynes, formerly gas and illumination expert for the city of Chicago and recently with the Union Carbon & Carbide Corporation, will be associated with Haynes & Mote, Hume-Mansur Building, Indianapolis, public utility counselors, as consulting engineer on utility valuations, plant operation, street illumination and other engineering problems.

Thomas H. Taylor, assistant general sales agent of the American Steel & Wire Company in charge of the Eastern district, with headquarters in New York for the last twenty-three years, retired from active service April 15. Mr. Taylor began business life as a hardware clerk at Creston, Iowa, in 1875. Subsequently he organized a retail store, which was the nucleus of the Omaha Hardware Company, a wholesale concern. A fire destroyed this establishment in 1891, and Mr. Taylor entered the wire industry as secretary of the Columbia Patent Company, which had been organized for the purpose of taking over patents claimed by the Washburn-Moen Company. Four years later he became sales manager of the Washburn-Moen Company and in 1898 was made manager of sales of the American Steel & Wire Company of Illinois, which had just been organized. The following year, when the American Steel & Wire Company of New Jersey was formed, Mr. Taylor became assistant general sales agent in charge of the Eastern district and held that position until his recent resignation. Mr. Taylor will spend the next few months traveling in Europe with his family and on his return will give his attention to the management of a feldspar manufacturing plant, an interest in which he holds.

Charles Franck, manager of the Holophane Glass Company, Inc., New York, has sailed for a three months' trip in Europe. He will tour Germany, Switzerland and France, spending most of the time visiting friends and former business associates. Mr. Franck was manager of the Holophane company's Brussels office for several years and left Belgium to become manager of the American company.

Frederick W. Prince, formerly advertising manager of the Westinghouse Electric & Manufacturing Company, is now filling a position on the staff of the publicity department of the Western Electric Company. Mr. Prince will be engaged in general sales promotion and publicity work.

S. H. Taylor has resigned from the presidency of the Electric Railway & Manufacturers' Supply Company, Westinghouse Electric & Manufacturing Company agent-jobbers in San Francisco, and will be succeeded by W. H. Whiteside, adviser to the Westinghouse company on the Pacific Coast.

H. L. R. Emmet, Langdon Gibson's successor as production manager of the Schenectady works of the General Electric Company, has been associated with the General Electric Company for ten years. He entered the employ of the company in November, 1912, as a clerk in the production department. In 1915 he was placed in charge of special production in connection with the execution of ammunition contracts during the world war and he was appointed assistant to the production manager on Jan. 1, 1917. Mr. Emmet is a nephew of W. L. R. Emmet, one of the consulting engineers of the company. He was born in New Rochelle in 1889 and is a graduate of Yale, class of 1912.

H. L. R. EMMET

Obituary

Elisha A. Tinker, member of the Public Utilities Commission of Ohio, died suddenly at his home in Columbus on March 21. Prior to his appointment to the commission in January, 1921, he was an attorney in Chillicothe.

Robert Brisbane, senior construction superintendent of the J. G. White Engineering Corporation, died on April 13 after an operation. He was born in Scotland in 1885 and came to this country when twenty-one years of age. He constructed a large number of public works and many private works. He had completed the rebuilding of the Bolinas (Cal.) station of the Radio Corporation of America and was about to take care of an undertaking in West Virginia when he was stricken with the illness that caused his death.

George R. Wales, sales agent at Boston for the Washburn Wire Company, Phillipsdale, R. I., died in Boston on April 14 from the effects of a recent operation. Mr. Wales had been identified with the steel and wire business all his life. Originally he was engaged with his father under the name of John Wales & Company, and about twenty years ago he started the National Wire Company at New Haven, Conn. This plant was later destroyed by fire. He then erected a new plant at Auburn, R. I., and this was taken over by the Washburn Wire Company some years later. When this deal was consummated Mr. Wales became associated with the Washburn company at Boston.

Hugh Trumbull of Plainville, Conn., died at Hartford, Conn., April 18, at the age of seventy-five years. Mr. Trumbull was connected with the Trumbull Electric Manufacturing Company, Plainville, until his retirement some years ago. He was the father of John H. Trumbull and Henry Trumbull, president and treasurer respectively of the Trumbull company; Alexander H. Trumbull, president of the Connecticut Electric Manufacturing Company, Bridgeport, Conn.; Frank S. Trumbull, secretary of the Connecticut Electric Manufacturing Company, and George Trumbull, Bantam, Conn. Besides his five sons, Mr. Trumbull is survived by his wife. He was born in Ireland and came to this country in his youth.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Minimum Prices Substituted for Heating Appliance Lists and Discounts

THE owners of the Marsh patent have made certain changes in Schedule B, which gave minimum list prices and maximum discounts, on heating appliances using the nickel-chromium alloy resistance wire. The changes become effective April 25. These changes consist of the abolishment of list prices and discounts formerly contained in Schedule B and the establishment of certain minimum prices for the various devices which are listed in the schedule. This enables each licensed manufacturer to establish his own list prices and discounts, and the only restriction with reference to prices placed upon the licensee by the owners of the Marsh patent is that the licensee shall not at any time sell the licensed appliances at prices lower than the minimum prices established by the schedule. In the schedule are listed both domestic and industrial types of heating devices.

The new minimum schedule prices are the same for all customers, with no differentiation between jobbers, central stations, contractors, department stores and other dealers.

The net prices are the same as under the old schedule except for flatirons, toasters and reflector-type heaters, which have been reduced slightly.

Inquiries for Steel Towers Increasing, with Orders Satisfactory

THE market for steel transmission towers has shown a new life since the first of the year, according to a statement to the ELECTRICAL WORLD by one of the manufacturers of this product, and the prospect is that there will be no let-up in orders for the rest of the summer. Central-station companies are in a good financial condition and very few of them are without plans for extending their transmission facilities. Much of this construction has been postponed for at least a year, and the result is that favorable quotations are now bringing it out into the open in quantity. Cheap money is another reason for going ahead with work now, a reason which was absent last year at this time.

The inquiries received are for work all over the country. The South is well represented and considerable work is going on in Kansas and other parts of the Middle West. St. Louis reports activity in Missouri and in the Southwest, while on the Pacific Coast several very large jobs have been proposed in recent months. Foreign demand is active also. A good-sized order has been received from the Dutch East Indies, and several central-station companies in Japan have also come into the market. European demand is not so marked as that of the Far East, but orders received from Europe have been fair.

Deliveries are good at the present time but are slowing up as the mills approach a normal working capacity. Manufacturers have not been carrying over-heavy stocks, and those they have are being worked off rapidly. The coal strike has not affected the supply of raw material so far, and little trouble is expected from that source inasmuch as the United States Steel Corporation has stated that its coal supply is sufficient to carry it through for several months. The strike, in fact, is fortunate for at least one manufacturer, who had $6,000,000 worth of coke on hand at the time the strike was called.

Prices have become more stabilized than formerly, partly as a result of the coal strike and partly because of better demand. Prices of general steel products have been going up for the past six weeks, and there is even a likelihood that quotations on transmission towers will show an upward trend in the near future.

Insulation Manufacturers Report Stronger Market and Better Buying

A BETTER demand for insulation materials and more stable prices are noted by manufacturers in this field, the pick-up having started early in February and having continued at an ever-increasing rate since that time. Bookings for March are estimated as double those of March, 1921, and April has bettered that record, it is thought, though exact figures have not been made available.

With higher prices ruling for cotton cloth and yarn, it is natural that insulation prices should show an upward trend. This has not resulted in increases, but rather in a stiffening of present prices. Better buying has been coming mainly from the repair and maintenance fields. Electric railways have shown considerable interest in comparison with the light buying from that direction in the first month of the year.

A very active market for mica insulation has been found in the radio business. Like every other industry connected with the radio-telephone business, mica insulation makers are working to capacity on this type of business and are behind in deliveries. Unfortunately few of these manufacturers can turn over all their machinery to making radio parts so that some departments are working below normal. The heating-appliance field is also taking a good amount of mica insulation, flatiron manufacturers being particularly active. Motor production is increasing, and as many of these concerns have been out of the market and have allowed their stocks to run down they are now ordering in good quantities. Starting and lighting systems for automobiles are also taking a great deal of mica insulation.

March Washing Machine Sales Increased 28 per Cent

SALES of washing machines for March, 1922, were greater than they had been during any month since August, 1920. According to Enoch B. Seitz, secretary American Washing Machine Manufacturers' Association, the March sales showed a gain of 28 per cent over the same period of 1921. The entire sales curve to date for 1922 is above that for the same period last year. A monthly improvement in this industry is also shown by the gain of 25 per cent in March sales over those of February, 1922. The March sales were better than the highest month in 1921—October—by 10 per cent. Figured on a dollar basis, March, 1922, showed an improvement of 18 per cent over the October business, because of the losses of liquidation. The total number of electric washing machines sold in 1921 was 289,406.

One of the reasons for this large and encouraging gain in business may be found in the fact that washing-machine manufacturers as a group have liquidated their prices to an extent that few others have. Price cuts taken over a year or more have totaled between 35 and 40 per cent, and some concerns have gone even further than this in the effort to find the bottom. At last, apparently, the public is satisfied that no more price drops are coming and manufacturers again can start to sell on a basis of quality. Another reason for better business lies in the working off of jobbers' and dealers' stocks. Until the fall of 1921 washing machines moved very slowly and the outstanding stocks had been so little reduced that the manufacturers had no market. Sales became slightly better in the fall, and jobbers now are reordering and doing it more generously than at any time since the depression hit them.

Employment in the larger industrial centers in the East and Middle West has become better also, and a large part of the public which had been forced out of the market simply by lack of money is now in a position to buy. Dealers report that it requires twice the amount of salesmanship to sell appliances now that it did formerly, but this condition is common to all industries at the present time. The time-payment plan is very strongly to the fore, the larger percentage of sales being made on the basis of a small payment down and installments over a long period. This is particularly true in the West, where strong sales campaigns are being waged.

Department Stores Strongly in Radio Broadcasting Work

A REPORT prepared by the National Retail Dry Goods Association, analyzing radio-telephone conditions, shows seventy-one licensed radio broadcasting stations in the United States, of which seven are department stores, located as follows: Philadelphia, three; New York, one; Newark, one; St. Louis, one; Los Angeles, one. Scores of applications for licenses have been filed by other stores throughout the country, for, it is stated, they recognize radio as a merchandising opportunity of the first order with an estimated annual volume of $70,000,000. In many of the large stores sales of apparatus average $5,000 to $6,000 weekly in spite of the shortage of sets and parts. An important field is expected to be the rural general store, because radio telephony will bring metropolitan entertainments to country districts and assist in saving life and property in storm, flood or fire by sending out alarms.

Trade Optimistic Over Prospects for Successful Fan Season

REPORTS received from all sections of the country would seem to indicate that, given the usual amount of hot weather, the coming fan season will equal if not exceed that of last year. Not only are dealers beginning to come into the market in larger numbers than last year, but jobbers also have the courage of their convictions and early contracts have been more than satisfactory though a trifle slow in coming in. A certain large maker of fans has 28 per cent more orders booked, with four fewer contracts in, than was the case at this time last year and from now on will go into normal production. An officer of this company has pointed out to the ELECTRICAL WORLD, however, that the comparison of bookings for the two years is somewhat misleading as to exact conditions. Last year a heavy carry-over cut down the number of fans ordered on advance contracts, whereas this year there was a very small carry-over. Discounting this fact, it is expected that sales to consumers will about equal or go slightly ahead of last year. Retailers are beginning to feel out the market, and they report some good sales already to hospitals, stores, public buildings and various institutions.

The 12-in. oscillating fan is expected to be much in demand again this year, but the greatest increase in sales will probably be shown by the 8-in. package fan and the 9-in. oscillator. Both have been advertised widely as useful for traveling and other purposes for which a large fan cannot be used, and the public, it is thought, will take kindly to these fans this summer. The alternating-current ceiling fan is also expected to encounter a heavy demand.

In the East the fan business has been exceptionally good and orders continue to come through from dealers. In the Middle West stocks are all new, as the carry-over was very small. Retailers are not buying there very strongly as yet, but are expected to start within a few weeks. Atlanta reports that there has not been enough warm weather yet to cause any brisk retail movement, though jobbers declare retailers to be placing good orders. San Francisco stocks are not yet in, but are expected shortly, and jobbers are looking forward to a good season. Portland jobbers are not so fortunate as those of other sections, for cold weather last summer left them with a considerable carry-over. Stocks are all ready for this season, but the demand has not yet started.

Metal Market Situation

COPPER inquiry in the domestic market is fair in volume, and a moderate amount of metal is changing hands. Foreign buying is slightly better, but sales are still comparatively small. Greater optimism seems to prevail in regard to the Genoa conference and the results to be obtained from it. Uncertainty as to the degree in which the coal strike may affect general business before it is settled is restraining domestic buying. Utimate consumers see no reason why they should hurry to place orders with wire and brass mills when copper production is increasing.

Domestic inquiry is mainly for May and June, and some producers notice a tendency for the buying to be relatively better from larger than from smaller consumers. However, stocks in dealers' and jobbers' hands are undoubtedly below normal, so that there is a large latent demand that as yet remains unsatisfied. It is thought that both the tariff and the bonus are making many buyers more cautious than they would ordinarily be.

Prices are more spotty than they have been for some time, mainly on account of the uncertainty spoken of above. Some producers who have been naming 13 cents a pound as their price have dropped to 12⅞ cents, and others who have been accepting business at 12⅞ cents have gone up to 13 cents. These two prices seem to mark the limits of quotations, and there is no talk of any lots going cheaper than the 12⅞ cents price.

That foreign and domestic buyers are following different policies has been noted. One large producer, commenting upon this, said that foreign users take American copper whenever they think the price is low, regardless of whether they will need the copper immediately or not. American users wait until they have orders for the fabricated copper in sight before they buy to cover. Accordingly they usually have to pay more for the metal. The largest foreign order going the rounds last week was for castings for shipment to China.

Reports from all steel centers indicate that demand is constantly growing. It is strong for virtually all lines, and were it not for the coal strike the industry as a whole would probably be operating at 80 per cent or higher.

NEW YORK METAL MARKET PRICES

Copper:	April 18, 1922	April 25, 1921
London, standard spot	£ s. d. 59 5 0	£ s. d. 59 0 0
	Cents per Pound	Cents per Pound
Prime Lake	12 87½	12.87½
Electrolytic	12.75	12.75
Casting	12 50	12.50
Wire base	14 00 -14.25	14.00 -14.25
Lead, Am. S. & R. price	5.00	5.25
Antimony	5.00	5.12½
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.22½-5.27½	5.35 -5 40
Tin, straits	30.87½	31.12½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	10 75 -11 12½	1.00 -11.12½
Brass, heavy	5 25 - 5 62½	5 25 - 5 50
Brass, light	4 75 - 5 00	4 87½- 5 12½
Lead, heavy	4 00 - 4 25	4 25 - 4 37½
Zinc, old scrap	2 50 - 2.75	2.50 - 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

TRADE in electrical circles pursued its leisurely way last week, and while there was no startling improvement to be noted, the activity of the first quarter is being maintained. In Chicago there has been a good movement of wiring materials, high-tension equipment, washing machines and vacuum cleaners. St. Louis bankers report financial conditions much better in the South and Southwest, and electrical jobbers are again selling in those territories. Bad weather hit Atlanta retail business once again last week, but industrial wiring is on the increase there. Boston trade is rather spotty, with prices steady. Interest in radio is growing rapidly in the Intermountain section and is far ahead of supply. Collections there show a gain of 7 to 10 per cent over this period last year. The San Francisco labor situation is quieter and a building strike will probably be avoided. The boom in lumber, together with good exports, seems destined to hurry prosperity back to the Northwest.

NEW YORK

Business conditions in the electrical trade continue to gain slowly but steadily. Jobbers do not report any unusually large sales, but the demand for wiring supplies holds up well and the general sentiment is that a very fair amount of business will be done during the spring and summer months. This is borne out by the development in building activity. Excavations for new buildings have been started in a number of locations in the commercial sections, and while many are far from being in the electrical stage of construction, this business will materialize during the summer and fall.

No price changes were reported this week, and prices generally seem to be more steady than they were a few weeks ago. Jobbers' stocks are in good condition, although there is no evidence of overstocks.

Rigid Conduit.—Jobbers have not been very rapid in advancing their quotations on conduit to cover the 7 per cent advance announced last week. The new prices will be as follows: For ½-in. black pipe in 2,500-ft. lots, $46.58; ¾-in., $59.57, and 1-in., $84.66 per 1,000 ft. Galvanized pipe in the same sizes and quantities will be quoted at $51.68, $66.47 and $94.88 per 1,000 ft. Most jobbers' stocks are in good shape

Rubber-Covered Wire.—Demand is very fair and jobbers' stocks are good. Prices are perhaps a little easier. No. 14 rubber-covered in 5,000-ft. lots sells for $6.25 to $6.35 per 1,000 ft. In 10,000-ft. lots it is understood that these quotations have been shaded slightly.

Flexible Armored Conductor.—Sales of this material hold up well and jobbers report a steady demand. Stocks are ample. Quotations on No. 14, two-wire, single-strip, range from $43 to $45 per 1,000 ft.. and double-strip from $45 to $47 for that quantity.

Porcelain.—A little better demand for porcelain for radio work has been noticed. No price changes have been announced.

Tape.—Both friction and rubber tape are quoted at 36 cents a pound in 100-lb. lots. A fair demand is reported.

Lamp Cord.—Sales are fair and jobbers' stocks are large. No. 18, cotton, twisted, sells from $11.65 to $12.75 per 1,000 ft. Parallel is quoted at $14.50 to $15.45 per 1,000 ft.

Fans.—Jobbers report about 20 per cent better sales than last year in spite of extremely cool weather for this time of year.

Metal Molding.—Movement of this material is fair and jobbers are carrying limited stocks. The three-wire size is quoted at $50 per 1,000 ft. for that quantity.

CHICAGO

With a continuing improvement in the electrical business, jobbers in general seem to feel that the burden of uncertainty of the past winter has been thrown off and that better business lies in the offing. Action on wiring materials is steadily increasing, and while prices are competitive, the building industry is constantly demanding these materials. High-tension manufacturers are unanimous in reporting a much improved interest in transmission equipment. Washing machines and vacuum cleaners are also moving well. One dealer reports sales for the month of March to be the best for some years. The interest in radio equipment is steadily increasing, but jobbers are operating under the handicap of small stocks.

Conduit.—A tendency toward a stiffening in price was noticed during the week. This action was undoubtedly taken in order to obtain a better return for handling this merchandise, since for the past few weeks jobbers have been forced to meet keen competition and accordingly have made little profit. The activity in the building industry has resulted in a steady movement of conduit. Jobbers' prices average around $42.50 per 1,000 ft. in 5,000-ft. lots. Stocks are ample.

Wire.—The demand for rubber-covered No. 14 wire is improving, jobbers reporting a good steady volume of business at prices around $6.25 per 1,000 ft. in 5,000-ft. lots. Quotations of some jobbers are still higher than this. Stocks are in good condition, but reorders are small. The call for weatherproof and bare wire is improving also owing to the building revival, but prices remain about on the same level as last reported.

Flexible Armored Conductor.—The previous active movement on armored conductor has been maintained and most jobbers sell the two-wire, single-strip, in lots of 5,000 ft. for $42 per 1,000 ft. Stocks are good but not excessive.

High-Tension Equipment.—Outdoor substations to be installed in the Middle West, rated at 33,000 volts, with a capacity of 600, 1,000 and 10,000 kva., were sold by one manufacturer. An order for 80,000-volt remote-controlled, pole-top switches was filled for a utility in Pennsylvania by another company.

Cleaners and Washers.—While strenuous efforts must still be made to sell these appliances, the good sales of the past three months have encouraged and compensated the dealers for this extra effort. Inquiries on vacuum cleaners are increasing and most dealers report a good business in this line. The demand for washing machines is steady, but sales are scattered.

Dry Cells.—The call for multiple-unit cells for radio use has increased steadily. In barrel lots the standard size is quoted at $30.52 per 100. This is a slight reduction due to a change in freight rates.

Appliances.—While the changing and unsettled weather for the past few weeks has somewhat aided the sale of open-air heaters, the market remains a bit sluggish. Flatirons seem to be the best line, but toasters, grills and percolators are also selling fairly well. Stocks are ample.

BOSTON

Trade is rather spotty this week, without much change in volume compared with last week. Conditions continue disturbed in the textile field owing to protracted strikes. Central-station earnings are improving, and considerable house wiring is keeping the contractors busy in not a few localities. Building and engineering contracts in New England for the week ended April 17 totaled $7,486,700, compared with $4,409,200 for the same week last year. Permits to build in thirty-four cities and towns of Massachusetts issued during March gained 24 per cent over February, 1922, and 117 per cent over March, 1921. Prices in electrical supply lines reflect hardening tendencies in rigid conduit, with steady quotations in most items carried by jobbers except where sales are put through under sharp competition by heavily overstocked concerns.

Wire.—Increased building operations are calling upon wire stocks, but no shortage impends. Rubber-covered No. 14 moved Monday at $6.25 per 1,000 ft. in 5,000-ft. lots to $6.75 in smaller quantities. A little buying of weatherproof is being done, base price being 16½ cents. Deliveries are very easy. Bare copper wire in small sizes is in considerable demand for radio aërials.

Tape.—Small-order business prevails. Prices vary widely and purchases reflect considerable interest in the cheaper grades. Representative Boston figures are as follows: Less than 10 lb., "Amazon" tape, 50 cents per pound; "Competition" white tape, 80 cents; "Two-flex" tape, $1. In less than 25-lb. lots, "Victor" tape sells at 50 cents per pound; "Victor" splicing compound at 45 cents and "Sticka" tape at 45 cents.

Lamps.—Demand is off on mill-type lamps and sign lighting is dull. Street-lighting business is more active and sales of lamps for residential and mercantile use hold up well notwithstanding the advent of longer days. Prices are steady.

Rigid Conduit.—New sheets are soon to be issued detailing advances of 7 to 10 per cent over the last bulletins, business during the past week having been taken on the higher basis. Plenty of pipe and fittings are on hand, and shipments are only such as to replace the present moderate requirements.

Electric Vehicle Specialties.—A new schedule took effect Monday on certain electric truck fittings, the discounts to contractor-dealers reflecting easier prices. These are as follows, on typical items: Pipe caps, over $25 list 40 per cent, under $25 list 35 per cent; service caps, over $25 list 44 per cent, under $25 list 39 per ce[illegible]niversals, over $50 list 27 per cent, under $50 lis[illegible]er cent; weather caps, over $25 list 47 per cent, un[illegible]5 list 43 per cent.

Motors.—Spasmodic sales of small units feature an otherwise dull market. A good deal of betterment work in small manufacturing establishments is under way, and this leads to a fairly continuous movement of motors in the district as a whole. Competition is extremely acute, and not a little engineering analysis is being demanded in connection with bids.

ATLANTA

The short spell of good weather which permitted the resumption of agricultural activities was broken by several days of heavy rains, again slowing up the work throughout this section. Planting already delayed is going to be materially interfered with unless a long spell of good weather comes soon. A general survey of the territory indicates that farmers are putting in about one-half of the normal cotton crop and will work this intensively, diversifying crops on the rest of their land.

Retailers' stocks throughout the section have been allowed to become badly depleted, and purchases, as a result, are on the increase, though buying continues to be largely of the hand-to-mouth sort, with jobbers very careful in their extension of credit. The residential building boom continues unabated, the first quarter of 1922 having piled up permits in Atlanta alone to a valuation in excess of $4,000,000, with the general outlook that this pace will continue for some time to come. There is to be noted a considerable activity in municipal improvements, with central-station companies beginning activity to undertake expansions to plants. Industrial activity is on the increase, as indicated by the increased volume of orders received by the larger electrical contracting firms in the section.

Vacuum Cleaners.—A seasonal activity is reported, with sales showing up as fair to good. One of the largest dealers undertakes a brisk campaign on May 1, and it is expected that the movement will be improved considerably. Local stocks are in good shape.

Washing Machines.—This line continues dormant in spite of all efforts to revive it, sales at the present time being confined almost exclusively to the larger centers. Cheap labor is one of the principal factors in holding down the volume of sales. Local stocks are good to heavy.

Electric Churns.—The smaller centers are taking a fair volume, with some sales of the 32-volt type reported in the country districts. Local stocks are in fair condition with the retail price steady at $35.

Sewing Machines.—Sewing machines have not come up to their usual seasonal volume, sales now being the exception rather than the rule, with the larger centers reporting all the sales made. Stocks have been allowed to fall to a low ebb, and the retail price on the three-quarter-head vibrating type is $51.50. Price cutting is not uncommon.

Distributing Transformers.—The movement of the popular sizes is reported as quite satisfactory, the activity for line extensions and improvements to the smaller plants being largely responsible for this situation. Sizes in larger than 25 kw. are somewhat slow. Local stocks are in splendid shape.

Rigid Conduit.—An increase in price of 7 per cent is announced this week, applicable to both black and galvanized. The movement is quite satisfactory in all of the popular sizes with a noticeable increase in the number of orders for the larger sizes. Local stocks are in excellent shape.

Fans.—There has not been sufficient warm weather to cause any brisk retail movement as yet, though jobbers report retailers as placing satisfactory orders and the outlook is good for an excellent season. Jobbers' stocks are ample to meet the anticipated demand.

ST. LOUIS

Bankers returning from the various conventions in the South and Southwest declare that both banking conditions and general business conditions there show decided improvement. "Where a number of banks in Arkansas were hard up, they are now paid up," one reports, "and the banks are in good shape. There is an excellent outlook for crops and the prospect for fruit is said to be better than ever before." In Louisiana it is reported that the outlook for rice, sugar and cotton is especially good and that the banks have liquidated and are in good shape. This improvement in the South is naturally having its effect upon the business of St. Louis jobbers, and they all report substantial improvement in sales to that part of the territory.

Business in electrical lines showed no particular change last week. Movement in all lines is comparatively good, and while it is difficult to notice the change in comparing one week with the previous one, comparisons of month-to-month business reveal a continuance of that gradual and steady improvement which is marking the return to normal conditions in this locality. In the appliance lines flatirons, toasters and waffle irons are meeting with favored demand. Motors are moving much better than a year ago, and the increased building is aiding the sales of wiring materials. Carpenters are back at work pending arbitration of their wage scale.

Porcelain.—Demand and stocks continue on about the same average basis that has obtained for the past few months. "Nail-it" knobs are now priced at $15 per 1,000; two-wire and three-wire unglazed cleats at $10.70 per 1,000, 5½-in. split knobs at $10.70 per 1,000, $\frac{5}{16}$-in. x 2½-in. tubes at $3.75 per 1,000, and $\frac{5}{16}$-in. x 3-in. tubes at $4.50 per 1,000—all in barrel lots.

Loom.—Sales are becoming less spotty, and the amount being sold is reported to be from 10 per cent to 15 per cent more than at this time last year. The $\frac{7}{32}$-in. size is quoted at $14.80 per 1,000 ft. in 250-ft. coils and at $14.40 per 1,000 ft. in 1,000-ft. lots. The $\frac{1}{4}$-in. size is quoted at $18.90 per 1,000 ft. in 250-ft. coils and at $17.55 per 1,000 ft. in 1,000-ft. lots.

Wire.—No. 14 rubber-covered continues to grow in demand and there is an active call for certain sizes of bare wire for radio purposes. Weatherproof shows some improvement, but extensive buying on the part of the power companies has not yet developed. No large stocks are to be found, for conservatism still rules. Rubber-covered solid, with single braid, in 5,000-ft. lots, is priced as follows: No. 14, $6 to $6.25 per 1,000 ft.; No. 12, $8.50 per 1,000 ft.; No. 10. $11.25 per 1,000 ft.; No. 8, $15.05 per 1,000 ft.

Portable Lamps.—A good indication of the better spending spirit on the part of the public is found in the sales of portables, as lamps of the higher grades are now selling in greater proportion than last year. A large retailer of lamps reports that business is materially better.

Flatirons.—The reduced prices have unquestionably strengthened the market, and the quantity being sold in this territory is reported to be at least 10 per cent better than at this time last year.

SAN FRANCISCO

The labor situation is quieter. Nearly all the crafts, including all the electrical unions, are working, and there are hopes that a general building strike may be averted. Contracting work is very good, with intensified competition. Nearly all the larger firms are working full crews. A great deal of municipal construction, such as schools, is reported, with more in sight. The spring is tapering off into summer, but some severe frosts have greatly harmed certain districts, such as the Santa Clara valley and San Leandro, and probably put others out of the running for the year as possibilities for much building or retail selling.

Fixtures.—This line has picked up considerably during the past month owing partly to numerous large jobs, but principally through the enormous increase in the building of private homes and small apartment houses. There still is a housing shortage, but "to let" signs are again noticeable even in the cities that until recently have been greatly cramped for room.

Fans.—Stocks are not yet in but are expected shortly. The country has been well covered and a good year is looked for.

Ranges.—No decision has yet been reached on the widespread demand that dealers and central-station companies should sell ranges at list prices, but their selling organizations are marking time in expectation of early action on this line.

Radio.—Absolute shortages of stock are reported on all sides in the face of a demand that is unprecedented. Late May deliveries are considered quick. Several local hotels are equipping their dining rooms with radio receiving apparatus, and at least one apartment house is furnishing such equipment with its apartments.

Washers.—The situation apparently is unchanged, but under the surface are plans for a revival of selling activities. Lack of this activity, which has been diverted in large measure to vacuum cleaners, is considered the real reason for the stagnant washer market.

Wire.—Special insulated wires, such as heater cord and stove wire, are in big demand by local manufacturers of waffle irons and radiators. As an index to the market, No. 16 reinforced heater cord is being quoted generally at about $37.50 per 1,000 ft. with a 5 per cent increase for 500-ft. quantities and a 10 per cent increase for coils. No. 14 single-braid solid rubber-covered wire is selling for about $6.50 per 1,000 ft. in 5,000-ft. lots. A brisk business is reported in expectation of an advance in the near future.

PORTLAND—SEATTLE

A continuation of the recent favorable weather, it is expected, will have a markedly stimulating effect on retail business and building operations. A very encouraging feature of the industrial situation in the Northwest is the continued acceleration of activity in lumber. Production for the week ended April 15 was only 4 per cent below normal, while new business was 22 per cent above production and shipments were only 11 per cent below new business. It is evident that production will have to increase materially if it is to keep pace with demands. This increasing demand for lumber is causing many of the mills to start night shifts, and several mills plan to put on night crews on May 1. Seattle's foreign trade for 1922 shows a substantial gain over the year before. This is true for a month to month comparison as well as for the first quarter of the year. A report just issued shows a gain of more than 20 per cent in imports for March of this year as compared with March, 1921. Export tonnage for the same period shows a material gain.

Electrical jobbers report business about the same, with a slight tendency toward improvement. Portland jobbers report that accounts for March were forty-one days outstanding as against forty-seven days for February. Credits are not loosening up to any extent. Small construction jobs are numerous enough to keep the contracting business fairly active. Great activity in Portland exists in public utility stock sales at this time.

Appliances.—Washing machines are fairly active, but ironers do not move very rapidly. Some reports show that vacuum-cleaner sales are high, but others find demand moderate.

Ranges.—The demand for electric ranges in Portland is exceptionally good, approximately a car load a month being installed within the city.

Air Heaters.—Demand for heaters is about over, and the stocks in general are very well cleaned up.

Fans.—Stocks of electric fans are all in. The demand has not started and probably will not for some little time. There is considerable carry-over in some stocks from last year, as last summer was a very poor season.

Fixtures.—Electrical dealers of Portland report fixtures very active but store sales quite slow.

SALT LAKE CITY—DENVER

The biggest construction job pending in the Intermountain region is the proposed Moffat tunnel piercing the Continental Divide about 35 miles west of Denver. The Colorado Legislature is now considering the proposition of issuing construction bonds in a sum not to exceed $6,720,000. The tunnel is to be wide enough for both a railway line and an automobile road. It will greatly facilitate traffic between Denver and Salt Lake City by shortening hauls and tapping rich agricultural and mining districts. Interest continues active in radio. The Salt Lake City Commercial Club has ordered the installation of an outfit for the benefit of its members. The report is current that the city is to have a large broadcasting station. Jobbers are overwhelmed with inquiries and orders from the retail electrical dealers, but as yet very little equipment has been received from the manufacturers.

Building activity is speeding up. This applies particularly to cottage construction but many large jobs are also getting under way. There has been a slight general advance in building materials. Collections show an improvement of 7 to 10 per cent over the corresponding month of last year.

Switchboards.—The activity in this line is showing a steady increase. Manufacturers are handling some large installations and using a bigger force of men than they have employed for months.

Conduit.—The demand is steady and stocks are ample. There has been a recent 7 per cent advance in price.

Sockets.—Prices are pretty well down, but the market shows a healthy tone.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Merger of Radio Manufacturing Companies Contemplated

Arrangements are being made to merge the Dubilier Condenser Company, the Federal Mica Company and the Cambridge Manufacturing Company into one corporation to be known as the Dubilier Condenser & Radio Company. All of these companies have been organized and are controlled by William Dubilier, who invented the Dubilier condenser now in use on most of the wireless instruments made. The new company will manufacture the radio condensers and also the larger condensers which are applied to big machinery. All classes of radio accessories will be manufactured also.

It is stated that the large demand for his condenser has rendered it necessary for Mr. Dubilier to enlarge his facilities, and he has entered into negotiations with bankers in order to provide the additional funds to accomplish this purpose. Capitalization of the new company will be $500,000.

Electric Furnace Company Now Issues House Organ

Publication of a new house organ, the *Electric Furnace News*, has been started by the Electric Furnace Company, Salem, Ohio. The publication is intended for distribution to industrials interested in the melting equipment manufactured by the company. The April issue contains articles on the results of the test of a resistance furnace by a British rolling mill, on tests of electric melting of glass and ferromanganese, and one on the new fields of usefulness for electric furnaces by T. F. Baily, vice-president of the company.

Dwight P. Robinson Reports Industrial Construction Active

The volume of industrial construction, which has been lagging behind during the last year, is now gradually increasing, according to Louis H. Bean, vice-president Dwight P. Robinson & Company.

Mr. Bean says: "An increasing demand for goods is gradually taking up the slack in available manufacturing space, and many industrial companies are now proceeding with new plants and extensions, as indicated by new contracts we received during the month of March. We have been authorized by the Denkmann Lumber Company to design and construct a complete electrically driven sawmill at Denco, Miss., together with a village of about fifty houses, schools, churches, etc., and additional work at the Denkmann plants at Canton and Pelahatachie, Miss., and also to design and construct a new sulphur-mining plant at Hoskins Mound, Tex., for the Freeport Sulphur Company. Additional purchases of American products were approved by the Brazilian government for our work on the great irrigation project now in progress in northeastern Brazil, the items including twelve locomotives."

Engineering Company Reorganizes

The announcement has been made that Webster L. Benham, under the firm name of the Benham Engineering Company, has taken over all the contracts of Benham & Mullergren, consulting engineers, Kansas City, Mo. The new company is established at 512 Gumbel Building, Kansas City, and will act in a consulting engineering capacity on electric light and power plants, waterworks and other construction projects. A. L. Mullergren retires from the firm, according to the statement issued, and will engage in private practice, specializing in electric light and power plant engineering and public utilities. His office will be at 555 Gates Building, Kansas City.

United Construction Company Optimistic

Edgar J. Ellis, president United Construction Company, 1727 Sansom Street, Philadelphia, gives a very optimistic view of the construction situation in that city. Mr. Ellis said to a representative of the ELECTRICAL WORLD: "Business in the building construction line has never been so good for the United Construction Company as it is today. We have been in electrical work for over twenty years and have never felt better satisfied. An extra large jump in work is expected shortly. The labor supply is good, and the men are satisfied with present wages but are anxious for more work."

New Yorkers Establish Lee Radio Corporation

The organization of the Lee Radio Corporation, Haddonfield, N. J., by New York interests has been announced. The company has obtained space in the factory of John E. Hand, nautical instrument makers. One hundred men are employed. Mauntwell Van Rensselaer of New York City is president of the company.

Order Sought to Sell Auto-Lite Factories

The Ohio Savings Bank & Trust Company has filed in the federal court at Toledo a motion for order of sale of the Auto-Lite Corporation's plants at Toledo and Fostoria, Ohio, in an effort to assist in payment of claims against the Willys Corporation, of which the Auto-Lite Corporation is a subsidiary. The total claims filed against the Willys Corporation, which is in the hands of a receiver, amount to $24,000,000, one-half of which will be admitted to be valid, a report accompanying the motion says. It is further stated that the Auto-Lite Corporation, whose business has been conducted separately from that of the Willys Corporation, has been and is doing a good business.

The report adds that all current obligations of the Auto-Lite Corporation will be taken over by the purchaser and that the proceeds of the sales of the properties will be distributed among the creditors of the Willys Corporation. Filed with the motion is an inventory of the Auto-Lite plants prepared by the receivers of the Willys Corporation, which shows that the Auto-Lite property is worth about $4,210,000.

Company Organized to Handle Used Machinery

Offices have been established at 30 Church Street, New York, by W. H. Campbell, Inc., an organization formed to sell both new and used power, refrigeration and chemical apparatus. The company is headed by W. H. Campbell, who for the past two years has been general sales manager of the Charleston Industrial Corporation, Nitro, W. Va. While with the Charleston Industrial Corporation, Mr. Campbell devoted his time to the sales of equipment from the former government munitions plant at Nitro.

Heine Boiler Company Sees Long Buyers' Market

In a message sent out to salesmen of the Heine Boiler Company, St. Louis, by C. R. D. Meier, president, it is stated that it may safely be assumed that it will be twenty years before the readjustment period is completely over and that in the meantime competition will be very strong and prices will not show much recovery. Mr. Meier takes as the basis of his statement a chart of wholesale prices from 1810 to 1920 prepared by the Russell Sage Foundation. In this period occurred the war of 1812, the Civil War and the World War, and the chart shows that prices declined steadily from 1812 to approximately 1835 and for an equally long period after the Civil War.

"Those who were in business as early as 1880," says Mr. Meier, "will recall that for a time prices were getting lower, business was scarce and competition very great. About 1898 conditions began to pick up and we were steadily on an ascending wave until about 1914, when the increase was so marked as to be almost vertical on the chart. Now we are following exactly the same trend of conditions as was evidenced after the war of 1812 and the Civil War, the only difference being that the late conflict was of much greater magnitude and civilization today is much more complex than it was before. Consequently the readjustment period is going to be harder and perhaps longer."

The only means by which business can be kept afloat, Mr. Meier continues, is by sound financing, the establishment of a reputation for fair dealing and an honest product, low factory costs and intensive selling.

"I telegraphed you [the salesmen]," he says, giving an example of what intensive selling can do, "not long ago that we must have more business or the time would soon arrive when we must shut down our plants as our output was greatly exceeding the sales we were booking. What was the result? Within three days we booked orders that would take us two weeks to fill. Is it not perfectly evident that concentrated double-barreled work on sales-prospects is the only thing needed to put us over the hill?"

Pacific States Company Starts Intensive Wiring Campaign

An intensive campaign to acquaint the public better with the necessity for a complete job in the electrical wiring of homes, based on quality rather than on price, has been launched in southern California by the Pacific States Electric Company, Los Angeles, and more than 300 of its dealers. As more or less of a side issue, war will be made on the irresponsible contractor who provides an incomplete job at a cut-rate price, the number of these contractors having increased considerably in that section in the last year owing to employment conditions. The decision to wage these two campaigns was made recently at a meeting in Los Angeles of the heads of the Pacific States company and representatives of a large number of contractor-dealers in that territory.

The speakers at the meeting included David E. Harris, vice-president and general sales manager of the Pacific States company, who outlined briefly the salient points of the campaign, and J. D. Barnhill, president Evans & Barnhill, Inc., who is to have charge of the advertising and publicity of the campaign. A total of nineteen separate advertisements will appear thirty-eight times in the cities of Los Angeles, San Francisco, Portland and Seattle and nineteen times in Oakland, Fresno and Sacramento. These advertisements will attempt to sell house wiring to the public on the basis of good workmanship, standard materials and fair prices. The installation of sufficient convenience outlets in all wiring jobs will be an important object of the campaign.

Radio Industries Corporation Now in Production

The Radio Industries Corporation, 131 Duane Street, New York, has announced that it is in production of radio-telephone head sets and will be able to make deliveries beginning May 15. The company is manufacturing telephone head sets on which it has recent patents, and other patents are still pending. Benjamin Gould, formerly general sales manager of the Gould Appliance Company, which manufactured ironing machines, is vice-president and general sales manager for the Radio Industries Corporation and will have his headquarters at the Duane Street address.

Standard-Package Plan for Electric Truck Sales

An exceptional sales plan was begun this week by the Ward Motor Vehicle Company, Mount Vernon, N. Y., to stimulate electric road-truck sales. The company has just reduced the price of all models, the reduction ranging from 10 per cent to 35 per cent. In addition there is a special offer on the ½-ton and ¾-ton trucks, one model in each size, which might easily be called the standard-package plan, with the privilege of partial payments.

In these two sizes a truck, complete with chassis, body and Edison battery, is offered as a unit. This saves the customer from the confusion of having to decide on a battery and go elsewhere to pick out a body. A unit price is made, and in addition there are standard discounts for five and ten trucks. A partial-payment plan of $100 down, $495 on delivery and the balance in twenty-one equal monthly payments, is offered.

This standard-package plan is of more than passing interest because it is the first special merchandising attempt in the electric truck field made for some years. Besides, the co-operative plan of selling a special-type truck and one kind of battery is sufficiently unusual in itself to command attention.

Philadelphia Jobber Sees Prices Governing Present Business

Owing to the increased building construction work in Philadelphia, according to T. H. Lewis, president of the Elliot Lewis Supply Company, electrical jobber of that city, a larger demand for electrical goods is being experienced. A comparison of each month's business with that of the previous month shows a steady gain. New trade, coming from the occupants of the lately constructed houses, is resulting in a more active market for household appliances, such as vacuum cleaners, washers, electric flatirons and toasters. There is an increasing call for wireless apparatus, especially radio telephones.

Today, however, Mr. Lewis stated competition is very strong and it has narrowed down to a question of prices, the jobber who makes the lowest price usually getting the business.

"This company," Mr. Lewis continued, "adopted the policy when first starting in business of giving the public service. This policy was successful until two years ago, when business dropped suddenly. A conference was held and the decision to take the matter to the dealer was made. Here we found that the dealer was satisfied with our service, and we could not find what was the matter until it came to a question of prices. It was then found that the dealer could get goods at a lower price—he liked our service and our goods, but had to sell cheaper in order to get any business. We then took the question of prices up with the manufacturer and a reduction was made on both ends. This was accomplished through increased buying. Where we formerly brought a quarter of a million feet of wire, for instance, we today buy two million feet. The result has been a larger trade than ever, but the profit taken as a whole is not so large as formerly.

"Today, if sales to a particular customer drop, a conference is held, and if it is a question of prices, the matter is taken to the manufacturer and a meeting is arranged between the manufacturer, ourselves, as the jobber, and the dealer. The question of prices is then discussed, and we come to a satisfactory conclusion. Today, it is a question of prices and not service."

The Combustion Engineering Corporation, 43 Broad Street, New York, has arranged with the Power Plant Equipment Company, Kansas City, Mo., to act as its sales representative in eastern Kansas, eastern Nebraska, western Arkansas and western Missouri. Office will be at 1002 Coco-Cola Building.

The Federal Electric Company, Inc., with which is affiliated the Federal Sign System (Electric), has moved to the Bush Building, 130 West Forty-second Street, New York City, the change taking place on April 17.

The Vacu Signal Company, Haddonfield, N. J., has been organized to manufacture electric signals. John H. Lippincott, Jr., Mayor of Haddonfield, is president of the company.

The Roller-Smith Company, 233 Broadway, New York, has appointed Eshavick & Hoyle, Otis Building, Philadelphia, to handle its line of electrical instruments, meters and circuit breakers in that territory in place of the Perkins-Lenoir Company. The Perkins-Lenoir Company, which also represented the Roller-Smith Company in Baltimore, has been succeeded in the latter city by F. E. Perkins, 113 East Franklin Street.

The Driver-Harris Company, Harrison, N. J., manufacturer of electrical resistance wire and other products, on May 1 will move its Chicago office to larger quarters at 562-574 West Randolph Street. The old facilities, the company has announced, had become inadequate to handle the business of that territory.

Foreign Trade Notes

ELECTRICAL MACHINERY IMPORTED INTO SPAIN.—During the first ten months of 1921 the following material for the electrical industry, according to *Commerce Reports*, was imported into Spain: Generators, electromotors, induction coils, transformers and regulators up to 100 kw., 1,229,764 kw.; same from 100 kw. to 400 kw., 1,094,698 kw.; switchboards and interrupters up to 400 kw., 160,585 kw.; generators, electromotors, switchboards, etc., from 401 kw. to 2,500 kw., 2,590,484 kw.; same from 2,501 kw. to 5,000 kw., 455,271 kw.; same from 5,001 kw. upward, 930,729 kw., making a total of 6,461,531 kw. Of these quantities Germany sent 2,598,183 kw., Great Britain 770,313 kw., and the United States 1,428,210 kw., while imports from Switzerland totaled 384,106 kw.

JAPAN RAISES DUTY ON COPPER.—Japan has put into effect decided increases in the rates of duty applying to copper, according to cablegram advices to the Department of Commerce. The rate on copper ingots and slabs has been increased from 60 cents a picul (133 lb.) to $3.50 per picul. The increase on copper bars and rods is from $4.45 a picul to $7.50 a picul. The increase on copper plates and sheets is from $4.98 a picul to $8.00 a picul. The cablegram states that the action is necessary to protect Japan's domestic copper industry.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An inquiry has been received from Mexico (No. 1,356) for a wireless telephone with two receiving and two transmitting telephones, with a radius of 5 miles, to be used in connection with a street-car system.

There is a market in Italy (No. 1,377) for electrical machinery, apparatus, etc.

TELEGRAPH AND TELEPHONE MATERIAL FOR BANGKOK, ASIA.—Tenders will be received by the Department of Posts and Telegraphs, Bangkok, until June 5, according to the *Electrician*, for telegraph and telephone material, to cost about £10,000. Tender forms may be obtained from the chief electrical engineer, Telephone Exchange, Bangkok.

New Apparatus and Publications

TRANSFORMERS.—The Moloney Electric Company, St. Louis, has issued catalog No. 215, covering its various types of transformers, including dimensions, price lists, etc. Catalog No. 217 issued by the company contains information in regard to the care and use of transformers.

RECORDING EQUIPMENT.—The Uehling Instrument Company, Paterson, N. J., is distributing bulletin 112, covering Uehling CO_2 recording equipment. Particular attention is called to the recently developed "Pyro-porus" filter, and also to the separate recorder for the engineer's office and indicator for boiler-front continuous (not intermittent) chart record and dry method of absorption.

RESISTANCE-MEASURING INSTRUMENT.—Herman H. Sticht & Company, 15 Park Row, New York City, is distributing leaflet No. 15, describing its model "D" and "2 in 1" megohmers for measuring and testing voltages.

INDUSTRIAL TRUCKS.—The Eleveyor Electric Industrial Truck Company, 56 Huntington Street, Brooklyn, is distributing two leaflets covering "Eleveyor" electric industrial truck with loading platform.

WATER HEATER.—The Electric Heating & Manufacturing Company, Westlake and Republican Streets, Seattle, is distributing a circular describing the Apfel "Coppersert" electric water heater, recently developed by the company.

WASHING MACHINE.—The Maytag Company, Newton, Iowa, has placed on the market an electric washing machine with a tub of cast aluminum.

AUTOMOBILE SIGNAL.—An all-electric directional traffic indicator, "Hankee," operated by an electric motor, has been placed on the market by the Naser Electric Company, Minneapolis.

UTILITY APPLIANCE.—The Sieben Manufacturing Company, Kansas City, Mo., has issued a four-page circular describing its "All-in-One" electrical unit, consisting of a fan, heater, toaster, clothes drier, grill, hair drier and hot-plate range.

COPPER TUBING.—The Chase Metal Works, Waterbury, Conn., are distributing a six-page leaflet covering their seamless brass and copper tubing.

PULVERIZING MILL.—The Hardinge Company, 120 Broadway, New York City, has issued a bulletin covering the Hardinge conical mill, in which is shown the adaptability of the mill to industrial and metallurgical grinding problems, etc.

CLOTHES WASHER WITH CHURN.—The Wayne Manufacturing Company, 124 Sidney Street, St. Louis, has added a new feature to the "Wayne" Electric clothes washer, consisting of "Baby" washer and churn.

New Companies

THE SMITH-SANDERS POWER COMPANY, Rogersville, Tenn., has been incorporated with a capital stock of $50,000 by Charles M. Smith, John R. and X. T. Sanders.

THE PAGE POWER COMPANY, Richmond, Va., has been incorporated with a capital stock of $300,000 to distribute electricity in Page and adjoining counties. The officers are: M. E. Roundabush, Stanley, president, and A. A. Roundabush, Shenandoah, secretary.

THE GRAND ISLAND (N. Y.) LIGHT & POWER CORPORATION has been chartered with a capital stock of $50,000 by F. J. Offerman and J. Schutt, Jr.

THE FARMINGTON LIGHT & POWER COMPANY, West Farmington, Ohio, has been incorporated with a capital stock of $5,000 by J. H. Elwell, Orris Newcomb, F. S. Hart, C. E. Stevens and H. G. Chapel.

Record of Electrical Patents

Notes on United States Patents

(Issued April 4, 1922)

1,411,586. System of Motor Control; Harold W. Rogers, Schenectady, N. Y. App. filed May 21, 1920. One of the Ward-Leonard resistance type.

1,411,613 to 1,411,616. Flashlight; Fred Evans, Summit, N. J. Applications filed March 22, 1920. Four types of flashlamps with self-contained generator operated by hand.

1,411,619. Electrical Apparatus; John J. Frank, Pittsfield, Mass. App. filed Dec. 10, 1919. Coil form and support for transformers, reactors, etc.

1,411,620. Electric Switch; John H. Groegr, Bridgeport, Conn. App. filed Dec. 6, 1917. For automobile headlight having a separate dimming bulb.

1,411,643. Instrument for Generating Electric Currents for Ignition Starting and Lighting; Kurt F. Ries, Dayton, Ohio. App. filed April 8, 1920. Magneto, generator, distributer, dual circuit breaker and condenser in one unit.

1,411,657. Circulation for Electrodeposit Systems; Charles Duncan, Philadelphia, Pa. App. filed Dec. 11, 1920. Propeller to keep electrolyte in circulation.

1,411,663. Electrical Heating Appliance; Robert Kemp, Elmhurst, N. Y. App. filed Feb. 26, 1921. Used with portable fans.

1,411,700. Motor Controller; William T. Holmes, Baltimore, Md. App. filed Feb. 8, 1918. For dynamic braking on direct-current motors.

1,411,712. Time-Controlled Motor; Frederick Diehl, Elizabeth, N. J. App. filed July 26, 1916. Device for stopping fan motors after a definite period.

1,411,716. Electric Light Bulb; Andrew A. Flory, Grand Rapids, Mich. App. filed May 10, 1918. Automobile bulb with two filaments for dimming

1,411,754. Headlight Regulator; Edgar M. Soreng, Milwaukee, Wis. App. filed Nov. 24, 1916. For lights supplied from magneto.

1,411,814. Power System for Radio Apparatus; Hugh M. Stoller, New York, N. Y. App. filed April 30, 1918. Transmitting tube set for aëroplanes.

1,411,849. Trolley Pole for Trackless Trolley Cars; Edward L. Kraft, York, Pa. App. filed June 8, 1921.

1,411,862. Controlling and Regulating Apparatus for Alternating-Current Dynamo-Electric Machines; Friedrich W. Meyer, Milwaukee, Wis. App. filed Jan. 21, 1918. Stable operation by using electro-ionic valves.

1,411,893. Trolley Shoe; John L. Whittaker, Winthrop, Mass. App. filed May 2, 1918. Sliding shoe.

1,411,901. Rheostat; Edward M. Bentley, Lawrence, N. Y. App. filed July 17, 1919. Formed of a ribbon folded into a series of loops.

1,411,947. Electric Socket Device for Vehicle Lamps; Frederick G. Whittington, Chicago, Ill. App. filed June 23, 1920. Switch and socket arrangement for spotlamp.

1,411,987. Ship-Propulsion System; Frederic H. Clough, Rugby, England. App. filed Jan. 28, 1921. By synchronous motor with dynamic braking.

1,411,988. Terminal Structure for Electric Batteries; Thomas R. Cook, Pittsburgh, Pa. App. filed Feb. 18, 1920. To prevent leakage in storage battery by wedged bushing.

1,411,989. Terminal Structure for Electric Batteries; Thomas R. Cook and Paul E. Norris, Pittsburgh, Pa. App. filed March 10, 1920. To prevent leakage.

1,411,998. Trolley Head; Edwin B. Grace and William J. Laffey, Memphis, Tenn. App. filed July 16, 1921. Collector for three-wire system.

(Issued April 11, 1922)

1,412,051. Armature Tester; Percy A. Gaalaas, Minneapolis, Minn. App. filed Sept. 20, 1920. For short circuits, open circuits and grounds.

1,412,067. Voice-Current Telephone Repeater; Arthur B. Smith, Evanston, Ill. App. filed June 6, 1918. In either direction, over long-distance trunk line.

1,412,079. Cable Connection for Brushes; Victor C. Hamister, Cleveland, Ohio. App. filed June 2, 1919. Pigtail soldered in way to prevent solder running out when overheated.

1,412,080. Telephone Transmitter; Alexander E. Keith, Hinsdale, Ill. App. filed April 14, 1917. For reducing "packing" effect.

1,412,094. Automatic Telephone System; Arthur B. Smith, Evanston, Ill. App. filed Oct. 8, 1921. Trunking system.

1,412,103. Service-Observing Set; George Crisson, Hackensack, N. J. App. filed Nov. 24, 1920. For determining service on telephone lines.

1,412,112. Direction Signaling Apparatus for Motor Vehicles; Carl Claussen Heise, Decatur, Ill. App. filed Aug. 18, 1920.

1,412,174. Art of Making Electrolytic Iron; Frederic A. Eustis, Milton, Mass. App. filed Dec. 1, 1920. Means for preventing ferric iron from acting on cathode.

1,412,228. Automatic Starting and Short-Circuiting Device for Asynchronous Motors; J. U. F. Andersen and A. F. B. Iversen, Copenhagen, Denmark. App. filed Dec. 6, 1918. Mercury while held in position by centrifugal force short-circuits starting coils.

1,412,252. Machine Gun and Similar Weapon; Helmuth P. Martin and Owen D. Lucas, Westminster, London, England. App. filed Sept. 15, 1920. For timing the firing of electrically detonated ammunition.

1,412,269. Rail Bond and Method of Making Same; Charles A. Cadwell, Cleveland, Ohio. App. filed June 23, 1919. For putting terminal onto wire.

1,412,271. Means for Control of Engines or Apparatus; Leon J. Creplet, Paris, France. App. filed Feb. 14, 1919. Operates from distance engines having limited movements.

1,412,272. Electric Regulation; John L. Creveling, White Plains, N. Y. App. filed Oct. 7, 1916. For regulating either current or voltage.

1,412,273. Electric Regulation; John L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. For variable-speed generators.

1,412,274. Electric Regulation; John L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. Maintains constant voltage on variable-speed generator.

1,412,339. Electric Regulation; John L. Creveling, New York, N. Y. App. filed March 8, 1912. Automobile generator regulator for charging battery.

1,412,372. Electrical Switching Device; William H. Sharpe, Lakewood, Ohio. App. filed May 5, 1920. Plunger type for automatic telephone systems.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PRINCETON, ME.—The Electric Light Department is considering building a new power station for the municipal electric plant and installing new equipment. W. W. Kneeland is chairman of the commission.

PROVIDENCE, R. I.—The Narragansett Electric Light Company has awarded a contract to the Fred T. Ley Company, Springfield, Mass., for the erection of a two-story power house and service works, totaling eight buildings, on Melrose Street.

LITCHFIELD, CONN.—The Washington Electric Light & Power Company expects to extend its system to New Preston Village and New Preston Station. E. L. Miner is superintendent.

NORWICH, CONN.—The Eastern Connecticut Power Company has increased its capital from $1,500,000 to $4,000,000, part of the proceeds to be used for extensions and improvements.

WATERBURY, CONN.—The Connecticut Light & Power Company has completed plans for the construction of a service building, on Freight Street, to cost $80,000. Louis A. Walsh, 51 Leavenworth Street, is architect.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates extending its transmission lines to Nimmonsburg and Chenango Forks, with local distributing systems. A distributing system will also be installed at Vestal.

BROOKLYN, N. Y.—The Brooklyn Edison Company is taking bids for the erection of a power plant at the foot of Sixty-sixth Street, to cost about $1,000,000 with equipment.

BUFFALO, N. Y.—Bids will be received by the Department of Hospitals and Dispensaries until May 8 for work in connection with the new hospital at 642 Grider Street, including auxiliary lighting system, lighting fixtures, refrigerating and ice machinery (electrically operated), conduit and wire. George S. Staniland, M.D., is secretary.

DANSVILLE, N. Y.—The Dansville Gas & Electric Company is rewiring the village for changing the system to three-phase, 60 cycles, 110/220 volts, 2,200 volts primary. Electricity will be purchased from a hydro-electric company, which is erecting a dam and power house between 2 and 3 miles from Dansville. Power will be delivered at 2,300 volts. When the change is made the company will furnish service outside of the village. C. H. Mason is superintendent.

GOWANDA, N. Y.—The Iroquois Utilities, Inc., contemplates the installation of additional waterwheels with a total capacity of 980 hp., General Electric generators of 600 kva. and the erection of 12 miles of 60,000-volt transmission lines. J. W. Grace is manager.

LOCKPORT, N. Y.—The Lockport Light, Heat & Power Company contemplates the erection of new rural transmission lines and the installation of a 1,500-hp. waterwheel to replace a 500-hp. wheel. John A. Duff is assistant secretary and treasurer.

NEW YORK, N. Y.—Bids will be received by the Treasury Department, office of the Supervising Architect, until May 8 for mechanical equipment for an addition to the boiler plant and transformer substation at the Quarantine Station, Hoffman Island.

NEW YORK, N. Y.—The Manila (P. I.) Electric Company, operated by the J. G. White Management Corporation, 43 Exchange Place, has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

PLATTSBURG, N. Y.—The Plattsburg Gas & Electric Company contemplates extending its transmission line from Cadyville to Lyon Mountain to furnish electricity to the iron mines at the latter place. H. A. Stutchbury is superintendent.

PORT HENRY, N. Y.—The Port Henry Light, Heat & Power Company contemplates the installation of an additional 1,500-hp. waterwheel. C. F. Carpenter is superintendent.

RETSOF, N. Y.—The Retsof Mining Company will build a power house in connection with its new salt-mining and refining plant, to cost about $700,000. T. F. Courthope is engineer.

SARANAC LAKE, N. Y.—The Paul Smith's Electric Light, Power & Railroad Company contemplates the erection of rural lines and extensions in villages, to cost about $10,000. P. A. Gould, Saranac Lake, is manager.

FRENCHTOWN, N. J.—The installation of an entire new generating unit of about 100 kw. capacity in the municipal electric light plant is under consideration. Russell W. Bloom is clerk.

CHAMBERSBURG, PA.—The Council will soon take bids for the erection of a new municipal power plant on Third Street, to cost about $150,000 with machinery. Albert C. Wood, Stock Exchange Building, Philadelphia, is engineer.

DALLAS, PA.—A power house will be erected at the new convent to be erected for the Sisters of Mercy, to cost about $400,000. Charles L. Morris, Coal Exchange Building, is head of the building commission.

GROVE CITY, PA.—New equipment, including a 185-hp. Bessemer oil engine directly connected to a 125-kw., three-phase General Electric generator, and one 35-kw. General Electric motor-generator exciter set will be installed in the municipal electric plant; both sets to be in operation by August 1. Frank H. Poehlman is superintendent.

HARRISBURG, PA.—Bids will be received by T. W. Templeton, Superintendent of Public Grounds and Buildings, until May 9 for power-plant supplies, etc., for the coming year.

HARRISBURG, PA.—Athenas George, 1601 Eleventh Avenue, Altoona, Pa., is organizing a company to construct and operate a power plant on Independence Island, Susquehanna River. Walter Frieling, 1312 Fourteenth Avenue, Altoona, is architect and engineer.

HELLERTOWN, PA.—The Pennsylvania Power & Light Company will extend its transmission line to Bingen, Saucona and Springtown.

HOLLAND, PA.—The Pennsylvania Edison Company, Easton, Pa., has acquired the Lippincott property, on which it proposes to erect a new hydro-electric plant.

ORRTANNA, PA.—The Orrtanna Electric Light & Power Company is building a new power station about a mile from the present location. The equipment will include a waterwheel, which is being installed, and a steam engine and boiler, which have not yet been purchased. S. Z. Musselman is secretary.

PARRYVILLE, PA.—The Lehighton Electric Lighting Company, Lehighton, will build a transmission line to Parryville, to furnish electric service. James I. Blakslee is president.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 2 for motors, control panels and spare parts for the local navy yard (Schedule 9598).

READING, PA.—The Metropolitan Edison Company is considering the installation of a new generator in the Reading plant and may erect a transmission line to Easton.

STAUFFERSTOWN, PA.—The Staufferstown Electric Company has applied to the Public Service Commission for permission to operate in Franklin County.

BALTIMORE, MD.—A power house will be erected at the new hospital group near Montebello Park, to cost $750,000. Edward H. Glidden, American Building, is architect.

HAGERSTOWN, MD.—The Hagerstown & Frederick Railway Company has changed its name to the Potomac Public Service Company. Permission has been received from the Public Service Commission to issue bonds for $2,155,000, part of the proceeds to be used for extensions and betterments in its electric system.

CLARKSBURG, W. VA.—The Council has authorized plans for the installation of an ornamental lighting system in the business district.

ROMNEY, W. VA.—The Romney Electric Company contemplates the construction of a 50-kw. hydro-electric plant to supplement the present plant. J. S. O'Hara is manager.

DAMASCUS, VA.—The Damascus Light & Power Company is considering the construction of a new generating station. B. W Mock is secretary and treasurer.

LYNCHBURG, VA.—The Lynchburg Traction & Light Company has filed plans for an addition to its local power plant.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has specifications under way for the following equipment and will call for bids in the near future: Turbo-alternator for Pearl Harbor (Specification 4548); reciprocating air compressor, New York (Specification 4555); alternators and auxiliary electric equipment, Yorktown, Va. (Specification 4612); reciprocating air compressor, Bellevue, D. C. (Specification 4622).

WASHINGTON, D. C.—The Potomac Electric Power Company contemplates the replacement of a 9,000-kva., 25-cycle, 6,600-volt, three-phase turbine with a 12,500-kva., 60-cycle, three-phase, 13,200-volt turbine; installing 12,000 kva. capacity in step-down transformers, 13,200 and 2,400 volts, one high-tension heater, and changing three railroad substations to automatic substations. A. G. Neal is comptroller.

North Central States

BAY CITY, MICH.—The Council will soon call for bids for the construction of a power house and electric pumping plant for the waterworks system, to cost about $85,000. The Frazier-Sheal Company, Illuminating Building, Cleveland, is engineer.

ESSEXVILLE, MICH.—The Aetna Portland Cement Company, 412 Union Trust Building, Detroit, will build a one-story power plant in connection with its new cement works, to cost about $1,000,000. Oscar J. Lingeman is general manager.

LANSING, MICH.—A special election will be held on May 8 to vote on the proposal to issue $800,000 in bonds for extensions to the municipal electric light and power system.

SAGINAW, MICH.—The Riverside Coal Company plans to rebuild the power house at its Riverside mine, recently destroyed by fire, causing a loss of about $35,000.

STANTON, MICH.—Extensive improvements are contemplated to the municipal electric light plant, including rebuilding the distribution system, changing engine and generator and establishing a twenty-four-hour service, etc. Harry Slater is superintendent.

FORT COVINGTON, KY.—The Fort Covington Light, Heat & Power Company is considering the construction of a new power station. W. H. S. Keefe is manager.

COLUMBUS, IND.—The Board of Public Works is considering rebuilding the municipal street-lighting system. C. A. Reeves is president of board.

FILLMORE, IND.—Earl Padgett, owner of the Fillmore and Whitestown light and power system, contemplates the erection of 3½ miles of 2,200-volt transmission line to serve a small village and also farmers along the line.

VERNON, IND.—The Vernon Hydro-Electric Company contemplates extending its lines to make connections with two other corporations and to install a new Diesel engine. The company may discontinue the local generating plant and erect about 20 miles of high-tension lines. George C. Ale is president.

CHICAGO, ILL.—The Illinois Central Railroad Company, 135 East Eleventh Place, is preparing plans for the electrification of its local terminal and city lines, to cost about $10,000,000. Plans are being prepared and work will begin in July.

EVANSTON, ILL.—The Public Service Company of Northern Illinois will build a 12,000-volt transmission line from Evanston to Des Plaines. A transmission line will also be erected from Blue Island to Chicago Heights.

LOWELL, WIS.—The Lowell Light & Power Company will erect an extension to its rural line, 3 miles long, in May. W. F. Pease, Jr., is secretary.

PESHTIGO, WIS.—The Oconto (Wis.) Service Company will build an addition to its local power house and install a 500-hp. vertical waterwheel and generator. A. T. Pamperin, Oconto, is treasurer.

BEMIDJI, MINN.—The Minnesota Electric Light & Power Company is planning extensions to its plant and system, to cost about $1,000. Elmer E. Swanson is manager.

CLARKFIELD, MINN.—The Clarkfield Roller Mills, Inc., will discontinue producing electricity after May 7, as the village has voted bonds to erect a transmission line and purchase electricity from the Northern States Power Company and distribute it in Clarkfield.

MINNEAPOLIS, MINN.—The Northern States Power Company contemplates the erection of new hydro-electric power plants on the Mississippi and St. Croix Rivers. Application has been made to the Federal Power Commission for permission.

STARBUCK, MINN.—Plans are being considered to change the lighting circuits of the municipal lighting system from 220 volts to 110 volts. A. H. Dreyer is manager.

BOONE, IOWA—A special election has been called to vote on the proposal to issue $250,000 in bonds for the construction of a municipal power plant on the Des Moines River. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

LOVILIA, IOWA.—The Lovilia Light & Power Company contemplates extending its transmission line from Bussey to Hamilton.

JOPLIN, MO. — The Ozark Power & Water Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements to its system.

ST. JOSEPH, MO.—The St. Joseph Transmission Company contemplates the erection of 40 miles of three-phase, 22,000-volt transmission line. Morton R. Martin, Oregon, is manager.

SILEX, MO.—The Silex Electric Light Company will install an additional engine and generator, to double the capacity of its plant, and also extend its lines into the farming section near the town. James Lindsay is manager.

NEW LEIPZIG, N. D.—The New Leipzig Electric Company will change the motive power of its plant from oil to steam and will install a 100-hp. engine and two 110-hp. boilers, fire-box type, Line extensions call for 7,000 lb. No. 4/0 wire. Henry Lewis is owner and manager.

BEATRICE, NEB. — J. H. Krug, Beatrice, who operates the transmission system, which supplies electricity in the towns of Herkimer, Kan., Lanham, Odell, Diller and Steele City, Neb., expects to three-phase about 20 miles of 13,200-volt transmission line.

BROKEN BOW, NEB. — The Martin Brothers Electric & Ice Company expects to supply electricity to the village of Merna within the next two months. C. A. Martin is manager.

DESHLER, NEB.—The Deshler Light & Power Company contemplates the erection of a transmission line to Bryon and Hardy to supply electrical service in both towns. C. V. Stewart is manager.

MERNA, NEB. — The Council contemplates erecting a 6,600-volt transmission line from Merna to Broken Bow, where it will secure electricity to operate the municipal electric lighting system. The local system will be changed from direct to alternating current. W. O. Webster is superintendent.

WAHOO, NEB.—The installation of a new 300-kw. electric generating unit in the municipal electric light and water plant is under consideration. O. A. Clarke is general superintendent.

ANDALE, KAN.—The Council will soon call for bids for the construction of a transmission line from Wichita to Ardale, to cost $37,000. The Ruckel Engineering Company, Interurban Building, Hutchinson, Kan., is engineer.

DODGE CITY, KAN.—The Electric Service Company contemplates the installation of a 1,250-kva. General Electric turbine and a 350-500-hp. boiler. M. D. Leslie is chief engineer.

SALINA, KAN.—The Salina Light, Power & Gas Company contemplates the installation of a 4,000-kw. turbo-generator, new switchboard and auxiliaries, feed-water evaporator and pumping equipment, to cost about $175,000, and also the erection of distribution lines to cost about $15,000. P. B. Harbaugh is superintendent.

SEDAN, KAN. — The Sedan Electric Light & Power Company contemplates the erection of 15 miles of 22,000-volt transmission line to connect with the system of the Kansas Gas & Electric Company. M. W. Hartzell is president.

Southern States

BADIN, N. C.—The Tallassee Power Company contemplates the erection of a hydro-electric plant of about 25,000 hp. capacity, to cost about $3,500,000, including machinery and transmission system. Electricity will be distributed by the Carolina Power & Light Company.

CLEMSON COLLEGE, S. C. — The trustees of Clemson College will install new equipment in the power plant at the institution.

ATLANTA, GA.—The Georgia Railway & Power Company has issued $3,500,000, in bonds, part of the proceeds to be used for extensions and improvements to its electric power plants and system.

MEIGS, GA.—Bonds to the amount of $15,000 have been voted for improvements in the municipal electric plant.

TIFTON, GA.—The Council contemplates the construction of a municipal electric power plant, to cost about $50,000.

CLERMONT, FLA.—The Council is considering the construction of a municipal electric plant.

FERNANDINA, FLA. — Bonds to the amount of $150,000 have been voted for extension to the municipal electric plant, ice factory and waterworks system, of which about $20,000 will be used for the electric plant.

UMATILLA, FLA.—The installation of new machinery at the municipal electric plant is under consideration.

NASHVILLE, TENN.—The Council has approved an ordinance for the rebuilding of the municipal electric plant, to cost $90,000.

PONTOTOC, MISS.—The Pontotoc Light & Water Company contemplates the erection of an 8-mile transmission line to furnish electrical service in Ecru. G. W. Campbell is superintendent.

MOUNTAIN HOME, ARK.—The Mountain Home Electric Power Company is making extensions and improvements to its plant. N. E. Taylor is superintendent.

MARLOW, OKLA.—Extensive improvements are contemplated to the municipal electric plant, including the installation of generators, oil engines, having a capacity of 300 hp., electric line extensions, etc. L. A. Pritchett is superintendent.

RUSH SPRINGS, OKLA.—The Council has plans under way for extensions and improvements to the local power plant, which has been taken over by the municipality. H. G. Olmsted & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

STROUD, OKLA. — The Board of Trustees is considering installing a Diesel or semi-Diesel oil engine of about 125 hp. capacity in the municipal electric plant to replace the gas engine now in use. John A. Walker is manager.

WAPANUCKA, OKLA. — The Public Service Company will build a new transmission line from Atoka to Wapanucka, about 15 miles.

ALBANY, TEX.—The Abilene (Tex.) Gas & Electric Company has acquired the power plant of the Texas Stone Quarry Company and will soon extend its transmission line to Albany.

DALLAS, TEX.—The Texas Electric Railway has issued $625,000 in bonds, part of the proceeds to be used for extensions and improvements to power plants and system.

KERENS, TEX.—The Kerens Light & Power Company contemplates installing two 150-hp. engines to generate electricity to operate its system. The company now purchases energy from the Corsicana (Tex.) Gas & Electric Company. A. D. McKinney is manager.

NOCONA, TEX.—The Nocona Ice & Light Company expects to install a 100-hp. oil engine directly connected to a 2,300-volt alternating-current generator and to erect a high-tension transmission line from Nocona to Ringgold to connect with its plant there. J. W. Lehman is president and manager.

YORKTOWN, TEX. — The Yorktown Electric & Ice Company plans to rebuild the portion of its local plant recently destroyed by fire, causing a loss of about $50,000.

Pacific and Mountain States

ENTERPRISE, ORE. — The Enterprise Electric Company contemplates the construction of a new hydro-electric plant on the Wallowa River, with transmission line to include a number of towns in this section, to cost about $100,000.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will make extensions and improvements in its system to cost $500,000. The work has been ordered by the Public Service Commission to be completed this year.

CHINO, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental street-lighting system on Sixth and D Streets.

FULLERTON, CAL.—The City Trustees contemplate the installation of an ornamental lighting system on several streets in the city.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation contemplates extensions to its system, including the installation of a 15,000-kw. turbo-generator, together with necessary condenser and cooling tower equipment, six additional Stirling boilers, 24,500 kva. capacity in transformers, two motor-generator sets of 750 kw. each, additional substation, high-tension lines and distributing equipment, etc. T. P. McCrea is secretary.

SANTA ANA, CAL.—The proposition to vote $75,000 in bonds for the installation of a municipal electric plant at the waterworks was defeated at a special election.

SAWTELLE, CAL.—The Council is considering the installation of an ornamental lighting system on the Santa Monica Boulevard to cost about $29,000.

STOCKTON, CAL.—A special election will be held on May 2, to vote on the proposal to issue $125,000 in bonds for the installation of a police and fire-alarm signal system.

YUBA CITY, CAL.—The Pacific Gas & Electric Company, San Francisco, is preparing plans for the erection of a new local substation to cost about $75,000. The company will also rebuild its transmission line across the Carquinez Straits, near Martinez to cost about $250,000.

ASHTON, IDAHO.—The Ashton & St. Anthony Power Company may possibly erect 10 miles of 6,600-volt transmission line to supply a 100-kw. mining load. R. F. Crouse, Idaho Falls, is manager.

McCALL, IDAHO.—The McCall Light & Power Company contemplates doubling the capacity of is plant. T. E. Bennett is owner and manager.

SALT LAKE CITY, UTAH.—The Denver & Rio Grande Railroad plans to consolidate two present power plants into a single unit in the viaduct section, to cost with new equipment about 40,000.

MALTA, MONT.—The Malta Light & Power Company expects to install a 150-hp. oil engine (Diesel or semi-Diesel type) directly connected to a three-phase, 60-cycle, 2,300-volt generator, switchboard and accessories. M. F. Kemper is manager.

GREEN RIVER, WYO. — The Green River Electric Light & Power Company contemplates enlarging its plant and increasing the output to 3,000 kw., to serve a coal mine 15 miles distant. J. H. Jacobucci is president and general manager.

ARRIBA, COL.—The Council has authorized $15,000 in bonds for the construction of a transmission line to Flagler. W. B. Rollins & Co., Railway Exchange Building, Kansas City, Mo., are engineers.

COLORADO SPRINGS, COL.—The Council contemplates the construction of a municipal electric plant at the Pike's Peak watershed, to cost, with transmission system, about $450,000. Surveys have been ordered. George G. Anderson is hydraulic engineer.

DENVER, COL.—A power plant will be built by the Chicago, Burlington & Quincy Railroad Company in connection with its proposed local shops, to cost about $2,000,000.

SIMLA, COL.—The Council has authorized plans for a municipal light and power plant, bonds for which have been voted.

LORDSBURG, N. M.—The Model Canal Company, Franklin, Ariz., is planning to construct a hydro-electric plant on the Gila River for irrigation service in this section.

Canada

KINGSTON, ONT.—Plans are under consideration to secure electricity from the Ontario Hydro-Electric Power Commission for Ernestown, Kingston and Pittsburg Townships.

MIMICO, ONT.—A by-law authorizing an appropriation of $25,000 for extension of the Ontario Hydro-Electric system in Mimico has been passed by the Town Council.

PORT CREDIT, ONT.—The Council has passed a by-law authorizing an issue of $20,000 in debentures for extensions to the hydro-electric power system within the town limits.

TORONTO, ONT.—Surveys are being made by the Ontario Hydro-Electric Power Commission for electric distribution systems in Kirkton, Winchelsea and Elimville, to cost about $45,000. A. Purcell, 190 University Avenue, is engineer.

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Which Kind of Business?

WHILE we are all responding and expanding to the joyful knowledge that good times have come again, there is a question to be asked. The industry is organizing for a protracted crusade to *"Electrify America!"* We realize that at last we can go forth and seek and find more business—better business. But—which *kind* of business does this mean?

It is all right to say "more business." It is wise to stress the point that this new business should be "better." But, frankly, what is it we mean by "better business"? Do we really know, we central-station men and manufacturers, jobbers and contractor-dealers?

AS EACH central-station executive takes up in his own town the vital local work of the great national movement for business development he must decide what he is going to do. The first step with most companies will be the rebuilding of an adequate commercial department, manned with expert salesmen. But what next?

Will the main effort be applied to residence business, or commercial lighting, or small power—to appliance merchandising, lighting used for advertising purposes, such as electric signs, store windows, outlining and floodlighting, or to large power load? And how much shall they concentrate on the development of industrial heating, electric vehicles and domestic ranges? In short, what is the value of each kind of business—rated by the cost of sales effort, by the profit from the energy to be consumed and by the value of the influence on public relations? Do we know?

And what of the jobber and the manufacturer—both major factors in this great creative plan? Both have some very pressing economic problems that will help or hinder as they are well solved or not. The whole existing system of distribution is under scrutiny right now, and at the heart of it is the same question: *Which kind of business?* Shall the jobber sell appliances or shall he not? And should the manufacturer reduce waste by refusing to make up and sell unneeded or unpopular types and styles?

OPEN the door to business by all means, but in creating markets let us work with an intelligent regard for the net as well as an ambition to roll up the gross in total sales. We are embarking on a broad commercial venture, a co-ordinated movement to electrify all homes and industries—no less. We must have care that we produce not busy-ness alone, but a balanced service and a high degree of profit in return.

Before he undertakes to work the plan of this great enterprise each man will do well first to plan his work in it. Make sure—which kind of business.

Frank Wheatcroft Frueauff

A pioneer in public relations who is one of the foremost of public utility executives.

IF ONE were to ask what more than anything else is occupying the attention of electric light and power company executives, the answer would probably be public relations. When the public understands it becomes sympathetic and not only is willing but demands that its local public service company shall get fair treatment. Good public relations, however, is not a new idea—it is merely that its value is becoming more widely appreciated One of the earliest to recognize that people respond to human kindness even when it comes from a public utility employee was Frank W. Frueauff, now the "& Company" in Henry L. Doherty & Company. Mr. Frueauff is a director in more public utility properties probably than any other individual. He has never forgotten the lesson he learned as a young man in Denver and as a result has instilled into the minds of those operating the properties under his guidance the value of a smile, individual recognition and honest dealings.

It was at Columbia, Pa., that he was born in 1874 and at Leadville, Col., that he spent his boyhood days. At seventeen he had finished high school, and at once he started work with the electric light company at Denver as a meter reader and lamp clerk. His first advance was to office collector, where he met customers who came to pay their bills. Here he began applying his theory of public relations. He memorized the names of customers, because as he said: "I had figured out that if I got to know all these people and if they got to know me, they would be a little more tractable whenever they came in with a kick." And they were. In fact, this ability of his to straighten out ticklish matters with customers so attracted the attention of his superiors that promotion was steady. He was elected secretary of the company in 1899, vice-president and general manager eight years later and president in 1913. In the meantime he became a partner in the organization of Henry L. Doherty & Company. The lessons learned at Denver were used elsewhere as properties, mostly rundown from mismanagement, were acquired. While Mr. Doherty was seeing that the properties were put in first-class operating condition Mr. Frueauff was bringing the company and its public together on a basis of mutual respect and confidence. From the top of the organization down the employees were taught that fair and considerate treatment must be accorded every customer. As the activities of the partnership expanded this work has naturally been delegated to the local managers, but the inspiration nevertheless still comes from Mr. Frueauff.

His home is now in New York, where, in addition to having a reputation as a public utility executive of first rank, he is recognized as one of the foremost financiers of the day. He is a firm believer in financing by customer ownership securities and in this way finds he is able to attract enormous amounts of new capital.

Unusual energy and activity have always characterized Mr. Frueauff. In addition to the demands made on him by his business he has found time to devote to association activities. He has been president of the National Commercial Gas Association, National Electric Light Association and Colorado Light, Power and Railway Association.

Editorial Comment

Electrical World, May 6, 1922

Volume 79 Number 18

The Forthcoming Convention at Atlantic City

WITHIN a very short time Atlantic City will contain one of the largest gatherings of electrical men ever drawn together in this country. Normally very interesting and instructive, the convention of the National Electric Light Association promises to be particularly so this year. Aside from matters of technical and engineering interest which contribute to improved service or service at less cost, questions of broad public importance will be discussed. One whole day has been set aside for serious and vital thought on improving and reviving business, and as a result of this it is expected that great impetus will be given to a nationwide co-operative campaign for better business under electrical auspices. In the present stage of the nation's affairs such a movement is commendable, and if all branches of the industry pull together, it ought to be effective as well. On questions of public relations, regulation and kindred managerial topics also the program is a full one and justly warrants the attendance anticipated. No phase of the electric light and power business appears to be left untouched, and with the ever-increasing interest shown in the affairs of the N. E. L. A. the convention ought to be a record breaker.

Confusing Decision on Going Value

THE United States Supreme Court in its decision of April 10 in the Galveston case eliminated development costs—*i.e.*, "the cost of developing an operating railway system into a financially successful concern"—as an element to be included for the purpose of determining whether the rates of a public utility are confiscatory. Unless modified or amplified, this decision will seriously affect the development of water powers and other utility enterprises in virgin territory where the construction period is followed by a period of building up the market during which revenues are not sufficient in many cases to pay expenses of operation, much less any return on the capital invested.

Going value, as representing the enhanced value of an assembled and established plant doing business and earning money over one not thus advanced, has long been recognized by the courts of this country, from the United States Supreme Court down, and by public service commissions, as a property right to be considered in determining the base value on which the owner has a right to earn a fair return. The difficulty has been to find some adequate yardstick with which to measure this property right. Recently certain commissions have adopted and followed the so-called "Wisconsin" theory of measuring it by the losses sustained during the formative developmental period in building the property to a going, paying basis.

While some ambiguity of language and confusion of terms are found in the Galveston decision which might lead one to believe that the court excluded going value as that term is commonly understood from consideration in a confiscation case, it is probable that what the court did do or intend to do was to exclude developmental cost or early losses as a measure of the going value, and not to exclude going value itself. If development of public utilities is to go forward in the public interest, early losses or costs must be taken into account in one way or another, whatever the term applied, and it is to be hoped that the United States Supreme Court will have the opportunity at an early date and in a clear-cut case to make its position clear on those points treated of generally and rather indefinitely in the Galveston case.

Striking Advantages of Interconnection

FOR years the ELECTRICAL WORLD has counseled the interconnection of contingent generating systems with a view to maximum economy and reliability of production. Probably nowhere else in the country has interconnection been practiced on so large a scale as at Niagara Falls, and just recently its advantages have been demonstrated in a most dramatic fashion. Owing to a series of accidents in two of the stations on the system of the Hydro-Electric Power Commission of Ontario it was suddenly deprived of more than 150,000 hp. Owing, however, to the extensive interconnections between all of the hydro-electric systems at Niagara Falls this load was quickly taken up by the Toronto Power Company and the Niagara Falls Power Company. It is a pleasure to note that, although the latter utility is under private control and management, it has always co-operated in a broad-gaged and enlightened manner with the governmentally owned system. The power companies at least have learned the advantages of reciprocity, even though their respective governments do not practice it. Were it not for the interconnections at Niagara, electric service in many of the municipalities of Ontario at present would be greatly curtailed. The fact that normal conditions prevail justifies the practice of interconnection, and when the economies are taken into consideration the arrangement is shown to be doubly profitable.

Keep Bins Well Stocked with Coal

ALTHOUGH more than five weeks have elapsed since the coal miners went on strike, we have yet to hear of an electric public utility which has been handicapped through lack of coal. Indeed, the demand for coal has been so small that many non-union mines which would normally be in operation are shut down for want of orders. Under such circumstances one need not refrain from buying coal for immediate consumption or for storage if it is obtainable at a reasonable price. There is no necessity for purchasing more than is needed, especially if lower prices are expected; but if reserves are permitted to run too low, it may be difficult to replenish them quickly when the pinch comes. Just now coal production ought to be encouraged, provided, of course, that the price is right. The electrical industry should avoid, if possible, bringing on any crisis in coal supply. A good load factor is as essential to a coal mine and a railroad as it is to an electric light plant, and a steady movement of coal to market is most desirable. The fact that the public has not been inconvenienced in its supply of electricity during the coal strike speaks well for the public utilities. There is no telling how long the strike will last, however, and as a matter of precaution coal stocks should be replenished gradually and discreetly.

Important Steps Made in Studying Cold Light

ALMOST simultaneously within the past few days there have appeared two independent announcements of important progress made toward the attainment of a practicable source of light of the class commonly spoken of as "cold light," in which the evolution of light is not dependent upon temperature. Both of these announcements bear the earmarks of careful work and of conservative claims. The first comes from one of our university laboratories and describes the work of Professor Harvey in studying the light-giving powers of insects and animalcules. He has found that a certain small shellfish found in Japanese waters can be stimulated to something approaching its original light-giving powers by chemical means even after long preservation. The principal feature of his work, however, seems to lie in the process he has discovered whereby the oxidation which accompanies the giving of light is made reversible and consequently the light-giving properties continue. No claim is made as yet that the principle may be incorporated into a commercial lighting source, but from present accounts it appears as though an important step has been made toward an understanding of the processes that underlie these natural sources of light.

The second announcement referred to describes an application of the principle of gaseous conduction to a lighting source suitable for ordinary commercial circuits. This has been a favorite field for experiment, and from time to time there have appeared on the market several types of tube lighting in which the passage of current through a rarefied gas causes the latter to emit light. The phenomenon is the same as that observed in Geissler tubes, in which ionization by collision of the particles of the gas is accompanied by the evolution of light. Carbon dioxide, neon, hydrogen and mercury vapor are among the gases which have been used. In all lamps of this type which have so far appeared high voltage has been necessary, thus placing a serious limitation upon their utility. Details as to the latest member of the group are as yet quite meager, but it is stated that it will operate on a 240-volt circuit, requires very little energy, and that it produces a pinkish-red light.

In addition to the matter of voltage a further difficulty found with light sources of this character in the past has been their low luminous output per unit of service. If the new lamp can even begin to approximate the incandescent lamp on this basis, its development will mark the beginning of a new epoch in lighting. Further information as to this lamp will be awaited with great interest.

The Educational Influence of Radio

TEN years from now men will look back upon these early days of radio and ask: "What is the greatest service that wireless broadcasting has rendered to the electrical industry?" And the answer probably will be that its educational influence has been more valuable by far than all the profits of the great trade which it brought into being. For radio is interesting the people in the technical aspects of electricity and building up a degree of popular understanding which has never been approached before.

Twenty years ago the average man or woman had no knowledge of internal-combustion engines and machinery, but the motor car has introduced this engineering problem into the family circle and made it a matter of common concern, until today we hear men talk of carburetors, lubrication and differentials as their fathers talked of whiffletrees and hames. What the motor car has done to educate this generation in the operation of gasoline engines radio is now proceeding to repeat in familiarizing the public with the principles and manifestations of electricity.

Up to now electricity has been looked upon as a mystery impenetrable by ordinary minds. People have simply refused to *try* to understand it, and therefore, though they have willingly used the comforts which it offers them, they have made little progress in a knowledge of this subject, which is so vital to the modern scheme of living. Yet already radio has lured these heretofore indifferent individuals deep into the lore of wave lengths, frequencies and voltages. They are studying the audion tube and working out the underlying principles that soon will make this subject of electricity as real to them as the driving of an automobile.

A Widening Interest in Physical Research

JUDGING from the papers presented before the recent meeting of the American Physical Society in Washington, D. C., there is a spreading interest in physical research among large organizations in the field of electrical industry, since only a few years ago the bulk of the papers came from colleges. About sixty papers were presented or read by title. Of these, 60 per cent were written by men and women connected with various institutions of learning, 27 per cent by persons connected with large electric manufacturing and associated concerns, about 8 per cent by the Bureau of Standards and Carnegie Institute, and the remaining 5 per cent may be termed "unclassified." What large manufacturing companies are doing today smaller companies and operating organizations will have to do in the near future.

It is also interesting to note that not a single paper came from a non-electrical industry, although some large industrial organizations in other fields also maintain extensive research staffs. Although this was somewhat of an accident in so far as this particular meeting was concerned, yet we would like to ascribe the fact to the well-known progressive spirit in our industry. Because of this broad attitude on the part of the managers, research men are allowed to spend some of their time on problems of such an advanced and theoretical nature that no commercial considerations prevent the publication of the results. As a result, the industry as a whole gets the benefit that inures from the best theoretical minds working on its problems, and the electrical art stands ready to interpret new discoveries in physics and to participate in their application for the benefit of humanity.

Leaving the Beaten Path in Station Design

THE new Hell Gate station of The United Electric Light & Power Company, to which we have devoted considerable space in this and our last previous issue, embodies so many departures from conventional design that its novel characteristics cannot be indicated by mentioning any one of them alone. Four features particularly command the attention of all engineers because of their bearing on simplicity, construction cost, economy of operation and continuity of operation. These features are the unusual position of the turbine room, the absolute dependence upon hydraulic sluicing for removal of ashes, the phase isolation of all electrical equipment, and the almost exclusive use of alternating-current motors for auxiliary drive.

With the turbine room next to the river, each condenser draws its circulating water through two short direct connections, and thus the expensive excavation which would otherwise have been required for intake tunnels was eliminated. In addition, this arrangement affords unlimited screening area for the intakes and virtually obviates occasion for the shutdown of any unit because of circulating water.

While there are no ashpits under the furnaces and no auxiliary means of ash removal are provided, the designers have no fear that any interruption of service can arise, because the clinker grinders discharge the ashes in such form that they can be easily flushed away by water through the troughs provided under each boiler. As a result it has been possible to use a much shallower basement than is commonly employed, the fumes and dripping customarily experienced in basements are absent, and the over-all cost of removing ashes is much reduced.

From an electrical viewpoint, the isolation of phases is the most conspicuous feature. It is one that seems well worth while, since a phase-to-phase short circuit in a station of Hell Gate's rating (300,000 kw.) connected with a 1,000,000-hp. generating system would be of a most destructive character. As it is, only a phase-to-ground short circuit can possibly occur, and such a short circuit would be limited to a small value by the generator and bus-tie reactors, by inherent reactance of the generators, and by resistance or zigzag transformers in the grounded neutrals as the case may be. Any disturbances that do arise can be easily cleared by circuit breakers having the unusually large rupturing capacity of 1,500,000 kva.

Though other stations have used electric drive for auxiliaries, this is the first station to adopt alternating current exclusively for this purpose. This practice makes possible the use of very rugged motors (induction type) in nearly all cases, brush-shifting motors being employed for the draft fans. With the squirrel-cage motors, speed adjustments have been possible by pole-changing arrangements or mechanical means.

Hardly less important are some of the minor features, such as the segregation of mechanical and electrical equipment into groups, the large outdoor coal storage and flexible arrangements for handling fuel, the extensive use of motor-operated valves, the provision of truck-type switchboards for station service, and the interlocking of circuit breakers, "disconnects" and cell doors. Truck-type switchboards have become quite common in Europe and could with advantage be used more extensively in this country. Among their merits are safety, simplicity, interchangeability, accessibility, compactness and low cost of installation. Interlocking of switches and cell doors will also be advantageous in other plants, if it does not add excessive complications.

As a whole, Hell Gate station embodies some of the latest ideas in design, and its owners are to be complimented for their courage in departing from conventional practice. In magnitude the requirements may not be duplicated in many other cities, but the fundamental principles are applicable everywhere. The extent to which the adoption of the special features of this station would be justified elsewhere depends on the degree to which the benefits would offset added expense.

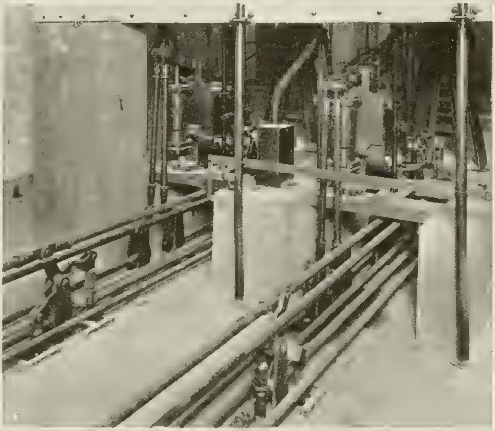
Kilowatt Versus Kilovolt-Ampere Demand Basis for Billing

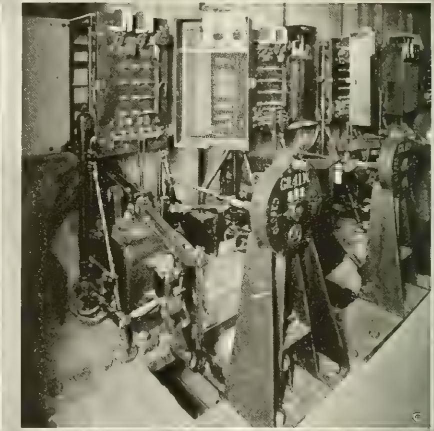
THE meaning of the various methods of considering power factor in the rate schedule and the dollars-and-cents evaluation of this meaning are something that so far have not been satisfactorily stated. There has, in fact, not been any well-developed basis for such a statement. Moreover, there has been a lack of instruments and methods for ascertaining what the customer's actual power factor is and its bearing on the investment that the central-station company must make.

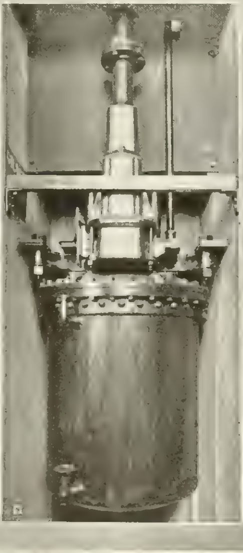
On another page J. E. Doran, J. B. Hodtum and R. C. Fryer endeavor in a collaborated paper to put in words a definition on a kilovolt-ampere-demand basis. They show that on this basis a 23 per cent increase in demand charges over the charges on a kilowatt-demand basis is obtained. This increase is justified because the customer absorbs plant capacity and creates expense in placing this demand on the central station. The argument is an interesting one, and while there will be disagreement with the stand taken, the authors give a statement of at least some of the conditions that must be faced in the sale of energy and that the manager of an electric light and power company cannot afford to ignore. Whether the kilovolt-ampere-demand basis is the final answer to the problem, or whether the kilovolt-ampere-hour basis, or a combination of these and the present energy bases, must be used is a question that no one has yet been able to answer.

So far the various discussions have concerned only the points involved in service to the larger consumers. The effect on a system of the power-factor conditions created by the small consumers has not yet been touched. They are by far the most numerous, and it is a question whether any consistent or satisfactory basis of considering power factor can be developed until the conditions on their installations are at least fairly well known. Our article indicates one of the handholds that must be used in grappling with the question and deserves the earnest consideration of those who wrestle with it.

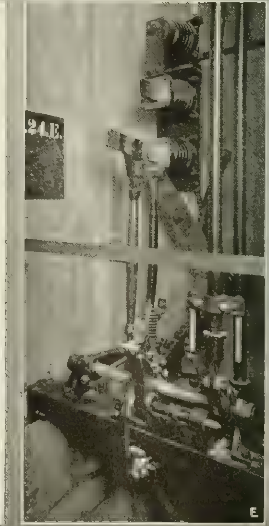
Isolation of Phases at Hell Gate Made Possible by Interlocking Mechanism







THE possibility of interphase short circuits is almost entirely prevented in the Hell Gate station of The United Electric Light & Power Company by separating each phase of the three-phase circuits and the corresponding equipment by fire walls and air ducts. The arrangement is shown on page 872. In order to operate the circuit breakers in the three phases simultaneously the solenoids are mounted on the floor above and connected with the circuit breakers by rods and bell cranks. Interlocks are provided so that the disconnecting switches cannot be opened while the oil circuit breakers are closed. The main operating room from which the solenoids are controlled is shown in A, two views of the switch-operating solenoids in B and C, one of the circuit breakers, having a rupturing capacity of 1,500,000 kva., in D, and a mechanically operated circuit-grounding switch in E.



Phase Isolation—A Feature of Hell Gate

While This Method of Preventing Interphase Short Circuits Is the Most Conspicuous Electrical Characteristic of the New Station of The United Electric Light & Power Company, Many Other Features Are Embodied

ELECTRICALLY no less than mechanically* the new Hell Gate Station of The United Electric Light & Power Company, New York, has many features of more than ordinary interest to both large and small central-station companies. As might be expected, most of the deviations from conventional practice have been made in order to isolate disturbances and thus to assure a continuity of operation even greater than has been achieved in the company's older plant. Many of the changes have greatly increased the safety of station attendants as well. Chief among the departures from standard practice are the following: Phase isolation of all electrical circuits and equipment; interlocking of circuit breakers and disconnecting switches with operating mechanisms on the floor above; use of a new type of oil circuit breaker with unusually high rupturing capacity (1,500,000 kva.); grounding switches interlocked with "disconnects" on feeder circuits; alternating-current drive of practically all auxiliaries; truck-type switchboards and dead-front panels for station service; simplified excitation with no automatic voltage regulation; duplication of supply for and segregation of control circuits and emergency lighting; use of three-pole overload relays with current-indicating scales on feeder circuits, and provision of a control-circuit terminal room below the main control room. In addition to these features, a unit electrical layout with double ring buses has been adopted, the electrical gallery has been separated from the power station proper, reactors have been inserted in generator leads, feeders and bus-tie circuits; hot-spot temperature indicators have been connected with the main generators and other apparatus, differential protection has been provided on generators, and resistance has been used in the 60-cycle and Z-connected transformers in the 25-cycle neutral ground connection.

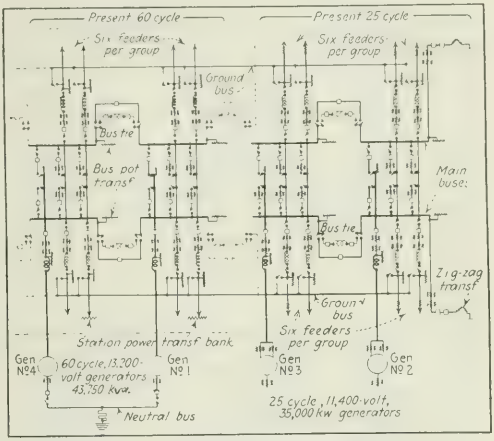


FIG. 1—ONE GENERATOR AND TWELVE FEEDERS CONSTITUTE A UNIT

From each generator the circuit passes through a reactor, a generator circuit breaker and one of two selector switches to the main or auxiliary high-tension bus. Normally these buses will operate in parallel interconnected by bus-tie reactors which can be shunted by a circuit breaker if necessary. The 60-cycle buses can be closed by a loop (shown by dashed lines). Twelve feeders may be energized from each section of either the main or auxiliary bus by closing the corresponding selector switch and feeder switch. Each feeder contains a reactor. The "disconnects" on the outgoing side of the reactors are interlocked with grounding switches so that a feeder may be grounded when disconnected from the bus. Among other features shown are the Z-connected transformer attached to the 25-cycle buses and the resistance between the 60 cycle neutral bus and ground.

STATION LAID OUT FOR 300,000 KW. ULTIMATE RATING

As mentioned in the previous article, the station is laid out for an ultimate rating of 300,000 kw., space being provided for four 35,000-kw., 25-cycle, 11,400-volt turbo-generators and four 40,000-kw., 60-cycle, 13,200-volt generators or for any other combination of these types. Two of each type are already installed. Each generator has its directly connected exciter without automatic regulation because the station will carry the base load of the system. The generator fields are connected permanently through rheostats to the exciter armatures, field control being obtained by adjusting the exciter-field rheostat and the generator-field rheostat simultaneously. This is made possible by single rheostat dial plates, which include both exciter-field and generator-field rheostat contacts. They are mounted on inclosed platforms below the operating-room floor, as are also the neutral switches. The neutral current transformers are in a floor pit directly below the exciter. These transformers and another set at the bus end of the generator leads are connected differentially to relays which trip the generator circuit breakers and field circuit breaker in case of internal trouble. At a later period they may be arranged to trip the steam throttle, the fire-extinguisher valve and the air dampers in the generator ventilating duct. The generators are further protected by inherent reactance (12½ per cent for the 60-cycle machine and 12 per cent for the 25-cycle), by external reactors (5 per cent), and by a neutral ground resistor of 8.4 ohms in the case of the 60-cycle units and by Z-connected transformers in the case of the 25-cycle generators. Six temperature indicating coils are buried in each generator winding at possible hot-spot locations and connected to a temperature recorder near the main control board as a guide to safe operating load. These precautions, in connection with those which will be described later, are very important, because this station is connected with a system which involves approximately 1,000,000 hp. of generating capacity.

Leads from each generator run under the turbine-room and boiler-room floors to the electrical gallery back of the plant and separated from it by a space of 25 ft. (7.5 m.). Because of the rating of the generators it

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*For an account of the mechanical features see ELECTRICAL WORLD, April 29, 1922, page 821.

Layout of Equipment in Electrical Gallery Designed for the Prevention of Interphase Short Circuits

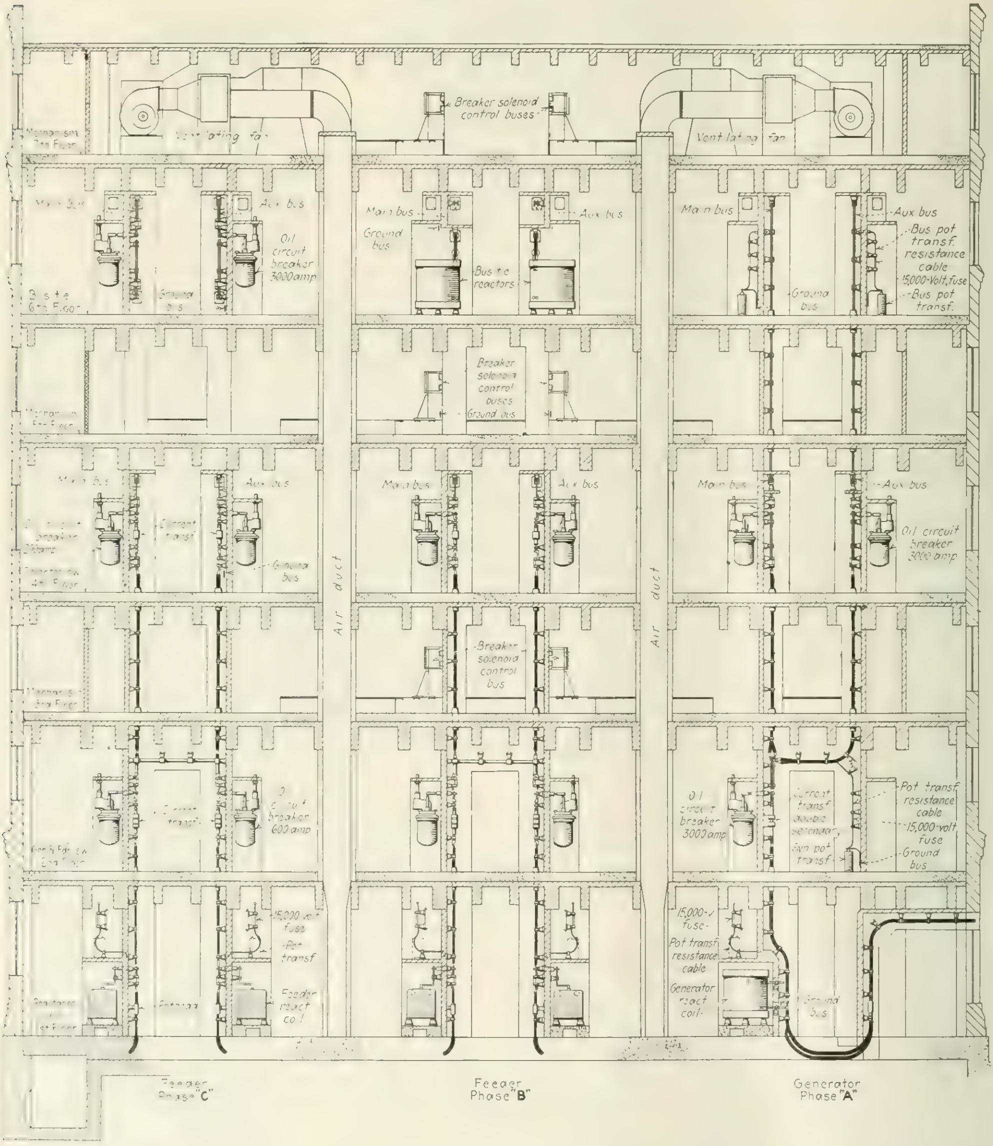


Fig. 2—In cross-section the electrical gallery is divided into three tiers by air ducts and fire walls, each tier being devoted to a single phase. Longitudinally the building is divided into as many sections as there are generators installed (four at present), so that all the circuits connected with any generator are in that section of the gallery corresponding to that particular generator. Hence any short circuit that may occur in any section cannot do more than ground one phase. In general the generator and feeder reactors are on the first floor; the generator and feeder circuit breakers and "disconnects" on the second floor, with operating mechanisms on the floor above; the buses, generator and feeder selector circuit breakers and "disconnects" on the fourth floor, with their mechanisms on the floor above, and the bus-tie reactors and circuit breakers on the sixth floor, with their mechanisms on the floor above with the ventilating fans. The sections depicted have been selected to show typical compartments; actually, however, the equipment for each phase of a generator lead or feeder is in line across the gallery. The method of connecting circuit breakers and "disconnects" with their operating mechanisms is shown on page 873. As indicated there, pipe linkages and bell cranks connect operating solenoids and breakers.

was unwieldy to use one conductor per phase; hence two 1,500,000-circ.mil paper and reinforced rubber-insulated cables were employed in parallel. Under the turbine-room and boiler room floors they are supported by corrugated post insulators mounted in inverted concrete troughs. Between phases are barriers which preclude any interphase short circuits. Above the troughs run the control circuits. In the electrical gallery the circuits run through ducts in the concrete floor, these having been molded by pouring concrete around reinforced spiral paper forms, which were later removed.

The electrical gallery to which the generator leads run is a seven-story concrete structure divided by fire walls and air ducts into three longitudinal tiers or sections, each of which is devoted to equipment in one phase only. This construction, a better idea of which than can be given in words will be had from Fig. 2, affords a unique, simple and positive means of protection against interphase short circuits. It effectually isolates the phases, and failure of any piece of apparatus or equipment can at the worst only cause a ground current, which would be limited, as mentioned before, either by resistors or by Z-connected grounding transformers.

To insure this high degree of protection no flexibility of bus arrangements had to be sacrificed, as may be seen from the accompanying one-line drawing of electrical connections (Fig. 1). Main and auxiliary buses with sectionalizing breakers and reactors between generators are provided for each generator and group of twelve feeders. Furthermore, each generator or feeder has two breakers in series between the bus and circuit terminals, thus affording a double line of defense.

From each generator the circuit passes through a reactor, a generator circuit breaker and one of two selector breakers to a section of the main or auxiliary high-tension bus. Normally the sections will operate in parallel, since they are interconnected by 5 per cent bus-tie reactors which can be shunted by a circuit breaker if necessary. When the station is completed the 60-cycle bus can be closed by a loop (shown by dashed lines). Twelve feeders may be energized from each section of either bus by closing the corresponding selector and feeder switch. Each feeder contains a 3 per cent reactor. Station-tie reactors have 5 per cent reactance and the house-service transformer reactors have 12.72 per cent reactance. The disconnecting switches on the outgoing side of the reactors are interlocked with grounding switches so that a feeder may be grounded when disconnected from the bus, but at no other time.

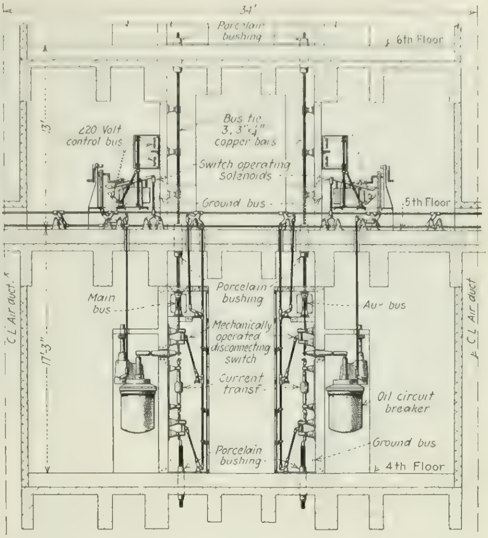
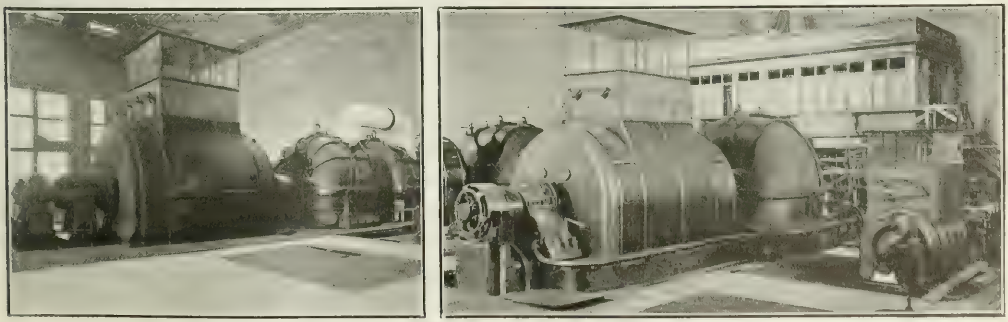


FIG. 5—INTERLOCKED OIL CIRCUIT BREAKERS AND "DISCONNECTS" WITH CIRCUIT-BREAKER-OPERATING SOLENOIDS ABOVE

The arrangement shown is typical of the method of connecting the interlocked oil circuit breakers and disconnecting switches with the circuit-breaker-operating solenoids on the floor above for the B phase of a selector switch floor. The solenoid on the right operates the auxiliary bus breakers and interlocks with the "disconnects" in the A, B and C-phase tiers by pipe linkages and bell cranks, as shown, while the solenoid on the left is connected with the main bus equipment. The bell cranks are so designed that the "disconnects" and circuit breakers cannot be opened and closed in the wrong order. In addition, accelerating devices are attached to the pipe mechanism to offset its inertia. This illustration also shows the buses running to the bus-tie breakers on the floor above.

The relative positions of the equipment mentioned can best be understood by again referring to the cross-sectional view of the electrical gallery. On the first floor are the generator and feeder reactors, on the next floor are the generator and feeder circuit breakers and "disconnects," and on the floor above are the switch-operating mechanisms. On the fourth floor are the buses, generator and feeder selector switches and "disconnects," while above, again, are the operating mechanisms. The sixth floor is devoted to bus-tie reactors, circuit breakers and disconnecting switches, while the operating mechanisms are on the seventh floor with the ventilating fans. Expressed in the simplest terms, the generator circuits feed up to the buses on the fourth floor and the outgoing circuits feed down from this point.

Longitudinally the building is divided into as many



FIGS. 3 AND 4—TWO TYPES OF TURBO-GENERATORS ARE INSTALLED

The one at the left is a tandem-compound unit rated at 40,000 kw., 60 cycles and 13,200 volts. The unit at the right is rated at 35,000 kw., 25 cycles and 11,400 volts.

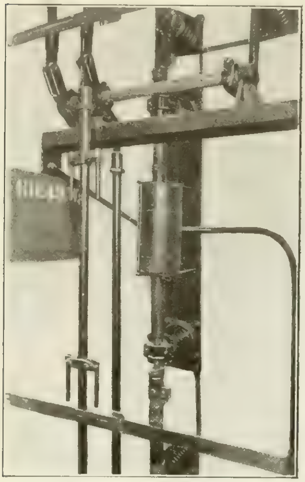


FIG. 6—CELL-DOOR LOCK OPERATED BY BREAKER MECHANISM

bays as there are generators (four being the present number), and thus all circuits, including feeders, which are connected with any generator are in a bay corresponding to that particular generator. The circuits and equipment for the 25-cycle generators are at one end of the gallery, and the equipment for the 60-cycle apparatus is at the other end of the gallery. Owing to the fact that the equipment is not opposite the particular generators involved, a subway had to be run below the electrical gallery in a longitudinal position. The sections shown have been selected to depict typical tiers. Actually, however, the equipment for each phase of a generator lead or feeder is in line across the gallery. Aside from phase isolation, the electrical gallery is noteworthy because of the arrangements made for interlocking the circuit breakers, "disconnects," cell doors and feeder-grounding switches and for operating the apparatus in each of the three phases of a circuit simultaneously. As may be observed from Figs. 2 and 5 the circuit breakers and corresponding "disconnects" of the same phase are mounted on opposite sides of the same wall and connected with the operating mechanisms on the floor above by bell cranks and pipe linkages acting in tension. The same linkages prevent opening of the cell doors or closing of a feeder-grounding switch when the circuit is "alive." Interlocks are also provided so that the disconnecting switches may not be opened or closed after the oil circuit breakers have closed. Interlocking of the circuit breakers, "disconnects," grounding switches and cell doors prevents accidents of a kind that have occurred in plants where interlocking has not been provided.

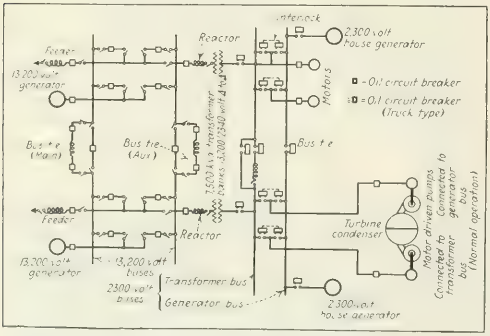


FIG. 7—STATION AUXILIARIES MAY BE FED EITHER FROM HOUSE GENERATOR OR MAIN UNITS

Schematically the method of assuring reliable auxiliary service and establishing a heat balance is shown by this one-line drawing. Where duplicate auxiliaries are provided, one is driven from the transformer bus and one from the house generator, the remainder being apportioned between the buses so that a heat balance may be obtained by adjusting the relative loads of such units as the forced-draft fans, boiler-feed pumps, etc. With this arrangement no service involving duplicate auxiliaries can be totally interrupted and any auxiliaries may be quickly transferred from one bus to the other. As may be observed, the transformer bus is sectionalized and has two sources of supply, either of which may be connected to either the main or the auxiliary bus. The house-turbine bus also has two sources of supply and is sectionalized.

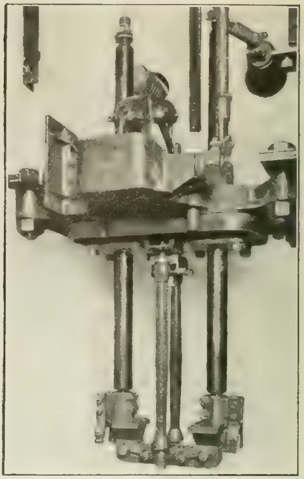


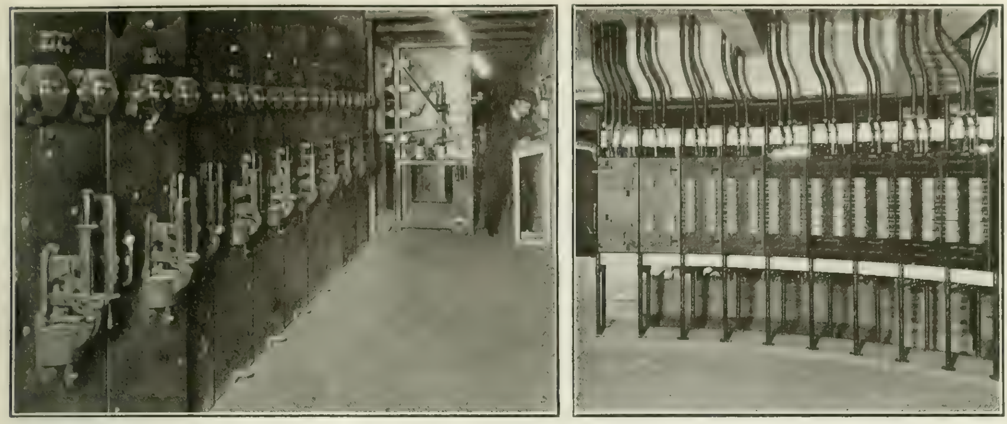
FIG. 8—CONTACTS OF 1,500,000-KVA. CIRCUIT BREAKER

To insure that closing and tripping shall take place with adequate speed, an accelerating device is attached to each solenoid and each bell crank above each pole unit. With this arrangement a closing speed of 0.3 second has been obtained at normal control voltage without sacrificing the inherently high tripping speed of the breakers. Closing and tripping is performed with 250-volt battery energy, duplicate sources of supply being provided. In case anything should go wrong with the automatic apparatus the switches can still be operated by a hand lever which is attached to the operating mechanism.

The method of operation just described has been made possible by the use of a new type of oil circuit breaker, one which is interesting also because of its unusually high rupturing capacity, namely, 1,500,000 kva. For this rating the oil tanks of the breakers, which measure only 28 in. (71 cm.) inside diameter, are relatively small. Among the characteristics of these breakers are the following: The tanks are grounded and lined with asbestos and micarta; protected butt-type condenser terminals are used; parallel-path contacts and arcing tips are employed which are wholly immersed in oil and opened by gravity; the breaker is fully automatic and anti-pumping; the tank is attached by six bolts to a cast-steel head and is vented through a check valve to a header. The lining is a good insulator and practically indestructible from arcing. By virtue of their arrangement the contacts are forced closer together during short circuits. The six-bolt connection makes tank removal easy, while venting by the check valve is expected to prevent any throwing of oil.

All of the generator, generator-selector and bus-tie breakers are rated at 3,000 amp., the feeder breakers at 600 amp. and the feeder selector breakers at 1,200 amp.

Control of this apparatus and starting and stopping of the generators are supervised from the main control room on the fourth floor of the electrical gallery. In general the layout of this room is on a plan quite similar to that used in other New York stations, consisting of a central machine control bench with the machine-control instrument board in front and a semi-circular feeder-control board behind. The machine-control bench carries the



FIGS. 9 AND 10—TRUCK-TYPE SWITCHES SERVING STATION AUXILIARIES AND CONTROL-TERMINAL BOARD BELOW THE MAIN SWITCHBOARD

usual complement of master switches and indicating lamps for controlling the generator and generator-selector circuit breakers, turbine governors, generator rheostats and turbine-room signals, while the instrument board carries such indicating instruments as generator temperature indicators, bus and generator voltmeters, wattmeters, synchroscopes, synchronizing voltmeters and frequency meters. Testing terminals for checking and calibrating meters, watthour meters and differential relays are mounted on panels back of the machine-control instrument board.

The feeder-control switchboard is very compact. The instruments and control switches for four circuits are mounted in vertical rows on each panel, though the panels are only 25 in. (62.3 cm.) wide. To permit this edgewise-type wattmeters and power-factor meters and three-pole overload relays—*i.e.*, three single relays mounted one above the other in a single case—are employed. These relays have the additional feature of having a definite minimum time setting and a current-indicating scale sufficiently accurate for all purposes and showing also whether current is flowing in the relay. To assure that the direct-current trip element of these relays shall be in operative condition, the pilot-lamp circuits are supervised through the relay and breaker trip circuit. Hence any open connection may be instantly detected by the failure of a lamp. Above each pilot lamp is a push-and-pull switch by which the lamp circuit can be opened when a circuit is de-energized to prevent confusion from the lights. Test terminals are provided at the bottom of each panel.

The wiring on the back of the board attracts special commendation because the control wires are bunched and held in fiber clamps, at right angles to and back of each panel frame. This construction leaves the back of the board clear of wires except for the few running from the risers to the terminals.

Back of the feeder switchboard is another semi-circular board on which relays and recording or integrating meters are mounted. Virtually all the panels in this station are made of ebony transite.

Much of the trouble sometimes experienced in tracing, changing and testing control and instrument wiring has been avoided in this plant by providing a special control-terminal room just below the main control room. The control and instrument circuits enter this room through conduit from all parts of the station and are attached to terminal boards arranged in switchboard form. No joint or tap in the entire length of any of the wires is permitted. All wires are labeled and occupy the same relative position on duplicate panels, thus minimizing the possibility of error in connecting, reconnecting and testing.

The main house-service board—the one controlling the house generators and house-service transformers—is erected on a gallery in the turbine room opposite the heat-balance board. At present there are two banks of 7,500-kva., 13,200/2,340-volt delta-delta house-service transformers. These are connected with the main buses and house-service bus as shown in Fig. 7. Schematically this indicates how reliable auxiliary service is assured and a heat balance established. Where duplicate auxiliaries are provided one is driven from the transformer

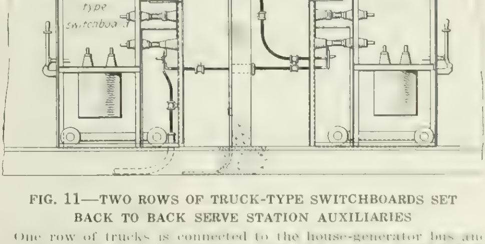


FIG. 11—TWO ROWS OF TRUCK-TYPE SWITCHBOARDS SET BACK TO BACK SERVE STATION AUXILIARIES

One row of trucks is connected to the house-generator bus and the other row to the transformer bus, the trucks opposite each other being joined to the same auxiliary. The connections are made at the back by jack-type connectors so that any truck may be withdrawn and replaced by another, if the circuit breaker is open, by pulling out the locking lever. Additional interlocking is provided to prevent putting the same auxiliary on both buses at the same time. The trucks are self contained, carrying an oil switch, instrument transformers, etc., which are readily accessible for inspection or maintenance when the truck is withdrawn.

bus and one from the house generator. The remainder are apportioned between the buses so that a heat balance may be obtained by adjusting the relative loads of such units as the forced-draft fans and boiler-feed pumps. With this arrangement no service involving duplicate auxiliaries can be totally interrupted. Other auxiliaries may be quickly transferred from one bus to the other. As may be observed, both buses are sectionalized and either may be energized from two sources.

The type of equipment and arrangement afforded for quickly changing any auxiliary from one bus to another are shown in Figs. 9 and 11. They illustrate truck-type switchboards set back to back, one row being connected to the transformer bus and one to the house-generator bus. The trucks opposite each other are connected to the same auxiliary. At the back of each truck are jack-type connectors which enable any truck to be withdrawn and replaced by another, if the circuit breaker is open, by pulling out the locking lever. Additional interlocking is provided to prevent putting an auxiliary on both buses at the same time. The trucks are self-contained, each carrying an oil switch, instrument transformers, relays, etc., which are readily accessible for inspection or maintenance when the truck is withdrawn. Among other advantages claimed for these trucks are compactness, safety and a lower installation expense than that of permanent switchboards.

As previously mentioned in this article, virtually all of the auxiliaries are driven by alternating current, even the coal towers, boiler-feed pumps, stokers and fans. All motors rated at 40 hp. and more are operated at 2,200 volts, except the coal towers, stokers, cranes and skip hoist, while motors under 25 hp. are operated at 220 volts or 440 volts. The motors for driving the forced-draft and induced-draft fans are of the brush-shifting, adjustable-speed type and the boiler feed pumps are driven by adjustable-speed wound-rotor induction motors. The clinker grinders are driven by two-speed squirrel-cage induction motors. All of the remaining auxiliaries, such as circulating, hot-well, dry-vacuum, booster and ash-handling pumps, are driven by constant-speed induction motors. To obtain adjustable speed from such motors the stokers are driven through double-cone transmission. Where starting equipment of the oil-circuit-breaker type is required, it is provided in the form of a switchboard close to the motor, although in the case of the induced-draft and forced-draft fans these are controlled by start-and-stop push-buttons with fast and slow auxiliary buttons.

Hydro-Electric Progress in Canada During 1921

THE hydro-electric industry of Canada, though naturally affected by the general depression, suffered no setback during the year 1921. In fact, almost 300,000 hp. was developed, which stamps the year as one of the most progressive in the history of Canadian water-power.

The progress of development is somewhat difficult to follow from year to year because a year is too short an interval. From three to five years or often longer elapse between the first consideration of a development and the delivery of power. Again, most projects commence with an initial installation much less than the ultimate projected capacity, and new units of machinery are installed from time to time as the load develops.

The yearly survey of the Dominion Water Power Branch indicates that the 300,000 hp. installed during 1921 is made up of both equipment for newly completed projects and additions to existing plants, and besides this a considerable amount of new construction was initiated, which insures that as the old power plants reach their capacity new ones will take their place in maintaining the continued growth and prosperity of Canadian hydro-electric enterprise.

That Canada is not lagging in this respect is indicated by comparison with the United States. In 1902 the horsepower installed per 1,000 population in Canada was 47, while in 1920 it had increased to 280 horsepower. In 1902 the United States reported 26 hp. for each 1,000 population, while in 1920 this had increased to only about 93 hp. The total increase in horsepower installed in Canada from 1900 to 1920 was 153 per cent.

The accompanying table gives in detail the developed and potential water powers of Canada. It will be seen from this table the Province of Ontario led the other provinces in new water-power installations, with 173,650 hp. Ontario also has the largest total installation in water-power plants with 1,212,650 hp., being followed by the Province of Quebec with 1,015,385 hp. The total rating of all the hydro-electric plants in Canada on Jan. 1, 1922, was 2,755,980 hp., which indicates that about 18 per cent of the minimum water powers of the country have been developed.

DEVELOPED AND AVAILABLE WATER POWER IN CANADA

	Turbine Installation, Hp.			Available Twenty-four Hour Power at 80 per Cent Efficiency	
Province	On Jan. 1, 1921	Installed During 1921	On Jan. 1, 1922	At Ordinary Minimum Flow, Hp.	Dependable for Six Months, Hp.
British Columbia	305,115	200	305,315	1,931,142	5,103,460
Alberta	33,187		33,187	475,281	1,137,505
Saskatchewan				513,481	1,087,756
Manitoba	83,447	13,800*	97,247	3,270,491	5,769,444
Ontario	1,039,000	173,650	1,212,650	4,950,300	6,808,190
Quebec	926,095	89,290	1,015,385	6,915,244	11,640,052
New Brunswick	21,180	9,000	30,180	50,406	120,807
Nova Scotia	34,073	12,875	46,948	20,751	128,264
Prince Edward Island	1,869		1,869	3,000	5,270
Yukon and Northwest Territories	13,199		13,199	125,220	275,250
	2,457,165	298,815	2,755,980	18,255,316	32,075,998

*Includes two units in the Queenston plant.

The Power Commission of Nova Scotia and New Brunswick has successfully carried out the first provincial development and is virtually ready to deliver electrical energy to the principal cities of these provinces. In Ontario the Queenston-Chippawa plant of the Hydro-Electric Power Commission of Ontario has been placed in operation with two 60,000-hp. units installed. In Manitoba the Manitoba Power Commission has extended its activities and has under active construction an important development at Great Falls, on the Winnipeg River, with an ultimate capacity of 168,000 hp.

The figures for available power are based upon rapids, falls and power sites concerning which definite or well-established information is at hand. Many feasible power sites are scattered from coast to coast which have not been investigated and placed on record. As illustrative of the conservative nature of these figures, attention might be called to the Provinces of New Brunswick and Nova Scotia, where detailed analyses have disclosed most advantageous reservoir facilities for regulating stream flow and where it is estimated that, after providing for the diversity factor between installed power and consumers' demand, these two provinces together possess within their borders between 200,000 and 300,000 commercial horsepower.

Kva. Basis Favored for Demand Billing

Studies Lead to Belief that Power Factor Is Too Inconvenient to Measure and Utilize to Be Employed as Basis for Demand Charges—Effect of Kva. Demand Basis on Billing

By J. E. DORAN, J. B. HODTUM AND R. C. FRYER
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DEFINITION and measurement of power factor is basically a question of methods to prevent economic losses caused by power factors less than unity. Were it not for these economic losses it would not be necessary to measure power factor—a term used herein in the abstract sense. It is first proper to analyze and define in order to determine whether the economic loss is directly or indirectly proportional to power factor. It is believed that possibly the power factor of an alternating-current circuit is not the measure of the loss in that circuit that takes place when the current and potential are out of phase. Two forms of loss due to out-of-phase current and potential exist.

The first loss taking place in circuits with power factor other than unity is the economic loss caused by the increase in investment to carry a fixed load at low power factor over the investment required to carry the same load at unity power factor. Because of this it is customary for the manufacturer to rate his apparatus in terms of kilovolt-amperes.

CENTRAL STATIONS ATTEMPT TO CORRECT FOR POWER FACTOR

The central-station company pays for apparatus upon a kilovolt-ampere rating. It has been selling the use of this apparatus by the year or the month, in its demand charges, at so much per kilowatt. Realizing that sufficient revenue must be produced from this demand charge to cover fixed charges, the central station has placed a value upon the kilowatt demand which is sufficient to produce the desired return, even at power factors other than unity. It is evident that if two customers have equal loads, one operating at unity power factor and the other operating at low power factor, but both customers paying for their demand upon a kilowatt basis, the customer with the low power factor is actually using a greater proportion of the producing company's capacity than is the customer with the high power factor. To adjust this condition, many central-station companies place a "power factor" clause in their contracts to recover from the low-power-factor customer the compensation for the additional capacity he is tying up. This compensation clause, however, is applied against a kilowatt measurement, though the kilowatt is not proportional to the cost of supplying demand, except over a very small portion of the investment charge, as will be shown below.

For a group of representative companies, inventories show chargeable to used and useful physical property for electrical production and distribution an average of \$9,974,201. Of this, \$1,585,152 is chargeable to steam equipment only, or 15.8 per cent of the total amount chargeable to electrical production and distribution. A kilowatt demand could be considered as proportional, within certain limits, to only 15.8 per cent of the total investment charge. The remaining 84.2 per cent represents the cost of generators, substation and transformer equipment, underground and overhead lines, etc., for which the central-station company is paying the manufacturer upon a kilovolt-ampere basis. The central station is selling this capacity to its customers on a kilowatt basis. To establish the lack of equity in basing the demand charges upon a kilowatt basis, it is necessary to remember only that any customer with a low power factor is using, without charge, more units of system capacity throughout the major portion of the investment serving him than he is paying for. If for every kilovolt-ampere supplied a customer is using a direct proportion of 84 per cent of the investment, it seems sound economics to collect demand charges upon that basis.

A kilowatt does not represent the total demand even against that portion of the investment chargeable to steam because the coal pile is carrying the energy losses due to effective idle or magnetizing current at low power factor. This loss is a variable, dependent upon the effective idle amperes and the resistance in the system circuits. Therefore, at any power factor other than unity the kilowatt does not represent a true proportion for measurement of demand against the steam investment, which in the specific example is shown to be 15.8 per cent.

THE QUESTION OF ALLOWABLE POWER FACTOR

Extensive use has been made of 80 per cent as an allowable power factor. This neglects the fact that if proper voltage is maintained, a customer's power factor is not appreciably affected by the power factor of the circuit from which he draws his power. John Jones may have a power factor of 60 per cent, while his next-door neighbor on the same circuit may operate at unity with proper equipment. Why, then, should the central station, allowing 80 per cent as minimum power factor, sacrifice 20 per cent of income from 84 per cent of its investment because John Jones has not, for some reason, purchased motors of a size that will operate at unity with his load, and why, unless the diversity factors are taken into consideration and unless a 20 per cent value is considered a correction for some factor or factors of diversity, should the central station give John Jones back as much as 20 per cent of its demand revenue from 84 per cent of its investment, when conditions approach ideal?

As an example, take one contract which specifies that the billing demand shall be (75 ÷ power factor of demand interval) × kilowatt demand of the same interval when the power factor is below 75 per cent, and when above 80 per cent at the interval during which demand occurs billing demand shall be (80 ÷ power factor of demand interval) × kilowatt demand.

On this basis, assuming a rate of $18 per kilowatt for the first 500 kw. demand per year and $15 for each additional kilowatt demand per year and an actual hourly demand of 2,800 kw. during which hour the reactive component meter showed a reading of 3,600 reactive kva., the demand rate would yield as follows:

With 2,800 kw. demand and 3,600 reactive kva. our power factor is 61 per cent. The billing demand is therefore (76 ÷ 61) × 2,800, or 3,443 kw. Therefore:

500 kw. at $18 = $9,000 yearly,
2,943 kw. at $15 = $44,145 yearly,

and total yearly kilowatt-demand charge is $53,145.

This is based upon power factor taken during the demand interval, which is doubtless higher than the so-called "average monthly power factor."

By the use of an accurate kilovolt-ampere meter, however, we might obtain the following:

2,800 kw. at 61 per cent power factor = 4,500 kva. (reading of kilovolt-ampere demand meter).

500 kva. at $18 × 84 per cent = $7,560
4,050 kva. at $15 × 84 per cent = 51,030
500 kva. at $18 × 16 per cent = 1,440
2,300 kva. at $15 × 16 per cent = 5,520

Total $65,550

To this should be added the demand load on the 16 per cent representing the steam-end investment, this demand being effective idle I^2R losses as follows: Total current at time of demand, 197 amp.; inphase current at time of demand, 122.5 amp.; total I^2 — inphase I^2 × 1.42345 ohms (actual resistance) per conductor = 33.8 kw. effective idle I^2R loss per conductor. Three conductors therefore produce a total loss of 101.4 kw. supplied by steam. Considering generator loss as 3 per cent, at full load the effective idle I^2R losses in the generator are 15 kw.

	Kw.
Line losses =	101.4
Generator losses =	15.0
Total losses due to effective idle current =	116.4

116.4 kw. at $15 × 0.16 = $279.36

Adding this to $65,550 makes $65,829, which shows a net loss on the demand rate with power-factor correction as compared with a power-factor rate considering property investment of $12,684, or 23 per cent.

This is based upon the assumption that the rate per kilovolt-ampere demand per year is the same as the present rate per kilowatt demand per year. This assumption is made because of the manner in which the present kilowatt rate was worked out. The question of rate per kilovolt-ampere demand is an individual one. In some cases the rate per kilovolt-ampere should be less, in some the same, and in other cases higher than the kilowatt demand rate now in effect. The quantities used can be measured by a graphic watt-hour demand meter and a graphic kilovolt-ampere meter. Had this contract been made upon a kilovolt-ampere basis, the metering could have been done with a polyphase watt-hour meter and a kilovolt-ampere demand meter with proper time intervals. The kilovolt-ampere meter would not necessarily be a graphic instrument. Not only does a power-factor-correction clause fail to define correctly the demand, but the method of obtaining the necessary factors upon which to base the correction requires more complicated metering than would be necessary with the same contract based upon kilovolt-ampere demand.

Economies of Electric Ovens for Baking Bread

Reel and Continuous Conveyor Type Electrically Heated Bake Ovens Show Savings in Cost of Operation and Materials Used

BY WIRT SCOTT
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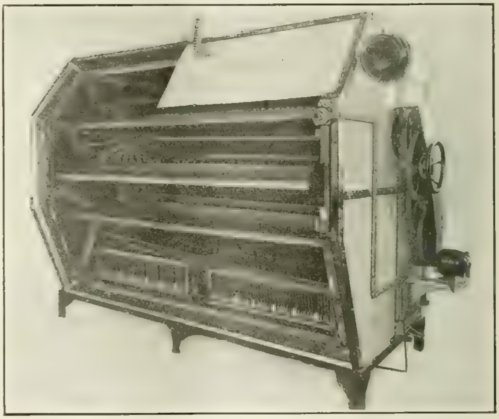
DEVELOPMENTS in the application of electric heat to bread-baking ovens have reached a stage where absolute certainty as to the uniformity and quality of the product is assured and where distinct savings in labor, time and material have been realized. The number of installations that have been made indicates the increasing use of these ovens in commercial bakeries. From tests on electric ovens in regular use valuable data have been obtained showing remarkable and unexpected economies effected in the cost of operation.



REEL TYPE ELECTRICALLY HEATED BAKE OVEN

A reel-type bread-baking oven and a continuous-conveyor shelf-type baking oven, both types electrically heated, with the temperatures automatically controlled, have been thoroughly tested in actual operation and are in daily use, producing the highest quality of bread, pies, cakes and pastry. The capacity of an oven in loaves per hour or per bake depends upon the weight of the loaf and the size of pan used. On this basis the output of the reel oven is as follows:

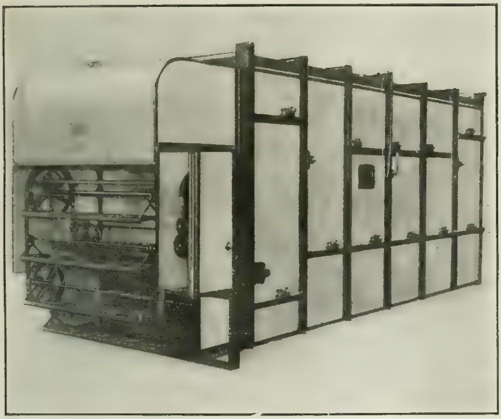
Product	Size Pan	No. per Bake	No. per Hour
1-lb. loaf	4¼-in x 9¼-in.	136	250
1-lb loaf	4¼-in x 8½-in	120	200
1½-lb. loaf	5 -in. x 11-in	112	160
1½-lb. loaf	5¼-in. x 9¾-in.	96	150
Pies	10-in. diam.	56	112

Capacity of reel oven (kw.)	25
Time required for heating up from cold oven to 450 deg. Fahr. (minutes)	40
Length of time required for baking 1-lb. loaves (minutes)	25 to 28
Length of time required for baking 1½-lb. loaves (minutes)	35 to 38
Radiation losses of oven at 450 deg. Fahr. (kw.-hr.)	8
Power consumption, including radiation losses, per pound of bread baked (watts)	100
Power consumption baking 150 1½-lb. loaves per hour (kw.-hr.)	21.5

The conveyor ovens are made in two sizes, nominally rated at 600 and 1,000 1½-lb. loaves per hour. The continuous-conveyor type ovens, being of larger capacity, are still more efficient than the reel ovens. Operating results obtained show that a pound loaf can be turned out with a consumption of 80 watts.

A very important advantage of the electric bake oven is that when an oven is so constructed as to retain the steam driven out of the bread it is unnecessary to inject live steam into the oven. This eliminates the necessity for steam boilers, which is of considerable importance, particularly in case of the small bakery.

It has been found that a loaf of bread baked in an electric oven stays fresh much longer than a loaf baked in other ovens and that the grain structure is much more uniform. The fact that an oven will turn out its rated capacity continuously, without shifting of the bread after it is placed in the oven, is also of vital importance, as is the automatic temperature control. But under present financial conditions the baker must be shown how he will actually save money before investing. Some very important operating data just obtained from an installation at Fisher Brothers' bakery in Cleveland, using two of the continuous-conveyor-type ovens, have been verified and the results duplicated with the reel-type oven. Two 1,000-loaf conveyor-type ovens have been in operation in this bakery for a period of one year. Formerly natural gas containing approximately 1,000 B.t.u. per cubic foot was used for fuel, costing 30 cents per 1,000 cu.ft. The gas bill per day amounted to $6. The electric bill, at a rate of 2.38 cents per kilowatt-hour, amounted to $36 per day. No complaint was made as to increased operating costs since the greatly improved quality of bread produced in the electric oven offset, so it was stated, the difference between the gas and electric bills. However, in course of time a very unlooked-for saving occurred, and the way in which it came about is of vital importance in developing the use of the electric bake oven.


CONTINUOUS CONVEYOR TYPE ELECTRICALLY HEATED BAKE OVEN

At the end of several months' operation it was found that the amount of flour required per week to turn out 125,000 1½-lb. loaves of bread was much less than had been the case with gas ovens. An investigation showed that in producing with the electric oven a 24-ounce loaf of bread, weighed twelve hours after being baked according to standard practice, it was not necessary to use the same amount of flour as had formerly been used. Further investigation showed that each barrel of flour actually produced ten additional 1½-lb. loaves. Fisher Brothers are using on an average 57 barrels of flour per day and, owing to the electrically baked loaf, are actually obtaining 570 more 1½-lb. loaves than they formerly obtained. With bread selling at 11 cents per loaf, the additional income amounts to $62.70 per day. Deducting the power bill of $36 per day, it may be said that the firm is now doing its entire baking at no cost for heat and making an additional profit, as compared with the use of gas, of $26.70 per day.

On the basis of the above results and later investigations, a table has been compiled using as a basis for computation the saving of three-quarters of an ounce of dough on each 24-ounce loaf of bread. This table is made on the basis that with a gas oven the bread is scaled at 27 ounces and with the electric oven at 26¼ ounces.

SAVINGS IN QUANTITY OF FLOUR EFFECTED BY USE OF AUTOMATIC ELECTRIC BREAD-BAKING OVEN

Number of Loaves Daily Output Gas Oven	Number of Loaves Daily Output Electric Oven	Increase By Using Electric Oven	Reel Type—Increase in Daily Revenue When Bread Sells at Following Prices per Loaf 10 Cents	11 Cents	12 Cents	13 Cents	14 Cents	15 Cents
2,000	2,057.2	57.2	$5.72	$6.29	$6.87	$7.44	$8.00	$8.59
3,000	3,085.8	85.8	8.58	9.43	10.29	11.13	12.01	12.86
4,000	4,114.4	114.4	11.44	12.60	13.72	14.89	16.01	17.18
5,000	5,143.0	143.0	14.30	15.72	17.18	18.5	20.02	21.46
6,000	6,171.6	171.6	17.16	18.86	20.58	22.26	24.02	25.72
8,000	8,228.8	228.8	22.88	25.20	27.44	29.78	32.02	34.36
10,000	10,226.8	226.8	28.60	31.44	34.36	37.18	40.04	42.92
12,000	12,343.2	343.2	34.32	37.72	41.16	44.52	48.04	51.44
14,000	14,400.4	400.4	40.40	44.06	48.02	52.04	56.04	60.08
15,000	15,429.0	429.0	42.90	46.16	51.54	55.77	60.06	64.38

For example, assume that a baker turns out 2,000 1½-lb. loaves per day using gas ovens, also that his bread retails at 13 cents a loaf. Referring to the table, it will be seen that the same amount of flour will produce 2,057.2 1½-lb. loaves baked in an electric oven, or 57.2 additional loaves, which at 13 cents per loaf, retail price, gives an increased revenue of $7.44 per day, more than paying for the power bill at the average rate.

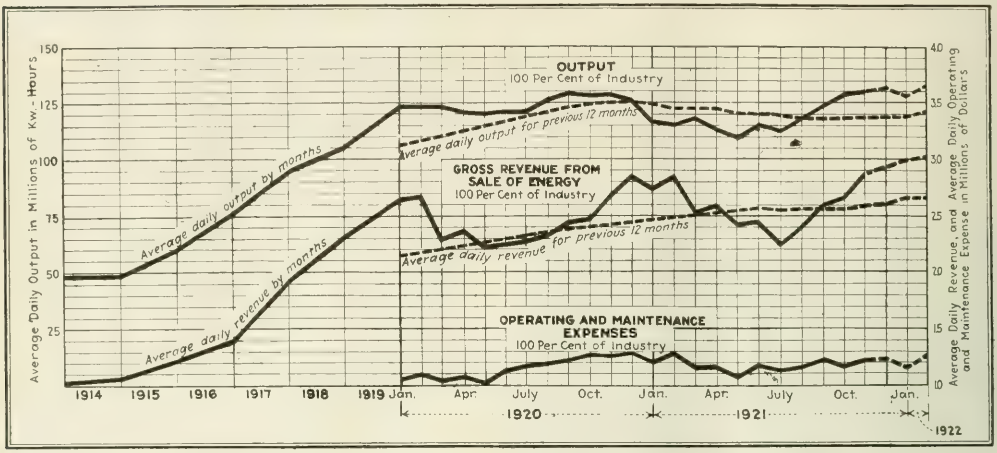
National Standardizing Bodies Organized in Japan and Norway

STANDARDIZATION work in Japan has recently been given a great impetus by the organization of the Japanese Engineering Standards Committee. The main function of this committee is to serve as a bureau for solving and initiating problems involving engineering standardization. The committee consists of seventy members, presided over by the Minister of the Department of Agriculture and Commerce, acting as president, and a vice-president, who is elected or appointed. The details of the work are handled by seven secretaries who are engineers of the government Departments of Agriculture and Commerce, Communications, Railways, Military Engineers and Naval Engineers. The work is being pushed with vigor, investigations already being under way on metals, woods, bricks, screws, electric wires and electric motors.

In Norway a national standardization committee has been organized by the Federation of Norwegian Industries.

There are now national standardizing bodies in Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States.

Record Output and Revenue During February



TWO new records were hung up by the electric light and power industry during February. Reports for the month received by the ELECTRICAL WORLD from central generating and distributing companies representing 77 per cent of the installed rating of the industry indicate that the average daily output was 132,720,000 kw.-hr., which exceeded the previous record, made during December, by 1,840,000 kw.-hr., and that the average daily gross revenue was $3,028,000, which exceeded the former high figure, set during January, by $48,000. February being a short month, however, the total output for these items for the month fell considerably below the record monthly output of last December and the record monthly revenue of January.

In spite of the fact that the lighting load undoubtedly decreased during the month owing to the advancing season, every section of the country reported increased electrical energy requirements during February, indicating a material increase in the industrial load during the month. This increase was most pronounced in the North Central and Mountain-Pacific sections and was least apparent in New England, where there was a strike in the textile mills.

Nearly complete returns indicate that the total output of the central generating stations in the country for 1921 was 43,905,000,000 kw.-hr. The output in 1920 was 45,678,000,000 kw.-hr., indicating a decrease of about 3.9 per cent during 1921. This decrease was due to curtailed industrial energy requirements, resulting from the industrial depression. However, new residential consumers added during 1921 served to lessen the effect of the general slump in energy output.

On the other hand, the gross revenue in 1921 is estimated at $944,400,000, indicating an increase of $61,650,000, or 7 per cent over 1920. For the first time data are available showing the annual operating and maintenance expenses of the industry. Returns from 55 per cent of the installed rating of the country indicate that the total operating and maintenance expenses, exclusive of interest, taxes, depreciation or sinking fund, were $432,400,000 during 1921, against $440,000,000 during 1920. An increased revenue and decreased expenses point decidedly in the right direction.

TABLE I—CENTRAL STATION RETURNS FOR TWENTY-FOUR MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
Mar.	76	2,806,609	2,989,581	−6.1	70	$55,513	$49,071	13.3
April	77	2,675,949	2,895,067	−7.0	72	55,326	49,064	12.8
May	77	2,668,457	2,889,174	−7.6	72	53,901	47,932	12.6
June	77	2,686,479	2,872,900	−6.4	70	52,385	47,977	9 3
July	77	2,706,016	2,949,132	−8.2	70	50,747	49,195	3.4
Aug	77	2,839,498	3,041,927	−6.7	70	51,931	50,848	2.1
Sept.	77	2,848,212	2,937,339	−3.0	70	54,501	52,955	2.9
Oct.	76	2,997,133	3,045,696	−1.5	71	57,340	55,599	3 1
Nov.	77	3,006,349	2,969,175	1.3	71	61,059	58,381	4.6
Dec.	77	3,124,073	3,024,374	3.3	71	64,088	61,420	4.4
		1922	1921			1922	1921	
Jan.	78	3,102,079	2,843,201	9.1	71	65,669	61,366	7.0
Feb.	77	2,861,542	2,554,282	12.0	72	61,121	57,112	7 0

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
					Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	1921	1920	1921	1920	1921	1920
Mar.	52	18,757	17,248	8.7	56.1	57.7	23.4	19.6	40.2	44.8
April	52	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	52	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	53	18,836	19,089	−1.3	56.2	62.5	20.4	21.6	45.8	50.9
July	52	18,633	20,964	−11.1	56.8	65.9	20.6	20.2	43.0	52 6
Aug.	53	19,301	20,900	−7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept.	53	19,765	21,359	−7.5	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	54	19,828	22,231	−10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov.	55	19,692	21,773	−9.0	49.9	58.9	23.1	23.3	43.4	50.5
Dec.	55	21,065	22,347	−5.7	47.8	55.9	26.9	29.3	46.1	49.2
		1922	1921		1922	1921	1922	1921	1922	1921
Jan.	55	20,005	20,343	−1.7	45.7	52.7	23.0	23.9	41.2	42 3
Feb.	54	19,067	19,407	−1.8	46.1	51.7	26 6	27 1	41 2	42.3

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWENTY-FOUR-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase		1921 Thousands	1920 Thousands	Per Cent Increase
KW.-HR. OUTPUT																				
Mar....	80	205,348	230,309	-10.8	81	1,029,120	1,119,428	-8.1	72	894,500	941,893	-5.0	59	139,381	136,017	2.4	83	538,260	561,934	-4.2
April....	80	196,680	227,008	-13.3	79	963,659	1,052,716	8.4	71	828,457	894,028	-7.3	59	132,075	135,421	2.5	89	555,048	586,894	-5.4
May..	81	191,141	219,298	-12.8	78	934,973	989,408	5.5	71	819,506	899,657	8.9	59	136,573	138,416	1.3	91	586,264	642,495	-8.7
June..	80	192,007	219,476	-12.5	78	940,443	1,003,727	-6.3	71	806,270	880,934	-8.5	60	136,011	129,120	5.3	92	611,128	639,637	-4.5
July.....	80	187,622	218,995	-14.3	77	934,822	1,026,390	8.9	71	804,009	884,572	-9.1	60	140,795	141,450	0.6	92	639,768	678,725	-5.7
Aug..	79	205,351	224,324	-8.5	78	992,681	1,054,124	5.8	71	848,803	923,210	-8.1	60	147,967	154,353	-4.1	93	644,696	685,916	-6.1
Sept...	79	221,364	223,269	-0.8	78	1,004,252	1,051,268	-4.5	71	851,671	886,370	-3.9	60	149,758	151,680	-1.2	93	621,167	624,752	-0.5
Oct ..	79	249,202	221,929	12.1	78	1,103,525	1,121,676	1.6	71	919,514	930,236	-1.1	60	154,266	156,713	1.5	94	570,626	615,142	-7.2
Nov.....	79	247,119	215,565	14.6	77	1,128,453	1,112,914	1.4	71	913,142	908,121	0.5	60	154,125	150,976	2.0	94	563,510	580,124	-3.1
Dec....	79	253,206	216,717	16.8	78	1,196,724	1,150,695	4.0	71	948,909	925,346	2.2	61	153,549	150,920	1.7	93	571,685	580,696	-1.6
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan...	81	253,217	203,843	24.0	81	1,182,389	1,071,994	10.2	71	946,627	859,191	10.2	60	156,540	141,937	10.3	93	563,306	566,236	-0.5
Feb....	82	230,875	182,068	26.8	81	1,077,631	957,113	12.6	68	867,475	778,625	11.4	60	145,052	131,937	9.9	93	540,509	504,539	7.1
REVENUE		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Mar.....	80	$5,784	$5,566	3.8	72	$21,822	$18,934	15.3	58	$15,853	$14,103	12.4	59	$3,747	$3,246	15.5	83	$8,307	$7,222	15.0
April....	80	5,665	5,554	2.0	72	21,504	18,609	15.8	58	15,506	13,822	12.2	58	3,744	3,312	13.2	89	8,817	7,767	13.6
May...	81	5,362	5,342	0.4	72	20,795	17,613	18.0	58	14,866	13,558	9.8	59	3,516	3,179	10.7	91	9,362	8,240	13.7
June....	80	5,285	5,397	-2.4	72	20,058	17,438	15.0	58	14,485	13,519	7.1	59	3,536	3,152	12.2	92	9,021	8,439	6.9
July....	80	5,180	5,121	1.1	72	18,798	17,155	9.2	58	14,158	14,689	-3.6	60	3,509	3,145	11.3	92	9,101	8,733	4.3
Aug. .	79	5,297	5,483	-3.3	72	19,050	17,926	6.2	58	14,465	14,594	-0.8	60	3,612	3,536	2.2	93	9,507	9,309	2.1
Sept. ...	79	5,694	5,857	-2.7	72	19,992	18,750	6.6	58	15,324	15,192	0.8	59	3,811	3,673	3.7	93	9,680	9,482	2.0
Oct . .	79	6,332	6,072	4.2	71	21,520	20,115	6.9	58	16,098	16,175	-0.4	60	3,920	3,903	0.4	94	9,470	9,334	1.4
Nov....	79	6,806	6,238	9.1	71	23,282	21,541	8.1	58	17,123	16,954	0.9	60	4,139	4,158	-0.4	94	9,745	9,489	2.7
Dec.....	79	6,987	6,573	6.3	72	25,168	23,519	7.0	58	17,748	17,535	1.2	61	4,234	4,149	2.0	93	9,942	9,644	3.1
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan ...	81	7,212	6,582	9.6	75	26,008	23,859	9.0	58	17,780	16,745	6.2	60	4,366	4,222	3.4	93	10,237	9,913	3.3
Feb....	82	6,758	6,105	10.7	75	23,809	22,015	8.1	55	16,883	16,015	5.4	60	4,115	3,970	3.6	93	9,556	9,007	6.1
OPERATING EXPENSES:		1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
Mar.....	45	$1,576	$1,651	-4.5	58	$7,969	$7,241	10.0	34	$4,570	$4,228	8.2	47	$1,776	$1,514	17.2	80	$2,866	$2,614	9.7
April...	44	1,418	1,479	-4.1	56	7,590	7,168	5.9	34	4,347	4,112	5.7	48	1,567	1,403	11.6	80	2,893	2,479	16.8
May...	48	1,548	1,577	-1.8	53	6,921	6,660	4.0	36	4,274	4,292	-0.4	49	1,563	1,486	5.2	83	2,969	2,713	9.5
June....	45	1,737	1,862	-6.7	53	6,916	6,878	-0.5	38	4,843	5,152	-5.9	56	1,835	1,678	9.4	86	3,565	3,519	1.3
July	46	1,712	2,077	-17.6	50	6,772	7,111	-4.8	37	4,940	5,800	-14.8	58	1,870	2,039	-8.2	86	3,339	3,937	-15.1
Aug.....	47	1,861	2,088	-10.8	50	6,871	7,131	-3.6	37	5,028	5,793	-13.2	58	1,892	2,003	5.5	92	3,648	3,884	-6.0
Sept....	47	2,049	2,262	-9.4	51	6,851	7,294	-6.0	38	5,353	5,687	-5.8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
Oct.....	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18.2	59	1,990	2,192	-9.2	93	3,511	3,891	-9.7
Nov	49	2,040	1,964	3.8	54	7,103	7,790	-8.8	38	4,992	5,972	-16.4	59	1,931	2,262	-14.6	92	3,626	3,785	-4.2
Dec.....	50	2,075	1,901	9.1	54	7,993	8,378	-4.6	37	5,216	6,205	-15.9	59	1,968	2,161	-8.9	92	3,814	3,705	2.9
		1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
Jan.....	51	2,050	1,800	13.9	55	7,387	7,391	-0.0	37	4,990	5,633	-11.4	59	2,007	2,153	-6.8	92	3,571	3,366	6.1
Feb.. .	52	1,956	1,639	19.4	55	7,009	7,192	-2.5	36	4,869	5,286	-7.9	59	1,892	2,068	-8.5	92	3,341	3,222	3.6

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
March	64.0	70.0	56.7	62.5	54.5	56.7	53.3	53.7	58.4	59.7	60.8	59.8	53.3	50.9	55.0	51.9	68.4	62.5	65.9	61.2
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	58.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.8	57.7	58.3	67.5	46.2	52.4	52.2	57.2	45.3	55.5	55.3	62.7	41.8	45.6	51.6	55.4	47.5	47.8	51.8	56.4
February	58.6	54.8	58.7	66.9	44.1	48.9	51.6	57.1	45.9	55.8	53.9	62.5	45.8	54.6	50.7	55.7	43.7	48.0	50.5	55.3
Hydro Plants:																				
March	29.9	30.0	26.9	35.3	21.0	20.6	20.8	20.8	23.0	20.6	23.5	20.6	30.4	23.2	28.4	21.3	24.9	19.0	25.8	25.6
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	25.0	19.3	30.0	49.7	16.7	21.4	18.0	21.8	28.9	25.6	22.0	21.1	33.8	28.3	29.2	22.2	26.6	25.9	26.1	24.3
February	29.7	32.8	30.0	47.9	17.2	20.8	17.8	20.8	26.7	23.8	22.4	21.4	37.4	37.7	35.2	33.8	37.8	36.5	26.7	24.2
Combined Systems of Steam and Hydro Plants:																				
March	49.7	53.8	47.3	56.0	39.7	47.3	42.0	45.3	41.5	46.0	41.8	47.3	38.6	39.2	40.2	41.2	36.4	39.7	36.9	43.0
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.7	43.1	53.4	54.6	39.9	44.7	43.0	47.8	38.8	43.9	46.2	56.1	40.1	38.6	43.8	45.2	33.5	32.2	38.0	42.3
February	45.3	66.5	53.2	53.3	46.5	50.0	43.6	48.4	44.7	46.6	46.4	55.8	38.6	43.0	43.7	45.7	34.6	34.7	37.7	41.5

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Thinks Viewpoint of Editorial Refreshing

To the Editors of the ELECTRICAL WORLD:

On page 519 of the March 18 issue of the ELECTRICAL WORLD an article appeared in reference to the single versus the double rating of electric motors. I think this article was of exceptional excellence; in fact, it seemed to me to be such an excellent exposition of the fundamentals of proper motor rating that I abstracted it in a letter which I sent to many of our salesmen, giving, of course, due credit to the ELECTRICAL WORLD.

So many of the authors who have written on this subject have overlooked or ignored the real fundamentals of the subject that it was particularly refreshing to note an article which went to the pith of the matter.

FRED M. KIMBALL,
Manager Small-Motor Department.
General Electric Company,
West Lynn, Mass.

Field Tests at 280,000 Volts

To the Editors of the ELECTRICAL WORLD:

I find that an unfortunate slide-rule error was made in the calculations included in my article under the above title in the Feb. 11 issue of the ELECTRICAL WORLD. This error affects the whole of the last two columns of Table I and the last three columns of Table II. I hope you will think the matter of corona loss of sufficient importance to warrant the publication of the corrected tables which are inclosed.

Southern California Edison Co., Los Angeles, Cal.
R. J. C. WOOD, Assistant Electrical Engineer.

TABLE I—TYPICAL EXAMPLES OF CORONA LOSS MEASUREMENTS

Date (1921)	Time*	Barometer (Cm.)	Temperature (Deg. C.)	Weather	Voltage to Neutral (Kv.)	Miles of Circuit	Corona and Leakage (Kw.)	Critical Voltage (Kv.)	Coefficient† (M_0)
9/20	**3:45**	72 3	28	Clear	156.0	7.0	82	138 4	0 906
9, 27	10:00	72.2	37	Clear	156.0	12.0	47	146.0	0 985
9/27	**8:00**	71 9	23	Clear	156.0	12.0	73	143.2	0 927
9/29	4:00	71.9	17	Clear	158.5	12.0	179	138 3	0.877
10/8	4:00	72.3	12	Clear	159.0	19.5	619	129.3	0.803
10 8	8:00	72 4	23	Clear	156 6	19.5	249	138.0	0 887
10/8	**7:30**	72 4	19	Clear	164 0	19.5	394	140 5	0.891
10/8	**10:00**	72 3	17	Clear	164 0	19.5	658	133.6	0 843
10 9	2:00	72 4	17	Clear	156.6	19 5	236	138 4	0 872
10 20	**2:35**	72 1	34	Clear	139.5	27.0	0	139.5	0.934
10 4	**8:00**	72 3	17	Cloudy	164.0	19.5	857	129.3	0 816
10 2	**4:00**	72 4	21	Cloudy	163.0	19.5	515	136.6	0.872
10 21	**12 M**	71 8	16	Cloudy	138 3	27.0	137	128.2	0.812
10 22	6:00	71 9	16	Cloudy	139.4	27.0	45	132 7	0 840
10 23	2:05	72 0	13	Cloudy	142.7	27 0	19	138.3	0 864
10 12	**9:15**	72 0	13	Fog	161.5	19.5	830	127.1	0 794
10/12	**10:10**	72 0	13	Fog	164 0	19.5	726	132.2	0 826
10 12	**11:10**	72 0	13	Fog	164.0	19 5	883	128 6	0 803
10 5	10:00	72 3	17	Heavy mist	159 0	19.5	354	136 7	0 863
10 4	8:00	72.4	17	Heavy mist	159 0	19.5	368	136 2	0 858
9/30	**2:00**	71 8	20	Rain	159.0	19 5	552	131.4	0 843
9 30	**3:00**	71 7	19	Rain	159.0	19.5	526	132.0	0 846
9 30	**8:00**	71 7	17	Rain	161.5	19.5	598	132.6	0 844
10 23	8:30	72 2	12	Rain	138 0	27 0	58	130.2	0 809
10 23	10.25	72 2	13	Rain	141 0	27.0	32	135.3	0 843
10 23	11:40	72 2	12	Rain	141.0	27.0	243	125.2	0.777
10 23	**1:45**	72.1	12	Rain	141.0	27.0	132	129.3	0 803

*Boldface type indicates after midday. †Coefficients in Peek's formula.

TABLE II—CORONA LOSS AT DIFFERENT VOLTAGES

(Length of circuit, 19.5 miles. Frequency, 50 cycles. Date of test, Oct. 12, 1921. Temperature, 11 deg. Barometer, 72.0 cm.)

Time (A.M.)	Voltage to Neutral (Kv.)	Total Loss (Kw.)	Transformer and Line I²R Loss (Kw.)	Corona and Leakage Loss (Kw.)	Average Charging Current (Amp.)	Loss per Conductor per Mile	Excess Over Critical Voltage (Kv.)	Disruptive Critical Voltage (Kv.)	Coefficient* (M_0)
12.50	124.7	26.4	8	18	11.4	0.308	5.08	119.6	0.742
1.05	116.2	0	7	0	10.5	0	0	116.2	0.721
1.20	133 1	13 2	10	3	12 4	0 051	6.54	126.6	0.785
1.30	139.5	66	11	55	13 1	0 941	8.88	130.6	0.810
1.43	147.9	119	12	107	13 7	1.83	12.38	135.5	0.841
1.55	155.5	264	14	250	14 4	4 28	18.92	136.6	0.847
2.05	158.5	356	14	342	14 9	5.85	22.13	136.4	0.846
Average, excluding first three as being unreliable owing to smallness of losses									0.836

* In Peek's formula.

Proper Rating of Motors Rather a Commercial than an Engineering Problem

To the Editors of the ELECTRICAL WORLD:

Your editorial in the issue of March 18 entitled "A Machine Rating Should Express a Definite Recommendation" does not at all coincide with the views of many of your readers. Your statement that "most of the slow processes of standardization have encountered considerable opposition" does not hold true so far as the standardization efforts of the Electric Power Club are concerned, and it is with this standardization that your editorial principally deals.

Virtually all standardization of apparatus during the past ten or more years has been very harmoniously concurred in by almost all manufacturers, and the handbook of the Electric Power Club is full of rules and recommendations that were passed in most cases unanimously. The one outstanding attempt at a change in standardization that has not been unanimous was the attempt to change from 40 deg. to 50 deg. as the fundamental commercial rating for electric power apparatus. This controversy has been going on since about 1914, and the attempt to change the standard has not been successful because the majority does not believe it is right.

In the third paragraph of the editorial you say: "In the first place, a liberal estimate had to be made of the power required and, secondly, a motor was applied that was ample for its rating." Question: Have you seen more than one out of fifty salesmen that would recommend anything larger than really necessary? Of course, the entire question in the final analysis resolves itself into the fitting of the motor to the job by experience. Every day, however, new experiences must be gained because new power-driven machines are coming into use and new conditions are coming up that require always a safety factor to take care of the changing conditions and machines. There is, therefore, now, and will be present probably forever, the question: "Do you want to operate your motor or other machine at exactly its limit of endurance?" If it has the limit of endurance marked on the name plate, the user will apply it usually to that limit and expect it to live up to its name-plate marking, and many a time it will be called upon to pull more than its name-plate rating because of unexpected load due to machines or parts of machines getting out of alignment, causing tight bearings, or due to rush work and similar causes.

Do motors need a factor of safety in their rating? Decidedly yes. Just because an electric motor does not blow up when the temperature gets to 51 deg. is not an indication that it is a satisfactory machine to recommend for continuous operation at 50 deg. It is the practice in nearly all engineering work to have factors of safety. The only factor of safety that the 50-deg. continuous-rated motor has is the hope of the manufacturer that it may not burn out in a month or a year, but there is no denying the fact that it has a shorter life than the 40-deg. motor, if both are operated within the limitations of their respective guarantees. The proper rating of electric motors is more a commercial problem than it is an engineering one.

C. H. ROTH,
President.
Roth Brothers & Company,
Chicago, Ill.

North Carolina the Fifth State in Developed Water Power

To the Editors of the ELECTRICAL WORLD:

In your issue of March 18 there appears a digest of data compiled by the United States Geological Survey purporting to show the amounts of developed water power in the various states. In the table accompanying this article North Carolina is credited with a total of 255,843 installed horsepower, of which 126,070 hp. is allocated to public utility and municipal use and 129,773 hp. to manufacturing and miscellaneous purposes.

The North Carolina Geological and Economic Survey has recently completed a detailed study of the power situation in this state, the results of which are set forth in Circular 2 of the survey. In Table I of that circular the total developed horsepower in the state is shown to be 360,000. Of this, 128,092 hp. is allocated to public utility and municipal use and 231,908 hp. to manufacturing and miscellaneous purposes. These figures are substantiated by actual returns from the plants and are certainly correct to within a very few thousand horsepower. The error, if any, is probably in underestimating the total amount.

A part of the discrepancy between the estimates of the federal and state surveys is explained by the noninclusion in the estimates of the United States Geological Survey of developments less than 100 hp., by omission of the 72,000-hp. plant of the Tallassee Power Company at Cheoah, and by omission of about 5,000 hp. in plants put into operation during the latter part of 1921.

Inasmuch as the allocation of 360,000 hp. to North Carolina would make this state rank fifth instead of eleventh in the amount of developed water power, it seems desirable to call this fact to the attention of readers of the ELECTRICAL WORLD. In this connection it is of interest to quote Warren E. Hall, district engineer of the United States Geological Survey at Asheville, N. C., who states in a letter to the writer: "As a matter of fact, I am convinced that your estimate of 360,000 hp. total is nearer correct than anything yet published."

THORNDIKE SAVILLE,
Hydraulic Engineer.
North Carolina Geological and Economic Survey,
Chapel Hill, N. C.

What Is One Man's Meat Is Another's Poison

To the Editors of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for Feb. 18, in the article on "Iron Wire Versus Copper," it is noted that "Several cases of unusual failure resulted from short circuits. When such a disturbance occurred several miles from the source of power the protective devices apparently could not clear before the line would overheat from the sudden rush of current."

It may be of interest to some of your readers to know that at least one large power company operating an extensive 25-kv. network uses the current-limiting characteristic of iron wire to secure selective action between fuses and relays. What is one man's meat is another's poison!

To this particular system are connected a number of privately owned lines belonging to resellers whose territory does not warrant the expenditure for lines and substations of the high standard adopted by the power company. These cheaper lines and substations are subject to many failures, as was to be expected. In the majority of cases fuses are installed at the take-off from the main line; in some few cases automatic switches are provided.

When the main line was fed from both ends it was found that trouble on these tap lines would generally result in blowing of the fuses, but would not often trip out the main-line breakers. However, when the main line was fed from one end only, branch-line trouble would generally trip the breaker at the point of supply as well as blow the fuses on the tap, or trip out the oil switch in the customer's substation at the take-off. By inserting a short stretch of iron wire in series with the branch lines at the point of take-off it was found that the value of the short circuits on these could be held down to a figure where there would be sufficient current to clear out the tap line but insufficient current to cause the operation of the relays at the points of supply.

The size of iron wire used is approximately the same as the copper in the tap line in each case; the length of iron wire is from 200 m. to 700 m., in series with each phase of the tap line. The amount of iron wire to be used in each case is dependent on the short-circuit current available at the take-off, the value to which it is desired to limit the current in the branch line and the cross-section of the iron wire.

The iron wire is inserted between the main line and the protective apparatus of the tap line so that flashovers on switches and fuses are choked down to a low value and do not trip out the main line. If they should occur, however, as stated above, short-circuits on horn-gap fuses are a thing of the past as far as all records show.

On those lines that have been equipped with these improvised iron-wire current limiters phase-to-phase arcs at horn-gap fuses have become a matter of history. Interruptions to the operations of industrial plants owned by important customers arising from branch-line troubles no longer occur. Automatic switches of low rupturing capacity in customers' substations no longer show such signs of distress as formerly. The power company's operating forces place greater reliance in the correct action of the branch-line fuses for clearing trouble than they do in the privately owned automatic switches.

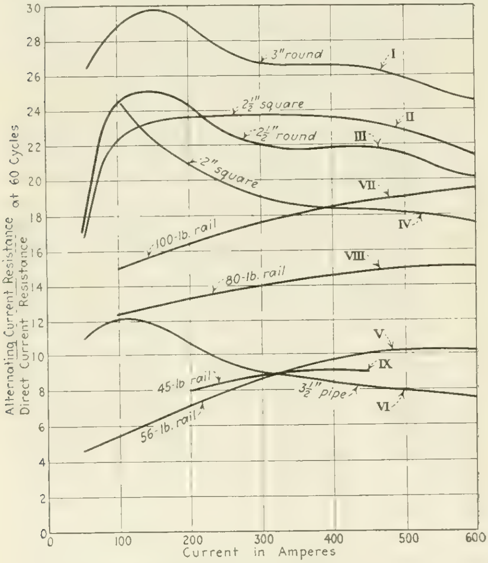
F. M. GILLESPIE.
Barcelona, Spain.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Effect of Cross-Section on Impedance of Steel Conductors

Since difficulty has been experienced in supporting flexible copper conductors for industrial cranes and heavy traction service and in providing suitable current collectors, some industrial concerns have adopted steel conductors as a solution of the problem. Although such conductors have come into almost general use for direct-current cranes and traction service, careful consideration has to be given to their impedance when alternating-current service is employed. This characteristic depends on the permeability of the steel, the current density and the cross-section shape of the conductor that is being considered.



VARIATIONS OF IMPEDANCE IN STEEL CONDUCTORS WITH CURRENT AND SECTION SHAPE

Curves I, II, III, IV, V and VI from report of the Electric Railway Test Commission of the Louisiana Purchase Exposition; curves VII and VIII from the *Journal* of the Franklin Institute; curve IX from Foster's Handbook.

The effect which cross-section has on impedance is shown by the accompanying tables for various shapes of commercial steel.

The methods of using copper crane conductors are well known and need no description. The general type depends upon a wire heavily strain-insulated at each end of the runway with diverse kinds of intermediate supports and a trolley-wheel collector with a spring and upward contact. With steel conductors it is possible to use a heavy contact shoe on cranes and depend solely on gravity for contact pressure. Moreover, with rigid members end strains can be eliminated.

Although there seems to be a prejudice against their use, the number of alternating-current industrial cranes is increasing, and the following data are intended to give an approximation of the impedance of commercial steel in view of its very successful use with direct current.

Copper loses its efficiency as a conductor of alternating current as the frequency and cross-section increase. Owing to the skin effect the maximum size of copper wire recommended is 800,000 circ.mil for 60 cycles and 1,250,000 circ.mil for 25 cycles. With steel the skin effect is very much greater, and it has been found that the effective depth of penetration is 0.08 in. for 25 cycles and 0.045 in. for 60 cycles. The following formula has been used to translate data from one commercial frequency to another:

$$\frac{\text{Impedance 25 cycles}}{\text{Impedance 60 cycles}} = \sqrt{\frac{25}{60}}$$

The ratio of alternating-current resistance is a function of the ratio of area to perimeter of the conductor.

IMPEDANCE OF STANDARD COMMERCIAL STEEL SECTIONS

			60-Cycle		25-Cycle	
	Weight per Foot	D.C. Resistance per 100 Ft.	$\frac{\text{A.C.}}{\text{D.C.}}$ Resistance	Ohms per 100 Ft.	$\frac{\text{A.C.}}{\text{D.C.}}$ Resistance	Ohms. per 100 Ft.
A. S. C. E. Rails:						
100-lb., $5\frac{1}{4}$-in. x $5\frac{1}{4}$-in.	33.3	0 00100	18.00	0.0180	11.60	0.0116
80-lb., 5-in. x 5-in.	26.7	0.00125	15.00	0.0187	9.67	0.0121
70-lb., $4\frac{5}{8}$-in. x $4\frac{5}{8}$-in.	23.3	0.00143	14.40	0.0205	9.30	0.0133
60-lb., $4\frac{1}{4}$-in. x $4\frac{1}{4}$-in.	20.0	0.00167	12.10	0.0202	7.80	0.0130
50-lb., $3\frac{7}{8}$-in. x $3\frac{7}{8}$-in.	16.7	0 00200	11.00	0.0220	7.10	0.0144
40-lb., $3\frac{1}{2}$-in. x $3\frac{1}{2}$-in.	13.3	0.00250	9.62	0.0241	6.22	0.0150
35-lb., $3\frac{5}{16}$-in. x $3\frac{5}{16}$-in.	11.7	0.00285	8.85	0.0254	5.70	0.0164
30-lb., $3\frac{1}{8}$-in. x $3\frac{1}{8}$-in.	10.0	0.00330	8.17	0.0270	5.28	0.0174
25-lb., $2\frac{3}{4}$-in. x $2\frac{3}{4}$-in.	8.3	0.00400	7.40	0.0296	4.77	0.0191
20-lb., $2\frac{5}{8}$-in. x $2\frac{5}{8}$-in.	6.7	0.00500	6.45	0.0323	4.16	0.0208
Section Tee Bars:						
3-in. x 3-in. x $\frac{3}{8}$-in......	7.80	0 00441	6 74	0.0297	4.35	0.0190
3-in. x 3-in. x $\frac{5}{16}$-in..	6 60	0 00512	5.78	0.0296	3.73	0.0190
$2\frac{1}{2}$-in x $2\frac{1}{2}$-in x $\frac{3}{8}$-in.	6 40	0 00535	6.74	0.0360	4.35	0.0230
$2\frac{1}{2}$-in. x $2\frac{1}{2}$-in. x $\frac{5}{16}$-in.	5 50	0 00625	5.78	0.0360	3.73	0 0230
2-in. x 2-in. x $\frac{5}{16}$-in......	4.30	0 00795	5.78	0.0460	3.73	0.0300
2-in. x 2-in. x $\frac{1}{4}$-in...	3.70	0.00953	4.72	0.0450	3.05	0.0290
$1\frac{1}{2}$-in. x $1\frac{1}{2}$-in. x $\frac{1}{4}$-in.	2.47	0 01370	4.15	0.0570	2.68	0.0370
$1\frac{1}{2}$-in. x $1\frac{1}{2}$-in. x $\frac{3}{16}$-in.	1 94	0.01760	3.37	0.0590	2.17	0.0380
Angles:						
3-in. x 3-in. x $\frac{3}{8}$-in...	7.20	0.00475	6.35	0.0302	4.10	0.0194
3-in. x 3-in x $\frac{5}{16}$-in ..	6.00	0.00562	5.40	0.0304	3.48	0.0196
3-in. x 3-in. x $\frac{1}{4}$-in...	4 90	0 00695	4.33	0.0300	2.80	0.0194
$2\frac{1}{2}$-in. x $2\frac{1}{2}$-in. x $\frac{5}{16}$-in	5.00	0 00685	5.40	0.0370	3.49	0.0225
$2\frac{1}{2}$-in. x $2\frac{1}{2}$-in. x $\frac{1}{4}$-in.	4 00	0 00840	4.33	0.0362	2.80	0.0233
2-in. x 2-in. x $\frac{5}{16}$-in...	3.90	0 00870	5.40	0.0470	3.48	0.0303
2-in. x 2-in. x $\frac{1}{4}$-in.. ...	3.20	0.01060	4.33	0.0460	2.80	0.0297
$1\frac{1}{2}$-in x $1\frac{1}{2}$-in. x $\frac{1}{4}$-in	2.86	0 01190	5 10	0 0610	3.29	0.0394
$1\frac{1}{2}$-in x $1\frac{1}{2}$-in x $\frac{3}{16}$-in...	2.34	0.01450	4 13	0 0600	2.66	0 0387
$1\frac{1}{4}$-in x $1\frac{1}{4}$-in x $\frac{1}{4}$-in ...	1.92	0.01780	4 04	0 0720	2.60	0.0465
Flat Steel:						
3-in. x $\frac{1}{2}$-in..	5	0.00667	7 71	0.0514	4 97	0.0332

Obviously, as in busbars, a thin, flat conductor would be most efficient. But, since the mutual inductance of mutually perpendicular surfaces is zero, a T or angle shape should be almost as efficient. The following empirical formula has been evolved to meet average conditions:

$$\frac{\text{A.C. Resistance}}{\text{D.C. Resistance}} = \frac{K \times \text{area (sq. in.)}}{\text{Perimeter (in.)}} = \frac{K' \times \text{area (sq. cm.)}}{\text{Perimeter (cm.)}}$$

The average values of K and K' for different shapes of commercial steel are:

	K	K'		K	K'
100-lb. rails	.44	35.2	Smaller rails	.36	28.8
80-lb. rails	.40	32.0	Angles and T's	.36	28.8
60-lb. rails	.36	28.8			

For convenience the accompanying table has been worked out based on average values of the ratio of alternating-current resistance to direct-current resistance. The direct-current resistance for steel is for an average value 12.2 times the equivalent sections of copper, or .01 ohm per 100-ft. length and 1 sq.in. of cross-section.

The value of impedance depends on the current density in the steel section. Experimental data have been plotted from actual results, and the manner in which this ratio varies with the current is shown in the accompanying curves.

As crane runways are not usually of great length, extreme accuracy of calculation is not required and the mutual inductance at spacings used in practice is neglected in this article. But remembering that the torque of induction motors varies as the square of the impressed voltage, we are concerned with maximum value of impedance. It may be desirable in some cases where steel conductors are used to add auxiliary feeders for a part of the runway.

L. S. LOOMIE,
Electrical Engineer.
New York, N. Y.

Starting Generators for Operation as Synchronous Condensers

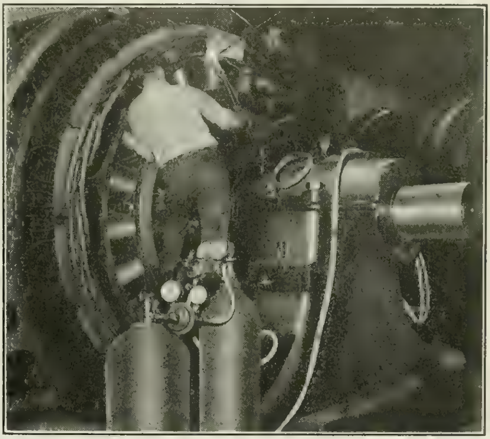
IN OPERATING generators as synchronous condensers for power-factor and voltage regulation some trouble may be encountered in starting them inductively. A turbo-generator is apt to be more difficult to start inductively than the ordinary type of generator on account of the high speed and solid rotor construction. Because of the high synchronous speed a comparatively long acceleration period is required, with resultant heating of armature and starting apparatus. As the maximum speed is approached the high windage loss may even prevent the machine from falling into synchronism. Furthermore, since the rotor is usually constructed so that eddy currents set up by the traveling field can flow freely through it, this fact may tend to prevent acceleration beyond half speed. In case the field winding is short-circuited, the induced current therein may have a similar effect.

From the standpoint of starting torque it would be preferable to have the field switch open during starting, but the high potential induced in the field winding at this time by the traveling stator field is apt to puncture the insulation if the field is not short-circuited. Hence the best plan, as a usual thing, is to short-circuit the field winding at starting; if the machine locks at half speed, the field switch can be opened. In case the machine ceases to accelerate at a point just below full speed, normal direct-current excitation may be applied to bring it into synchronism. The starting voltage should be approximately 25 per cent of the rated voltage. A higher voltage may safely be applied when half speed is reached if there is any tendency for the machine to stick at this point.

C. R. REID,
Power House Superintendent.
Shawinigan Water & Power Company,
Shawinigan Falls, Que.

Welding Reduces Cost of Repairing Motor Generators

REPLACEMENT or repair of substation equipment when auxiliary apparatus is not available was recently facilitated at the Bryant Street substation of the Market Street Railways of San Francisco by the use of welding, when trouble was experienced with some motor-generator sets.



WELDING OF END BARS SAVES FOUR-FIFTHS OF REPAIR COST

Starting strains caused a loosening of the bars on the end rings of the squirrel-cage windings of the 2,150-hp. synchronous motors used, causing them to burn off. It was first recommended that the rings be replaced, but when it was taken into consideration that the machine on which the replacements were being made would be out of commission four or five days, it was found that this was impracticable, load conditions being such that all the generators were needed during the peak hours. Consideration was given to removing the field spools from one motor at a time, sending them to an outside shop to be welded. This also proved impracticable.

The work was finally performed by welding. Preparatory to this plates of sheet iron and asbestos to insulate the coils from the heat were made and a blower was arranged to supply a blast of cold air through the coils while the work was in progress. The actual welding was done during off-peak hours. The stator was moved forward by jacking, allowing the squirrel-cage winding to project 2 in. From four to six coils were welded an hour, each coil having four bars. The stator frame moved in both directions to allow welding the bars at both ends.

Each of the five motors on which the work was done was out of operation but four hours, two hours in the morning between load periods and two hours in the afternoon. Approximately twenty hours was required to complete the work on the five motors. The cost for the entire job of welding on the five motors was $100, or $20 per motor. It was estimated that the replacement cost of the worn parts would have been $200 per motor, or $1,000.

According to J. E. Beckman, chief operator for the traction company, welding of the worn parts has improved the operation of the motors more than replacement would have done. Contact is better as a result of the weld than if new parts had been installed and riveted. The motors also start more quickly and with less danger of short-circuiting.

Field Editor Electrical World.
San Francisco, Cal.

Copper Fuses Used for Transformers

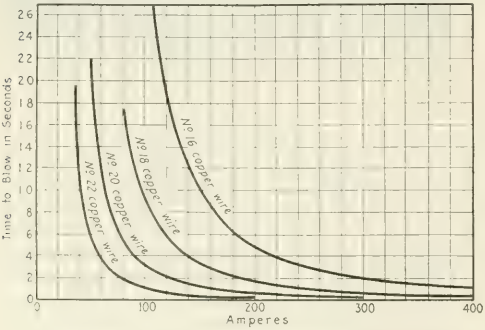
COPPER fuses have been successfully used in 2,300-volt transformer cut-outs for the past two years by the Worcester (Mass.) Electric Company. The time lag of these fuses and their portability in the form of coiled wire are decided conveniences. The size of copper wire used in the cut-outs for the various transformers is given in the accompanying table. Tests under regular operating conditions indicate that the wire as chosen for one transformer should be of such a size that the fusing current will be at least three times the full load current of that transformer. In a case where a smaller wire than this is used the heating caused by normal load currents will oxidize the copper slowly. The blowing periods of the various sizes of wire when tested in the ordinary 2,400-volt transformer cut-out are shown in the accompanying illustration.

SIZE OF COPPER WIRE USED BY WORCESTER ELECTRIC LIGHT COMPANY TO FUSE 2,300-VOLT TRANSFORMERS

Single-Phase Transformers:	Size of Copper Fuse Wire
Under 10 kva	No. 22 B. & S.
10 kva. to 20 kva. inclusive	No. 20 B. & S.
20 kva. to 37.5 kva. inclusive	No. 18 B. & S.
37.5 kva. to 50 kva. inclusive	No. 16 B. & S.
Three-Phase Transformers:	
Under 20 kva	No. 20 B. & S
20 kva. to 59 kva. inclusive	No. 18 B. & S.
60 kva. to 90 kva. inclusive	No. 16 B. & S

An added advantage where copper wire is used for fusing transformers is that the wire is not crushed under the terminals when it is inserted in the cut-out. This very often occurs with the ordinary fuse wire. To facilitate the work of inserting fuses in transformer cut-outs throughout the system, this company denotes on maps carried by the maintenance forces the size of fuse wire for every cut-out. On 13,200-volt circuits tetrachloride fuses are used.

G. M. Hardy,
General Superintendent.
Worcester Electric Light Company,
Worcester, Mass.



DISTRIBUTION TRANSFORMERS SUCCESSFULLY FUSED WITH COPPER WIRE

Definite Temperature Control Necessary in Babbitt Pouring

THERE is a statement on page 434 of the March 4 issue of the Electrical World in the article "Suggestions on Rebabbitting Bearings," by M. M. Brown, which I think is too dangerous to allow to be published unchallenged.

In this article, which is otherwise excellent, is the statement "the old rule (which I think is as good as any) says that when the metal is hot enough to blacken a pine stick it is hot enough to pour." This is absolutely true, but the question is, is it cold enough to pour? I think it is generally recognized that the closer we keep our pouring temperature to the solidification point in ordinary babbitts (still considering the intricacies of the pattern and the fluidity necessary to secure good flow) the better will be the bearing. If the bearing is "chill-poured," the initial pouring temperature is not so important as when using higher copper babbitts.

Who knows at what point a pine or birch stick blackens? Who knows the moisture content? I have seen in shop after shop the foundry man use an old charred stick in determining the pouring point, and, by actual measurements, I have found that the temperature covers a range of 75 deg.

Temperature Control Necessary

Good bearing work necessitates the employment of the definite temperature control in pouring, and for this work a base metal (thermocouple) is as good as anything else, considering the low temperatures involved. This instrument is also comparatively cheap.

It is also noted that Mr. Brown states "that sometimes it happens in the manufacture of babbitt that particles of copper and antimony amalgamate into what are called hard points. These are no larger than pinheads and are as hard as steel. If they come to the surface, as the babbitt wears down, they are sure to score the shaft or pin." Unless Mr. Brown specifically refers to the intermetallic compounds due to impurities—for example *Fe*, which should never be present if the raw materials are chemically controlled—this is not the case. All other hard crystalline bodies, such as *Sb*, *Sn* and Cu_3Sn, are deliberately put in the bearing, and no babbitt metal would be efficient without these particles. They do not and normally cannot score the shaft and the efficiency of the bearing depends entirely on the presence of these minute crystals.

Crystals of antimony and tin have a low coefficient of friction and are hard enough to resist wear, but as they are of low density there is a great tendency toward flotation in pouring unless copper is added. By the addition of copper an intermetallic network is formed which effectively entangles these small crystals throughout the babbitt, so that no matter how much the bearing is scraped the new surface will have these small crystals present. It is the contact with these crystals upon which the efficiency of this type depends.

The softer matrix is for the purpose of holding the journal and allowing the crystals to adjust themselves against the journal, thus preventing scoring. Of course, these remarks hold only when first starting the rotation of a journal and before an oil film is built up. After an oil film is built up the material of the bearing makes little or no difference provided that the oil film is not ruptured. However, the microscopic structure of the bearing metal does have a bearing on the ability of metal to create and maintain an oil film, and the low soft parts in which the crystals are embedded act as molecular oil pockets.

Karl F. Smith,
General Inspector of Naval Aircraft.
McCook Field, Dayton, Ohio.

Scheduling Departure of Meters by Portable Truck Saves Time

MUCH time is saved in drawing meters and repaired appliances from the stockroom of the Hartford (Conn.) Electric Light Company by a system recently adopted. Through the operation of this system each meter installer or delivery man finds a segregated group of meters or appliances waiting for him when he reports for work. The scheme saves from thirty to fifty minutes a day for each man on this class of work. This system replaced another less efficient scheme in which orders to install meters, etc., were written at any and all times of the day and marked for immediate execution. This made it impossible either to group the work efficiently or to start the delivery service out on time. Orders received up to 7 a.m. or 1 p.m. were written hurriedly and usually were given to an employee going in the general direction of the lighting department. The result was much disorganized rushing about and frequent mistakes.

METER AND APPLIANCE ASSEMBLY TRUCK SAVES MORE THAN A HALF HOUR DAILY PER MAN

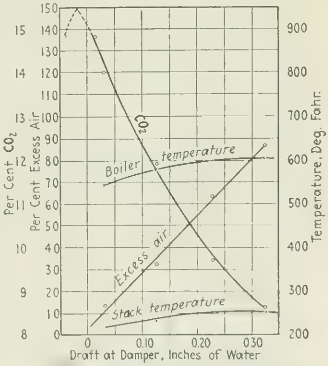
The first step in revising this system was to require that all orders for afternoon deliveries be written and in the hands of the lighting department by 10:30 a.m. All orders for morning work were required to be complete and in the department's hands by 3:30 p.m. of the previous day. This allowed sufficient time for grouping the orders in trips, considering both location and the work to be done. Under this arrangement the grouped orders are turned over to a clerk in the meter stockroom, who assembles all the necessary meters, fuses, lamps, appliances, etc. A four-wheel truck frame was purchased and fitted with shelves as illustrated. Five of these, 5 ft. long and 3 ft. wide, are provided, the vertical spacing between shelves being 12 in.; the shelves are of oak, shellacked, and are carried by 1½-in. x 1½-in. x ⅛-in. angle irons, with 1-in. x ¼-in. diagonal bracing at the ends. Movable wooden barriers ⅞-in. thick x 2⅜-in. high are provided to subdivide further the shelves. Metal clips bearing the installers' names are hung on the angle-iron supports.

On the truck the stock clerk lays out each man's apparatus in separate compartments as called for by the collection of orders grouped in trips. This truck with its load is sent to the elevator loading platform at the company's Pearl Street office building at 6:55 a.m. and 12:55 p.m., and in this way men reporting for work at 7 a.m. and 1 p.m. find everything arranged and ready for loading upon road trucks.

H. L. Thomson,
Superintendent of Lighting Department.
Hartford Electric Light Company,
Hartford, Conn.

Excess Air Causes Serious Losses in Boiler Plants

PERMITTING more air to enter a furnace than just enough to allow complete combustion to take place causes a loss in over-all economy that may amount to 2 per cent or more. As shown in the accompanying chart of a test on a boiler using fuel oil, the amount of excess air is drectly related to the percentage of CO_2 obtained. The higher the CO_2 content of the flue gases and the lower their temperature the better the boiler efficiency will be. The CO_2 obtained depends upon the draft and the condition of the boiler setting. If there are air leaks in the setting or around the doors, excess air is admitted and causes low CO_2 and hence a fuel loss. If the boiler settings are tight, it has been found that good CO_2 can be obtained for any load on the boiler or for any number of fires if the draft is regulated closely. Increasing the CO_2 content from 12 per cent to 14 per cent with the same flue-gas temperature, means a reduction of more than 2 per cent in the fuel consumed.



THE AMOUNT OF EXCESS AIR GREATLY AFFECTS THE BOILER EFFICIENCY

The flue-gas temperature depends upon the draft, the load, the air leaks and the cleanliness of the boiler, both inside and out, and the conditions of the baffles. With 14 per cent CO_2 a flue-gas temperature of 500 deg. Fahr. instead of 600 deg. Fahr. means a saving of about 2½ per cent of the fuel.

Therefore, if the CO_2 content is increased from 12 per cent to 14 per cent by keeping the settings tight, regulating the draft closely and cutting out the smoke, and if the baffles are kept in good shape, the draft set properly and the flue-gas temperature kept low it is possible to make a gain in efficiency of more than 5 per cent.

Southern California Edison Co., W. E. Thomson,
Los Angeles, Cal. Steam Plant Engineer.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

The Curse of "Canned Speeches" at Our Conventions

With the Approach of the N. E. L. A. Convention at Atlantic City This Article by "Kassandra" Is Particularly Pertinent at This Time

RECENTLY I was dining with three good lawyers and was interested to hear them discuss some of their confrères. Some men were good lawyers because they could dig up the law and write an excellent brief showing what the law was. Others were good because they could sit down with a client in their office and give good advice. Still others were good as trial lawyers or jury lawyers in conducting a case before the jury.

Then they went on to a particular friend of theirs who did a good deal of trial or jury work but was not particularly successful in winning his cases. They all knew the reason, and the scorn with which they put it was illuminating: "He *reads* his speeches to the jury." That he looked up from his manuscript at the jury, that the inflections of his voice and his gestures were good, were only a slight excuse for this cardinal crime of inefficiency in winning over the jury to his way of thinking.

Now the application of this to the electrical business is seen in our conventions, where too often the chairman of a committee presents a report and reads it to the assembled members. To read a report to a number of persons is almost a crime. It is a waste of their time even if a large percentage of them have come to the meeting solely for a nap. No report should be read. At most the chairman should be allowed perhaps ten minutes for presenting its salient points, and even then he can accomplish more by talking about it than he can by reading any portion of it. The writing of a report and the presentation of it to a convention are just as different as the writing of a legal brief and making a speech to a jury.

No lawyer would think of reading his brief to the jury or even reading it to the judge. He knows that if he did he would never win a case. When a chairman of a committee or its members spends valuable time in working up a good report, they should realize that a little extra time devoted to presenting it properly before the convention will double or triple its value.

Some reports are merely collections of statistics and should be presented by title only. They should be made available in the bound volumes or in separate copies, but there is no use whatsoever in reading them, nor is there any use in *reading* any report. If presented otherwise than by title, it should be talked and not read.

That each one of the audience loses or wastes only a little time while he sits before the reader of a report is no excuse when it is remembered that the sum total of all the time thus wasted would balance the giving of two or three days by the chairman of the committee or whoever presents the report to learning how to present it efficiently, just as a lawyer who is going to present a case to a jury or to a judge devotes a considerable portion of his time to learning how to present it efficiently.

Electrical men attend the N. E. L. A. convention in order that they may have a few days for the intensive interchange of ideas and to broaden and readjust their viewpoints on new problems and developments in the industry. Many of these men have spent considerable sums of money and several days' travel to gain the advantages of convention conferences. Their time is valuable and should not be taken up by the unnecessary reading of written reports which they can study to much better advantage when they get back home.

Connecticut Town Guarantees Return on Rural Line Extensions

THE town of Bloomfield, Conn., and the Hartford Electric Light Company have recently agreed upon a policy of financing rural line extensions which is believed to be of general application in cases where the municipality will agree to meet the extra cost of service above revenue by drawing upon the tax levy. Bloomfield is a community lying about four miles outside Hartford, with a surrounding agricultural district which was very desirous of obtaining electric service on reasonable terms. Conferences between the company and town officials resulted in a town meeting at which the citizens voted to guarantee a return upon certain extensions, making up from the tax levy the difference between the income received for the sale of energy including a monthly minimum guarantee by each customer and a total sum representing the company's estimated cost of service over all.

Four line extensions (2,300-volt, single-phase) were determined upon by the board of selectmen and the company under the agreement. The estimated construction costs of these were, omitting cents, $317, $494, $1,625 and $6,767, or a total of $9,205. On the basis of turning its capital on the average once in three years, the Hartford company agreed to make these extensions if the town would guarantee an annual income from them of $3,068 for three years, payable in thirty-six monthly installments of $255 each. Before beginning construction, the company and the board agreed that the latter should canvass the sentiment of residents in the districts to be reached by the new service and secure the signatures of at least forty proposed customers to an individual agreement by which each promises to pay the company $30 per year for three years in equal monthly installments of $2.50 each and further to pay the company the regular meter rates as filed with the Public Utilities Commission.

Adjustment with the town by the company is to be made annually to give the town credit for amounts used by any individual customers in excess of the monthly minimum contracted for by the individuals. In case additional customers desire to secure service from these extensions after construction of the lines, they are referred by the company to the board of selectmen, which discusses with applicants the terms under which they may share in the cost of providing the service, the usual rates of the company also of course being applied to service rendered.

Central-Station Manager Lends His New Bungalow as "Electrical Home"

FROM Boulder, Col., comes an unusually interesting story of an electrical home demonstration carried out in a house designed and built especially for a practical central-station man. To F. S. Henderson, manager of the Western Light & Power Company at Boulder, the credit is due for "putting over" the project, for it was his home that he offered to the electrical interests of the community to tell the story of "the modern home" for the first time in Colorado.

Mr. Henderson designed and built the home himself and put some of his own furnishings and equipment in it during the display. As the central-station manager in that city, he invited the contractor-dealers to co-operate in the wiring, furnishing and display of the home. The literature distributed during the exhibition referred to all individuals and concerns, including the furniture house and musical dealer, as making the exhibition possible.

The home was opened for display March 3 and closed March 12. With the exception of two Sunday nights, it was open for inspection daily from 1 p.m. to 10 p.m. The largest one-day crowd was 524, and the last Sunday afternoon 304 people entered the house. A severe snowstorm and windstorm for two days did not deter 250 people from seeing the house. Considering the population of Boulder as 15,000, the total attendance of 2,629 was approximately 18 per cent of the population. The advertising to secure this attendance cost about $350.

According to Mr. Henderson, the most valuable publicity secured was that resulting from the co-operation of the Boulder Woman's Club, which provided two of its members each day to serve as hostesses. Although they were not in a position to explain the features found in the home, they gave a personal touch to the affair, meeting the people at the door and making them feel at home.

The success of the Boulder home is indicative of the benefits which will come in other parts of Colorado through the electrical home movement. With many of the state newspapers showing an interest, it is believed that following the exhibition in Denver additional homes will be featured during 1922 in at least five other Colorado cities.

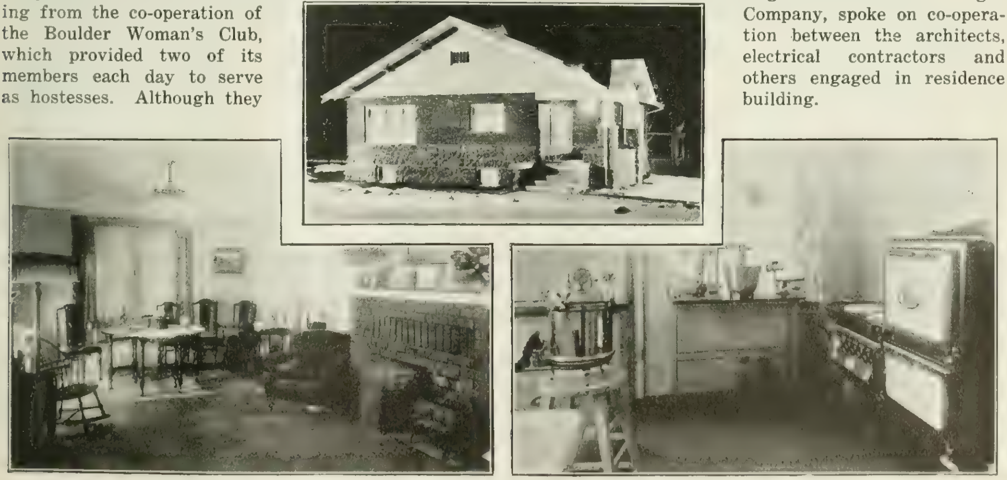
What Other Companies Are Doing

Illinois.—Public utilities companies will spend $75,000,000 in plants and equipment in Illinois this year because of their confidence in the business and industrial outlook. These figures were quoted by R. V. Prather, secretary of the Illinois State Electric Association, in his report at the annual convention of this organization at Chicago, March 15.

Boston, Mass.—A very successful series of lectures by employees on the history, growth and service of the Edison Electric Illuminating Company of Boston is now under way in the Metropolitan and suburban territory served by this utility. With a little coaching and a full assortment of lantern slides, employees are speaking before "capacity houses."

Omaha, Neb.—The Nebraska Power Company recently launched a customer-ownership campaign in its territory. The company is offering the stock to customers either for cash or on partial payments, and in the latter case the alternative is offered of withdrawing from the deal, the company refunding the money paid in with interest at 6 per cent.

Bellingham, Wash.—A continuation of the program of the Northwest Electric Service League to bring the idea of proper electrification of the home before building contractors and architects was accomplished by means of a joint meeting of the electrical men and those interested in building construction at Bellingham, April 12. H. B. Sewall, Bellingham manager of the Puget Sound Power & Light Company, spoke on co-operation between the architects, electrical contractors and others engaged in residence building.



VIEWS OF BOULDER, COL., CENTRAL STATION MANAGER'S ELECTRICAL HOME

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

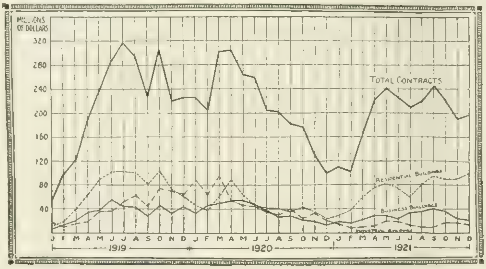
The Safety, Suitability and Soundness of Domestic Appliances

By Charles Edward Lucke, Ph. D.

Professor of Mechanical Engineering, Columbia University, New York City, Consulting Engineer Hoover Suction Sweeper Company

THE future of household electric appliances hangs on just one point, acceptably good service, or, rather, the highest possible quality of service. If these appliances are really good, each in its own proper way, their use will increase and as they wear out they will be replaced. If they are not really good, however, while many homes may buy one for trial, they will soon be discarded and will never be replaced. If these appliances are satisfactory, capital invested in the industry of appliance production will be safe, and so also will capital invested in the extension of electric distribution or increase of central-station capacity. If the household appliances are not satisfactory, all such capital will be at least unsafe, if not actually lost.

Trend of Building Operations



THIS chart, showing the trend of industrial, business, residential and total building operations by months for three years offers further encouragement to the electrical industry. Total contracts for the last six months of 1921 are well above those for the same period of 1920 and many of these buildings are coming into the electrical stage of construction now.

The public has accepted in principle the electric heating appliance, the curling iron, chafing dish, toaster and coffee pot, flatiron, and under proper conditions the room heater and cooking range. The public has also accepted in principle the electric power appliance, the fan, clothes washer, clothes ironer, dishwasher, vacuum cleaner and refrigerator. But acceptance in principle is not permanent acceptance in fact unless these things are right and suitable for the purpose intended. Continued use depends primarily on this service factor, which is in turn dependent on the quality of design, materials, workmanship and production of the appliance with its electrical connections.

The purchaser of an electrical household appliance is normally not skilled in electricity, in mechanical construction or in machinery. Incapable of passing judgment on technical matters of quality and not justified in paying for advice, the purchaser, usually a woman, has been forced to make selections on other grounds. Under such conditions, alluring advertising, persuasive salesmen, trick demonstrations, beauty of appearance in form, finish or color, and price or terms of payment are factors more apt to control selection than real merit in the appliance contributing to good service.

There seems to be but one way available for the correction of the defects in this situation as it exists—defects that threaten equally the stability of the interests of housekeeper, appliance manufacturer and central-station company. That way involves, as a first step, the establishment of some acceptable and practically attainable standards of quality, and with it, as a second step, the setting up of some means of enforcing those standards.

On the problem of arriving at proper standards there is much that can be said, based on experience that should prove useful. Here it is necessary to be specific, as the standards problem for one appliance is quite different from that for another, though, of course, certain things, like connections, are common to all. Plugs, cord connections and switches now in use, however safe they may be from the point of view of fire risk as to adequacy of insulation, are in all important respects normally bad. They do not give good service because they are mechanically imperfect and often unsuited to the service in other respects. This is not due to any lack of knowledge as to how such things should be made, but primarily because price controls, and the cheapest thing that authorities will accept is what is used.

Switches should be part of any appliance—switches that are convenient, and strong enough even to stand as much abuse proportionately as an automobile axle. Switch breakage, cord joint failure, plug or socket insulation breakage, loose screws and a hundred other mechanical defects can easily be eliminated, no matter how ignorant or careless the operator, if standards are established to prevent the sale of what is flimsy or dangerous.

No better proof of this possibility could be cited than the automobile of today, operated normally by people with no knowledge of machinery or with the little that is more dangerous than none, yet with no major failures worth mentioning except in collisions. In the case of the automobile no service quality standards were necessary nor was there need of a system of enforcement. Public observation itself was sufficient, because he who rides can see. Cars that fail to come home are observed by all, and their sale automatically stops.

In the case of the electric household appliance the conditions are different. One's home is not open to the inspection of every other owner as is the family automobile; the defects of the housekeeper's appliances are for psychological reasons more likely to be concealed even from intimate friends, than to be aired or explained. Therefore the creation of protective standards is not only important but necessary to a degree hardly equaled elsewhere.

Considering the appliance standards problem, so far as procedure is concerned, independent of the basic question of connections standards, attention must be directed toward the purpose of the appliance and the measure of attainment of that purpose. It should be accepted as an axiom that no measure of quality applied by test or otherwise should be accepted unless it is a direct measure of some necessary service quality, except when a direct measure is impossible or undiscovered. In this case an indirect measure is permissible and is acceptable in proportion as it bears on utility or measures of the appliance value for the purpose intended. Standards must be based on these direct and indirect measures of service quality, because it is obvious that a standard for which there is no measure is not a standard at all.

It must also be regarded as axiomatic that no standards, however desirable they may seem from the standpoint of quality measuring, can be accepted when they have the effect of preventing or even hindering legitimate progress in developing improved designs by invention or research.

Proceeding from these broad principles, applicable to all appliances, it is possible to set down some more detailed principles, also of general application. Standards and measures of standards for any appliance must be concerned with four main subdivisions of the general aim of achieving greatest service quality. These four main subdivisions are:

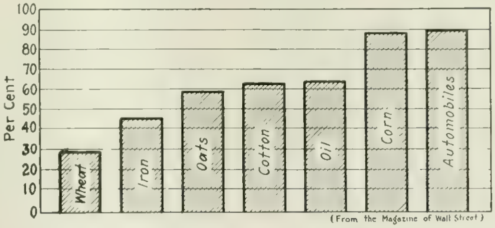
1. *The Principle of Safety or Hazard.*—Appliances should be as safe as possible against risk of fire and personal injury in the house.

2. *The Principle of Domestic Suitability.*—Appliances should not require reorganization of home or injure the furnishings of a home or the clothing of its inmates; should be adapted to use by a woman and should be equally adapted to all types of homes from the largest to the smallest, to the most or the least intelligent people, to the apartment or the house with stairs—unless, of course, the appliance is intended for some special domestic condition, in which case its limitations cannot be made too plain.

3. *The Principle of Structural Soundness or Reliability.*—Appliances should not be flimsy, or too quickly require adjustments that the unskilled cannot make, or too quickly wear out, or suffer from the loosening of fastenings. Certainly they should not cease to function until really worn out or quickly lose effectiveness.

4. *The Principle of Effective Functioning.*—Each type of appliance is intended to do something, and the effectiveness or efficiency with which the aim is accomplished is probably the most important of all its features, though by no means the only basis on which judgments of service quality may be formed.

America's Contribution to the World's Production



(From the Magazine of Wall Street)

WHEN everybody is thinking about the development of export trade this chart is of unusual interest as it shows the strength of our position. Of the seven items shown, with the exceptions of wheat and iron, the United States produces from 60 to 90 per cent of the entire world's supply.

The Price of Cash

IT SEEMS to be hard for a great many people to realize that cash is a commodity and that the price of cash is as fixed and definite as the price of any other goods that are bought and sold. Here is the problem in a thought. Does a cash discount mean what it says, or is it a little matter for juggle and jest, in which the customer stretches his ten days to twenty if he can get away with it?

Consider a typical transaction between a contractor and the jobber. In his warehouse lies a bin of wire and he wishes to sell it. The contractor needs a few coils of No. 14 and asks the price. The jobber quotes him a definite list and a definite discount and offers to sell it to him for the usual terms of credit. That is the price of the goods.

Then comes another and a separate transaction. At the same time the jobber sells this contractor the wire he offers to buy something from him—to buy cash. The jobber knows the contractor has a wad of ready money stowed away and offers to buy some from him. He offers the contractor one per cent discount for delivery of his cash in ten days. That is the price of cash. When the jobber makes his price on the goods and this contractor sends his order, there is never any question as to their cost to him. It is all clear and clean. If the goods are satisfactory, they are paid for at the agreed price. He would never think of deducting a dollar or so just because he thought he could, for when a true man orders goods at a price he pays the bill.

But here's a curious and singular thing: When this same man undertakes to sell cash to the jobber with delivery date stipulated as a part of the price, it is a fair bet that he may ship that cash from five to twenty days late and deduct the price of cash-on-time collected in advance, without a word to the man who gave the order for the cash he's selling.

Day after day to the jobber come checks, big and little, that cannot be accepted and have to be sent back. The money is not due yet for the purchase of the goods, but the jobber has offered to buy cash from these people, with delivery stipulated, and here comes the cash too late, not worth the price quoted and not wanted. A cash discount is the price of cash delivered on the dot.

When the contractor sells cash to the jobber, or to anyone else, the price of cash is always specified and delivery is ever a prime condition of the purchase.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Theory of Distortionless Alternators.—G. SHIMIDZU.—The author derives formulas for calculating the short-circuit current and voltage regulation of the distortionless alternator.—*Journal of the Institute of Electrical Engineers of Japan*, February, 1922.

Electric Drive for Reversing Machine Tools.—A. L. HARVEY.—Many of the machine tools in common use are of such a nature as to require operation in both directions. This may be accomplished by crossed belts, clutches or reversing electric motors. A careful consideration of the various details with respect to their effect on the operation of the machine and its rate of production determines the type of drive to be selected. When this is done properly the result is a more efficient tool, more satisfactory electrical equipment and higher production. This is especially important in the case of the older tools that are changed over to electric drive by the user.—*American Machinist,* March 9, 1922.

Lamps and Lighting

Measurement of Pressures in Vacuum-Type Electric Lamps.—DUNCAN MACRAE.—In making the measurements the tip of the lamp is removed in an evacuated glass system by means of an iron plunger electromagnetically operated. The resulting pressure is measured with a McLeod gage and the pressure in the lamp before opening is calculated. The results of measurements on unflashed, flashed and life-tested lamps are given.—*Paper presented before the American Electrochemical Society at Baltimore,* April 27, 1922.

Better Lighting an Economy Measure.—WARD HARRISON.—In a test recently conducted to determine the actual dollars and cents value of improved illumination it was found that as a result of the installation of a modern system of illumination in one of the departments of the Dover (Ohio) Manufacturing Company production was increased 12.2 per cent, while the increase in the lighting costs amounted to only about 2.55 per cent of the payroll. The results were so satisfactory in this department that company officials purchased the equipment used in the investigation. At their request a complete illumination design was made for the entire plant, and parts of this new system are already installed.—*Iron Age,* April 6, 1922.

Generation, Transmission and Distribution

Improvement of Power Factor.—M. HARLÉ.—Practical directions for bettering power factor by the employment of electrostatic condensers, with numerical and diagrammatic examples from actual experience.—*Bulletin de la Société Française des Electriciens,* Vol. I, No. 10.

Interconnection of Alternating-Current Power Stations.—L. ROMERO and J. B. PALMER.—The purpose of this paper is to show the importance of power-factor phenomena in interconnectors, both on technical and on economic grounds. Formulas for estimating the values of power factor resulting from interconnection are given, and the voltage boost required to transmit power at a given factor is shown. The adequacy of the synchronizing power of a proposed interconnecting line should, if possible, be calculated theoretically before the line is installed, as the result of installing a line with inaccurate synchronizing power might be very costly.—*Engineer* (*London*), Feb. 17, 1922.

Traction

***The Lancaster-Morecambe-Heysham Electric Railway.*—This branch of the Midland Railway (England) was equipped with single-phase electric traction in 1908 to obtain experience which would be valuable in dealing with the wider problem of main-line electrification. This article gives an account of the failures and modifications which have been shown to be necessary in various parts of the apparatus during the fourteen years that it has been operating. Protective devices,** bonding, power supply and traction equipment are dealt with —*Electrician* (*London*), Feb. 3 and 10, 1922.

Installations, Systems and Appliances

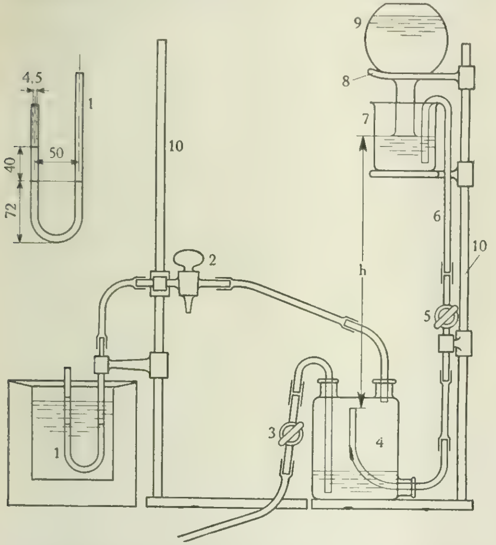
Electric Welding Applied to Steel Construction.—A. T. WALL.—The various methods in which electric welding is being applied to ship construction and the possibility of its use in steel structures are described. Reference is also made to the necessity of taking reasonable precautions in carrying out the work. The author considers the detailed construction of large steel structures, with particular reference to the joints and attachments of the component parts.—*Engineering,* (*London*), Feb. 24, 1922.

Electricity in the Lace Industry.—J. F. CROWLEY.—The principal features of a lace machine from the point of view of the power engineer are (a) the high starting torque required, (b) the great cyclic variation in the torque, and (c) the delicacy of the mechanism of the machine. As the machine is unusually long, occasionally covering as much as 40 ft., and has heavy reciprocating parts, it must have a steady drive unaffected by causes external to the machine which would tend to produce variations in torque or speed. The electric drive with three-phase motor provides a very good solution.—*Electrician* (*London*), Feb. 25, 1922.

Selection of Electrical Apparatus for Cranes.—R. H. MCLAIN.—The purpose of this paper is to assist crane designers and electrical engineers in mills and factories to select the proper size and kind of motor by mathematical calculation from given data. It refers particularly to the electric overhead traveling crane. It does not apply to heavy-duty cranes which undergo regular duty cycles or to very small hoists such as the monorail hoist. In discussing the selection of motors, direct-current motors are treated separately from alternating-current motors, as are the calculations for each.—*Journal of the A. I. E. E.*, March, 1922.

Electrochemistry and Batteries

Influence of Low Temperatures on Mineral Oils in Transformers and Oil Switches.—The thickening of oils in transformers and switches has certain disadvantages and dangers which it is the purpose of the article to explain. It is shown that if oil loses its fluidity on account of a considerable drop of temperature, the circulation of the oil is stopped and heat transmission by convection no longer takes place. Experiments were made to determine just what occurs in transformers and oil switches under these conditions. The methods for examining the behavior of oil all possess certain shortcomings. A new method has been deduced from these older ones which seems to work out very satisfactorily. The new method is based on the behavior of oil when it is cooled. The sample of oil is cooled to the desired temperature in a U-shaped test tube and an air pressure of 50-mm. water gage is applied for one minute. The apparatus used is shown in the accompanying illustration. When the pressure is applied it causes the oil to flow. The height to which the column rises is a measure of the consistency of the oil at the temperature chosen.—*Brown-Boveri Review*, January, 1922.



APPARATUS FOR DETERMINING THE SETTING POINT OF OIL

1—U-shaped test tube. 2—Three-way cock. 3—Drain cock. 4—Woulf's bottle. 5—Cock. 6—Siphon. 7—Glass receptacle. 8—Fork. 9—Inverted bottle. 10—Bracket.

Units, Measurements and Instruments

Oscillographic Investigations of Fields and Emfs. of Induction Motors.—W. Stiel.—The author describes in this paper a long series of exact oscillographic measurements made by him. A standard three-phase induction motor was equipped with a special smooth and laminated rotor, on the circumference of which a small silver ribbon was pasted in the axial direction, connected at each end of the motor shaft to a collector ring. Brushes upon these slip rings were connected to the loop of an oscillograph. The stator of the motor was excited with direct-current, single-phase current, and finally with three-phase current. A small auxiliary motor drove the rotor at a speed varying in the different trials. The resulting oscillograms disclose the influence of the slots in the stator, the shape of the emf. at each moment and the form of the magnetic flux depending upon the connection of the stator winding. In the series of three-phase tests several observations were made with the excited stator and stationary rotor to determine the nature of the so-called revolving field. The author claims that there is in reality no revolving field. The apparently revolving field is due to a configuration of polyphase currents in the windings, resulting in a periodic change of the induction at points on the circumference of the rotor.—*Elektrotechnische Zeitschrift*, Feb. 16 and 23, 1922.

Telegraphy, Telephony and Signals

The Grid Potential of a Triode and Its Measurements.—T. Ono.—The electric field in a triode valve is closely related to the distribution of negative charges in the inter-electrode space, and the potential distribution is determined when the plate potential and the filament temperature are given. In order to understand the behavior of the electronic space charges, the potential of the disconnected grid was measured. Two methods are proposed for its determination, and it is shown that their results coincide. Observations on triodes with different characteristics are described, and the physical phenomena in the bulbs are explained.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1922.

Miscellaneous

The Hydro-Electric Problem in Italy.—Domenico Civita.—An elaborate treatise filling 134 pages, with many illustrations, tables and charts. Historical and statistical information is followed by a discussion of Italy's hydro-electric enterprises in their technical, legislative, economic and financial aspects. Then the activities of electrical companies in the development of new power resources are reviewed under the following geographic headings: Liguria, Piedmont, Lombardy, Trentino, Venetia, Emilia and Romagna, Tuscany, Marches, Latium and Umbria, Abruzzi, Southern Italy, Sicily and Sardinia. Lombardy leads all the other provinces, with a total capacity installed or in course of installation of 603,000 kw., of which less than one-sixth represent steam plants and 270,000 kw. dates from or after 1918 and thus indicates plants "in construction." Piedmont is next, with 450,000 kw., of which only about 30,000 kw. is steam-generated and 155,000 kw. dates from or after 1918. Then there is a long drop to Venetia, with 281,000 kw., of which 201,000 represents post-1918 figures. The other provinces show much smaller total ratings, but a large degree of activity in hydro-electric development. About 100,000 kw. is being developed in Calabria, at the southern end of the peninsula. Previously Calabria had only 5,000 kw. Liguria has the largest proportion of steam plants, 75,000 kw., which about equals the rating of hydro-electric installations built or building in that province. A total consumption in 1919-1920 for all Italy and for every purpose reaching 3,826,562,180 kw.-hr. is recorded. The population served with energy for lighting is placed at 24,135,383, with an average annual consumption per capita of 12.9 kw.-hr. An outline map in colors shows the voltages, frequencies, interconnections of existing lines and projected interconnections and groupings of plants in the entire nation. The great need in carrying forward the work of hydro-electric development in Italy, the report says, is capital.—*Report presented at annual meeting of the Associazione Elettrotecnica Italiana at Palermo*, October, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

To Discuss Effect of European Conditions on America

"EUROPEAN Conditions and Their Effect on American Business" will be the main topic at the tenth annual meeting of the Chamber of Commerce of the United States, to be held in Washington May 16 to 18.

"In selecting the subject for the convention," a statement issued by the Chamber of Commerce says, "there was a desire to obtain a thorough discussion of world business conditions as well as domestic conditions for use as a basis of judgment in planning measures to insure a continuing future prosperity in the United States. The situation abroad has been constantly changing, and the time has come for a new inquiry into the facts. The biggest question before American business men today is the problem of formulating intelligent plans that may be of assistance in restoring normal economic conditions.

"No plans can be made that do not take into account the European situation, including such problems as the Allied debts, reparations settlements, paper currency issues, exchange fluctuations, ocean shipping, etc."

As in previous years the work of the convention will be done largely in group sessions. Groups representing the major divisions of business will take up the questions before the meeting in their relation to the particular interests or industries within the group.

Service Charge Approved in Malden Case

A GRADUATED service charge in connection with a selling price of not over $1.25 per 1,000 cu.ft. of gas was approved last week for the Malden & Melrose Gas Light Company by the Massachusetts Department of Public Utilities. This is the first case under the service charge law of Massachusetts concerning a company of substantial size, and it is regarded as an important precedent in the establishment of such charges by both gas and electric companies. The company's former schedule in most of its territory for the first 35,000 cu.ft. was 15 cents net per 100 cu.ft., with a minimum charge of $7 per year. It proposed to introduce a service charge of 50 cents per month to all customers having a ten-light meter or one of less capacity which would gradually increase to $5.75 for a 300-light meter or one of greater capacity, and a further charge of 12 cents net per 100 cu.ft. for all gas used. In its decision the commission graduated the service charge at from 35 cents per month for a ten-light meter to $5.60 for a 300-light meter and fixed the consumption rate at 12.5 cents net per 100 cu.ft.

In its finding the commission points out that the minimum charge already existing yields in revenue only the excess over the value of the gas consumed, an amount shown in this case to be negligible and equal to but a small proportion of the expenses, which are determined by the number of customers rather than by the amount of gas sold. Distinctively customer expenses include resetting and removing meters, repair of meters and service pipes, complaint work done on customers' premises, meter reading, bookkeeping, billing and collecting and losses that occur on bad bills. To this the company added 20 and 25 per cent respectively of insurance and general expenses and a fixed charge of 13 per cent of the investment in service pipes. The board concluded that customers using little or no gas not only contributed little to the company's revenue but not enough to cover the company's out-of-pocket expense incurred solely for them. The issue was really one between the customers themselves as to the most equitable method for raising a given amount of revenue, and with the exception of Commissioner Stone the board approved the charges and rate as coupled in the foregoing summary.

California Railroad Commission Orders Emergency Rate Reductions

RATE changes described by the California Railroad Commission as similar to those made by emergency orders during the war period, except that they carry decreases instead of increases, have been enforced by this commission as a result of hearings in which the Southern California Edison Company was concerned and of other hearings affecting the San Joaquin Light & Power Corporation. In the latter case the commission declared that the general economic situation and peculiar local conditions justified rates that would yield less than a normal fair return.

The Southern California Edison Company was ordered to make the following reductions, beginning on May 1: Street-railway service, 8 per cent; street lighting, power and resale, 10 per cent; general lighting, 12 per cent. The reductions will not apply to minimum charges, the commission finding that minimum bills for power and lighting service have not been increased above reasonable pre-war charges. Although the reduction applies to the regular street-lighting schedule, existing contracts are not disturbed, but cities that can benefit by so doing receive the right to change over to the new schedules. A modification previously made in the agricultural schedule will increase the total reduction by reducing the minimum bill for agricultural service in the San Joaquin Valley district $3 per horsepower-year.

The commission adopted in this procedure a rate base of $102,560,000 as against the company's claim of $105,827,699 and estimated that on this basis the return of 8.3 per cent allowed in a former decision would give the company $8,512,480. Present rates computed on the estimated 1922 business would yield, it was found, a total net revenue of $10,122,000. The difference of $1,609,520 measures the amount of saving to consumers.

The reductions ordered for the San Joaquin Light & Power Corporation range from 5 to 7 per cent, also dating from May 1. The rates for domestic and commercial service is reduced from 9 cents to 8 cents for the first 30 kw.-hr.; industrial power, approximately 5 per cent; street lighting, 6 per cent, and the agricultural rates, on an average, 6 to 7 per cent. The demand charge for farm service is reduced $1 per horsepower-year and the minimum charge $3 per horsepower year. The annual demand charge and minimum bill are made payable in eight monthly installments. The rate in the oil fields is continued as now.

The rate base for the San Joaquin corporation was fixed by the commission at $32,068,293. Items deducted from the company's own valuation were: From the total of $1,700,000 for the Kern Canyon enlargement all but $500,000, because it was held that only a comparatively small part of the product can be used advantageously; $65,000, estimated as the value of the Fresno steam plant, which was eliminated as obsolete; $50,000 for damage suits, held to represent payments due to negligence and therefore not chargeable to consumers; $36,300 written off from the cost of the Kerckhoff-Merced transmission line, and $400,000 for a projected office building in Fresno, which, however, the company was urged to build. Full allowance was made for the Kerckhoff development, costing $5,691,952, a contention that part of the cost should be deducted because the work was done in a period of high prices being disallowed.

American Engineering Council Denounces Pending Patent Bills

PATENT legislation pending in the United States Senate was denounced as "dangerous and destructive of the American patent system" before the Senate patent committee in Washington on May 1 by a delegation from the American Engineering Council of the Federated American Engineering Societies. The Stanley bill and the Ladd bill would, declared Edwin J. Prindle, chairman of the patents committee of the council, so lessen the value of patents that the incentive to produce inventions would be greatly decreased and the American patent system gravely impaired.

The object of the bills, Mr. Prindle asserted, is to throw German-owned American patents open to American use and prevent the Germans from manufacturing in Germany and exporting here while restraining the use of their invention here through their American patents. The international convention, to which most of the leading countries are parties, would prevent a working clause in our law which applied only to aliens. Therefore the Stanley and Ladd bills apply to all American patents. Few individuals or corporations would buy patents with a working clause hanging over them. Those patents which become valuable only during the last two or three years of their life would almost always lapse before that period would be reached. Where a development requires a series of patents much expense would be incurred, and the earlier patents would often have to be worked before the invention was perfected. Where necessary to patent several alternative inventions if no basic patent could be obtained to cover all the forms, each of them would have to be worked. The possible expense would discourage manufacturers, and the rich inventor would be favored.

Accidents Cripple 159,000 Hp. of Ontario Hydro Units

A SERIOUS accident involving a loss of several million dollars occurred in the generating station of the Ontario Power Company of Niagara Falls, Ontario, shortly before 3 o'clock on the morning of April 20. Generator units Nos. 15 and 16, rated at 20,000 hp. each, were destroyed, and when a part of the generator of unit No. 15 was hurled through the roof the entire covering of the new wing fell, smashing the casings of the two turbines as well. The Johnson valves controlling the flow of water to the turbines were shut as soon as possible, but during the interim the water shot over the roof, flooded the whole bay, washed out part of the embankment to the rear and rushed into the main power house, flooding units Nos. 11, 12, 13 and 14, rated at 16,000 hp. each. One operator was in the damaged wing at the time and saved his life by swimming. His escape from the wreck, however, was nothing short of miraculous. Fortunately the stop locks at the end of the station were out at the time, or the whole power house would have been flooded.

DAMAGED WING OF ONTARIO STATION

An official investigation is being conducted into the cause of the accident, the result of which will be published later As far as can be learned, the contributory cause of the mishap was a short circuit somewhere on the line of the Hydro-Electric Power Commission about 2:45 on the morning of April 20. The sudden dropping of the load caused the units feeding the line to speed up. At that time four units in the power house of the Canadian Niagara Falls Power Company, rated at 10,000 hp. each, were running in parallel with the units in the Ontario Power Company's station. When the operator in the Canadian Niagara station saw the four units speeding he pulled over the rheostats as far as they would go and also threw in the relays on the generators in an effort to cut down the voltage. This, however, had no effect, and when it was discovered that the units were being driven as motors by the larger generators in the Ontario Power Company's station, the feeder switches were pulled and the Canadian Niagara units cut off the line. Shortly afterward unit No. 15 in the Ontario Power Company's station flew to pieces.

The destroyed wing of the power house with its equipment was erected by the Hydro-Electric Power Commission of Ontario during the war to meet the great demand for power at that time. This increased the total capacity of the station of the Ontario Power Company from 160,000 hp. to 200,000 hp. and necessitated the installation of a wood-stave pipe line with an internal diameter of 13½ feet and the two 20,000-hp. units. The temporary end wall of the old Ontario Power Company's station separated the main station from the new wing. These additions to the power house cost approximately $3,500,000.

The waterwheels were not specially designed for the installation, but were obtained from the Aluminum Company's plant at Baden, in North Carolina. They were built by S. Morgan Smith and delivered 14,000 hp. at Baden, but under the head obtaining at Niagara Falls developed 20,000 hp. The generators were built by the Canadian General Electric Company. A section of unit No. 15, weighing many tons, which went through the roof, dropped back through the station about 150 feet distant and cut out a piece of the base of unit No. 11. The force with which the piece descended was such as to make a cut almost as clean as if it were made by a machine tool, but the base of the machine was not cracked or otherwise damaged. Some doubt has been expressed whether units Nos. 15 and 16 will be replaced, inasmuch as the commission is under obligation to remove the temporary wooden-stave pipe line by 1923 and can use the water to better advantage in the new Queenston station. The other four units are still being dried out.

A few days prior to the accident one of the large units in the Chippawa-Queenston station, rated at 55,000 hp., was damaged. Fins of the fans attached to the generator for ventilating purposes dropped off and became wedged between the rotor and the winding, injuring about fifteen coils. This necessitated shutting down the machine and rewinding it, an operation which will require about three weeks. Meanwhile a third 55,000-hp. unit is being erected at Queenston, and it is hoped to have this third machine in operation by July.

The power houses of the Toronto Power Company and the Canadian Niagara Falls Power Company are being operated with their gates wide open so as to supply the Hydro-Electric Power Commission of Ontario with the requisite energy. Part of the loss is also being made up from the Niagara Falls Power Company's American plant. Less than fifteen minutes after the accident the Canadian Niagara Falls Power Company and the Toronto Power Company were feeding the Hydro-Electric power system, which within a week lost two 20,000-hp. units and the use of four 16,000-hp. and one 55,000-hp. unit.

Progress of Colorado River Development Bill to Be Slow

NO RAPID legislative progress is anticipated for the Johnson and Swing bills, which proposed plans for flood control on the Colorado River and for the utilization of the waters of the stream. Congress and the administration are participating in the systematic study of the Colorado River situation being made by the Colorado River Commission. Until this commission submits its recommendations it is improbable that serious attention will be given any legislation prescribing methods for solving the problems involved.

A number of hearings have been held, but it is intended to have further public discussion of the matter and still other hearings are scheduled to begin Aug. 1. Because of differences of opinion among the states concerned as to the best methods of utilizing the resources of the river, considerable time must elapse after the hearings before the commission can be expected to submit concrete recommendations.

Disinterested opinion on Capitol Hill is to the effect that a measure such as that proposed authorizing an appropriation of $70,000,000 would have little chance under present Treasury conditions.

Would Stop Export of Canadian Power

CONSIDERABLE interest is manifested in the news report that Dr. H. Deslauriers of Montreal has announced that he will bring before the Canadian House of Commons a resolution which would have the effect of prohibiting the export of electric power from Canada to the United States. A number of American interests now take large blocks of Canadian power. Prior to the accident suffered by the Hydro-Electric Power Commission of Ontario at the plant of the Ontario Power Company (reported on another page) the Niagara, Lockport & Ontario Power Company received under contract a large block of power from this plant. The Aluminum Company of America is served at Massena, N. Y., with energy over a 48-mile 110,000-volt line from a plant of the Montreal Light, Heat & Power Company. Besides these cases, a large part of the energy generated by the Canadian Niagara Power Company is distributed by the American company.

No Danger of General Coal Shortage for Six Weeks

IN AN analysis of the coal situation issued early this week the coal bureau of the United States Chamber of Commerce calls attention to the unusual condition found in the general lack of demand for coal that exists throughout the country. At the present rate of production and consumption there is no danger of any general shortage, says the bureau, for at least six weeks. Summing up the situation as of April 22, the bureau says:

"On April 1 the stock of coal in the hands of railroads, industrial consumers, public utilities and retailers was approximately 63,000,000 net tons. Adding to this 4,250,000 tons estimated at the upper lake docks and the unbilled coal on hand April 1, there was a total of 68,650,000 net tons above ground April 1. Stocks cannot drop below 20,000,000 tons without danger of a coal panic. The quantity of coal which apparently can be drawn from stocks before a serious situation develops is 48,650,000 tons. To this supply there will be continuously added the output from the non-union fields, which up to date has averaged about 3,500,000 tons per week. At the present time the average weekly consumption is estimated to be 8,100,000 tons. Therefore supply from the non-union fields is falling short of meeting the consumption by 4,600,000 tons per week. To cover this deficit we have the 48,650,000 tons in storage. If the consumer continues to draw from this storage at the rate of 4,600,000 tons per week and unless there is an increase in production from the non-union fields, a shortage will be felt in approximately seven weeks from April 22."

Resolution Prohibiting Issuance of Tax-Exempt Securities Reported

THE resolution introduced into the House by Representative Green of Iowa proposing a constitutional amendment prohibiting the issuance of tax-exempt securities by federal, state or local governments was formally reported on Wednesday by the ways and means committee. Estimates obtained by the committee, the report said, showed that tax-free securities now amount to between $10,000,000,000 and $18,000,000,000 and that the right to issue was "a constant temptation to issue in larger amounts than is necessary."

The report said that the present system enables much property to escape taxation, unfairly discriminates between taxpayers, impedes private financing, discourages investment in new enterprises and creates social unrest.

Interconnection Proves Value in Texas Floods

ALTHOUGH Fort Worth, Tex., was visited last week with the highest flood condition that the Trinity River ever recorded, the city was never without electric service. The river broke through its embankments, flooding the city and flooding the boiler room of the Fort Worth Power & Light Company's plant. The plant was shut down for twelve hours and was then again started. In the meantime the city was served from the lines of the Dallas Power & Light Company and the Texas Power & Light Company, which are interconnected with the Fort Worth system.

Henry Ford Modifies Muscle Shoals Offer and Makes Concessions

INVESTIGATION of the private offers to purchase or lease the government's nitrate and power projects at Muscle Shoals, Ala., and to construct the necessary plants continued in Washington before Congressional committees during the week. The most notable feature of these investigations was the appearance before the Senate committee on agriculture and the House military affairs committee of W. B. Mayo, chief engineer for Henry Ford, to make further concessions and modifications in Mr. Ford's offer. By these Mr. Ford's insistence on obtaining possession of the Gorgas plant on the Warrior River, the government portion of which the Alabama Power Company has a contract to purchase, was tuned down. Mr. Ford surrendered the idea that the government should furnish him with a deed and clear title to this property and offered to amend the phraseology of his proposal as follows: "The company agrees to accept and the United States to assign and transfer to the company all rights, title, interest, power and benefit belonging to or that may accrue to the United States or its legal agents as a party to the contract." Another suggested change in wording is this: "And the company will assume all obligations and liabilities lawfully imposed upon the United States by said contract." Among other concessions offered a plan is included to pay 4 per cent interest to the United States on the cost of acquiring lands and flowage rights at Dam No. 3.

The House committee continued its "informal conversations," with no sign of an agreement resulting because of the modifications made in Mr. Ford's offer. The Senate committee perfected a plan to speed up its hearings and at the end of the week had before it J. O. Hammitt, vice-president of the Air Nitrates Corporation, which has a contract to purchase Nitrate Plant No. 2 from the government, notwithstanding Mr. Ford's insistence that he must have this plant. Mr. Mayo told the Senate committee in this connection that Mr. Ford's research engineers are working on a "new secret process" for the manufacture of fertilizer which it is the intention to manufacture at the same time with electric furnace steels and aluminum.

Illinois Central to Electrify Terminal at Cost of $80,000,000

STOCKHOLDERS of the Illinois Central Railroad have voted to issue $50,000,000 in preferred stock to finance the electrification of the road's Chicago terminal. Approval of the issue by the Interstate Commerce Commission will, it is officially announced, be followed by the beginning of work within ninety days. Under its contract with the city the Illinois Central will spend more than $80,000,000 in this work, receiving in return riparian rights and the title to made land.

The city ordinance passed after the agreement had been ratified requires that suburban service be electrified by 1926. Time is allowed for the work of depressing tracks. Freight service north of Roosevelt Road will be electrified by 1929 and south of it by 1934. Through passenger service must be entirely under electric operation by 1939.

A. S. Baldwin, vice-president in charge of electrification, and Hugh Pattison, chief of the engineering staff, are now in Europe studying systems in use on the Continent. They will return this month.

Radio Conference Recommendations for Federal Control

FINAL recommendations of the radio-telephone conference called by Secretary Hoover were made public last week. This conference, under the chairmanship of Dr. S. W. Stratton, director of the Bureau of Standards, and composed of a number of radio experts, received since its first session about two months ago a number of suggestions on its preliminary report and, after considering these on April 17, 18 and 19, made its final recommendations, which are to be the basis for legislation giving the Secretary of Commerce the authority to make and enforce regulations. This control, it was recommended, should cover the establishment of all transmitting stations except amateur, experimental and government stations, and also the operation of non-government transmitting stations.

It was the sense of the conference that radio communication is a public utility and as such should be under federal regulation. One interesting resolution proposed that "the types of radio apparatus most effective in reducing interference should be made freely available to the public without restriction."

Wave lengths, it was recommended, should be assigned in bands according to the class of service, details of which are given in the report. It was recommended that the Secretary of Commerce assign a specific wave length, within its band, to each broadcasting station, except government and amateur stations, and that the wave band, 150 m. to 275 m., assigned to amateurs be subdivided according to the method of transmission.

The conference disapproved of the elimination of essential services in order to take care of indirect advertising. "Point to point" communication over land was considered an uneconomical use of available wave bands, and so it was recommended that for the present at least such communication where possible be carried on by other means.

Use of unlimited power by broadcasting stations was disapproved and the following ranges were recommended: Government stations, 600 miles; public stations, 250 miles; private and toll stations, 50 miles.

Detailed recommendations for considerations to be followed in granting licenses were made, among which is one recommending that direct advertising by broadcasting be absolutely prohibited and that indirect advertising be limited to a statement of the station's call letters and the name of the concern responsible for the material broadcasted.

Amateurs, it was recommended, shall have their status determined by law, be under the jurisdiction of the Department of Commerce and be self-policed under a recommended plan.

The Secretary of Commerce, it was recommended, should prohibit transmitting apparatus and methods which result in unnecessary interference when more satisfactory apparatus is available at reasonable prices. For the reduction of interference the Bureau of Standards, it was recommended, should make technical studies with special attention to the following: Reduction in rate of building up oscillations in radiating systems, reduction of harmonics in continuous wave transmitters and of oscillation irregularities, comparison of the variable-amplitude method with the variable-frequency method of continuous-wave telegraphy, preferable methods of telephone modulation to avoid changes in frequency, proper arrangement of regenerative receivers to avoid radiation, use of highly selective receiving apparatus, use of receiving-coil aërials instead of antennas, other electrical processes such as X-ray and precipitation wave meters.

A provision was added calling for the appointment by the President of an advisory committee of twelve equally divided between the government and others.

Utility Purchasing Agents' Organization Proposed

A MOVEMENT looking to the organization of a division for public utility purchasing agents in the National Association of Purchasing Agents has been started. Harry H. Lloyd, purchasing agent for the Indianapolis Street Railway Company and the Terre Haute, Indianapolis & Eastern Traction Company and the chairman of the public utilities and public relations committee of the Indiana association, was at the Indianapolis convention of the National Association of Purchasing Agents appointed chairman of a tentative national committee for the formation of such a division. If sufficient interest is manifested by utility purchasing agents at the Rochester convention on May 15-20, the organization of a national committee and the division can be undertaken at that time.

Census of Electrical Engineers and Electricians

WHEN the 1920 census was taken there were 27,077 electrical engineers engaged in the practice of their profession throughout the country. This compares with 15,278, the number of electrical engineers shown in the 1910 census. It may be stated, however, that the 1910 figures were not gathered with the same detailed care as those of 1920, a portion of the former figures being made up of estimates. In 1920 there were 212,964 electricians, as compared with 120,241 in 1910.

Michigan and Florida Projects Seek Permits

THE White Rapids Paper Company of Oshkosh, Wis., has applied to the Federal Power Commission for a preliminary permit to cover a project on the Menominee River, 15 miles north of Kells, Mich. It is estimated that 5,700 hp. of primary power is available. It is the intention to install equipment sufficient to generate 10,000 hp. The power is to be used in the operation of a paper mill and public utilities.

Benjamin H. Hardaway of Columbus, Ga., has applied for a preliminary permit to cover a power project in the Chipola River, 20 miles below Marianna, Fla. He estimates the primary power at 3,000 hp. He expects to install 7,500 hp. The power is intended for public utility use.

N. E. C. Radio Regulations Modified

THE National Board of Fire Underwriters has published tentative regulations covering radio receiving installations that disclose considerable modification as compared with the previous requirements. The specifications were drawn up by a special committee of the National Fire Protection Association and on it were underwriters' representatives and engineers acting for the American Radio Relay League, American Telephone & Telegraph Company, Radio Corporation of America and the Independent Telephone Association.

The new rules are being published as proposed amendments to be included in future editions of the National Electrical Code. It is stated that the requirements contained in the current edition of the code were based largely on the hazards incident to the equipment of wireless-telegraph transmitting stations where antennas of considerable height and length were used and where the hazard of high-potential equipment had to be considered.

Four Hundredth Meeting of the New York Electrical Society

THE New York Electrical Society, the oldest electrical society in the United States, celebrated on April 26 its four hundredth meeting by a visit to the new Hell Gate plant of The United Electric Light & Power Company. A luncheon was given to more than 300 guests by the company, and an address on "Thirty Years of Alternating-Current Service in New York City" was delivered by Frank W. Smith, vice-president of the company.

Additions Being Made to Indianapolis Electric System

EXTENSION of the service of the Indianapolis Light & Heat Company that will provide for the growth of the city for the next twenty-five years has been made through an improvement program which has been going forward for the last eight months and which is to continue during the summer season, according to C. C. Perry, president of the company. The equipment to be added to the system includes a large 30,000-hp. turbine unit, a third unit in the storage-battery standby system, to which will be added a fourth on completion of the building now under construction, and new motor-generating sets.

Ordered to Reduce Funded Debt to Improve Financial Condition

THE Indiana Public Service Commission has authorized a financial reorganization of the Northern Indiana Gas & Electric Company, operating a number of utilities in Indiana, in order to improve the financial condition of the company and enable it to sell securities for making plant improvements. The reorganization will decrease the bond and note obligations of the company by $8,909,710, on which the annual interest charges are $526,113. The interest on common and preferred stock will offset this saving if dividends are paid, members of the commission said. New financial obligations of the company will be as follows: Common stock, $5,000,000; preferred stock, $9,000,000; bonds and notes, $14,458,000. Improvements on plants of the company are to be financed by a bond issue for $1,030,000.

April Financing on 6½ per Cent Basis Average

STOCKS and bonds amounting to $43,151,080 were offered to investors by the electric light and power public utilities during the month of April. This figure represents a decrease of more than $12,000,000 under the total reached in March and an increase of more than $8,000,000 over April of last year. The rate of return yielded the investor continued to decline —6.50 as compared with 6.62 for the month of March and 6.90 for February. Long-term securities continue to predominate. Only one 8 per cent issue was floated last month, and that at par. A few 7 per cent issues came out, but for the most part the new offerings bore 6 per cent coupons. Again some 5 per cent issues appeared. Special attention, however, is called to the Cohoes Power issue, a 6 per cent bond at 1½-point premium.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered at
United Light & Railways Co. (Mich.)	$7,000,000	Thirty-year	First lien and consolidated mortgage gold bonds, series A	Refunding	6	6.45	93¾
Metropolitan Edison Co. (Pa.)	4,555,000	Thirty-year	First and refunding mortgage gold bonds, series B	Refunding	6	6.10	98¾
Pennsylvania-Ohio Electric Co. (Ohio)	1,950,000	Sixteen-year	First mortgage and collateral-trust sinking-fund gold bonds, series A	To retire maturing bonds and to be applied to floating debt incurred for additions	6½	6.80	97
Eastern Wisconsin Electric Co. (Wis.)	450,000	Twenty-five-year	First and refunding mortgage gold bonds		5	6.20	85
Luzerne County Gas & Electric Co. (Pa.)	1,000,000	Twenty-year	Sinking-fund gold bonds	To provide funds for general corporate purposes	7	7.50	95
San Joaquin Light & Power Corp. (Cal.)	3,500,000	Thirty-year	Unifying and refunding mortgage gold bonds, series B	To provide for necessary extensions to plant	6	6.05	99½
Cohoes Power & Light Corp.	675,000	Seven-year	First mortgage gold bonds		6	5.75	101½
Potomac Public Service Co. (Md.)	2,155,000	Twenty-two-year	First and refunding sinking-fund gold bonds		7	7	100
Philadelphia Suburban Gas & Electric Co.	2,000,000	Forty-seven-year	Gold bonds	To retire maturing bonds and to provide funds for other corporate purposes	6	6.50	93
Ozark Power & Water Co. (Mo.)	2,000,000	Thirty-year	First mortgage bonds		5	6.90	76
Georgia Railway & Power Co.	3,500,000	Twenty-five-year	General mortgage gold bonds		6	6.40	95
Penn Public Service Corp.	4,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series C	To acquire in fee ownership other property and for extensions and additions	6	6.05	99½
Puget Sound Power & Light Co.	1,100,000		Cumulative prior preference stock	To provide funds for retirement of floating debt incurred for construction purposes	7	6.75	104
San Angelo Water, Light & Power Co. (Tex.)	250,000	Ten-year	Guaranteed gold notes	To make additions, extensions and improvements	8	8	100
Lowell Electric Light Corp.	416,080		Capital stock		..	..	..
Oklahoma General Power Co.	2,750,000	Thirty-year	First mortgage gold bonds, series A		6	6.60	92
Escanaba Power & Traction Co. (Mich.)	300,000	Twenty-year	General and refunding gold bonds, series B	For refunding and for working capital	6	6.50	94½
Los Angeles Gas & Electric Corp.	500,000		Cumulative preferred stock		6	6.86	87½
Nova Scotia Tramways & Power Co.	1,250,000	Thirty-year	General mortgage gold bonds, series A	To fund maturing note issue	7	7.20 7.30	97½* 96¾†
Manila Electric Co. (Philippine Is.)	2,500,000	Twenty-year	First refunding mortgage gold bonds	To provide funds for refunding notes falling due, for additions and other corporate purposes	7	7.10	98½
Illinois Power Co.	800,000	Eleven-and-one-half year	First mortgage gold bonds, series A		5	6.60	87½
Total	$43,151,080						

* Canadian funds. † New York funds.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Latest from Russia.—It is announced from Moscow that a new department of the soviet government will be created to regulate the electrical power and fuel industry. The new bureau will, the dispatch continues, correspond in many respects to the public utility commissions maintained in the United States.

Oklahoma Utility Assessments Increased 30 per Cent. — Tentative tax assessments for 1922 on Oklahoma public utility companies average about 30 per cent higher than those of last year, and the utilities are expected to protest. In 1921 the public service corporations of Oklahoma paid approximately one-sixth of the state taxes, many utilities being assessed, it is reported, on a higher basis than other industries.

Electric Trucks in India.—In far-away Calcutta the electric truck is holding its own in competition with its gasoline-driven rival. Heretofore two "electrics" and ten "petrol" vehicles have been employed to remove the city's refuse, all of them having a capacity of 3½ tons. The city authorities are now arranging for eight more of the electric trucks, of which the running cost, excluding interest and depreciation, is only half that of the gasoline truck. In Bombay electric vehicles are employed for the same purpose, and very little battery trouble is reported.

English Student Wins Scientific Research Prize for Women.—The annual prize of $1,000 awarded by the Association to Aid Scientific Research by Women was won this year by an English student. Thirteen papers were reviewed by the association's committee meeting at Bryn Mawr College, Pennsylvania. The winning paper, presented by Dr. Anna Catherine Davies of Royal Holloway College, Englefield Greens, England, was on the subject "Investigation of Critical Electronic Energy Associated with the Excitation of the Spectra Helium." Of the other papers submitted five were from England, five from the United States, one from Australia and one from Russia.

Lord Haldane Champions Superstations.—In the British House of Lords recently Lord Haldane, better known as a literary man than in other relations, showed himself possessed of the engineering sense by his advocacy of the electricity supply bill. He pointed out that small generating stations had been shown to be wasteful of fuel and suggested that there was a strong case for the abolition of the old system under which six hundred "generating authorities" were working in conditions which lagged behind the modern standpoint. Under the provisions of the bill he claimed that the generation of electricity would take place on a large scale near the collieries and that local authorities and the groups which had been organized for the purpose would be in a position to supply electrical energy for power and lighting at a low rate. Lord Haldane reminded his hearers that in the United States and the Continent energy is furnished at much lower rates than in Great Britain, a result he held to be largely due to its generation in superstations.

Electrical Development in Arkansas.—The Arkansas Light & Power Company has just concluded a contract to furnish power for the operation of the mills and mines of the Aluminum Company of America at Bauxite, Saline County, Ark. The company is constructing a 54-mile, 66,000-volt transmission line from Picron to Malvern, Ark. This transmission line will tie in the extensive transmission system in the Arkansas rice fields and the electrical power plants at Pine Bluff, Picron, Little Rock and Malvern. The new line will supply Benton, Bauxite and Mabelville. The proposed water-power developments on the Caddo River will be connected with this transmission line.

Revenue of California Companies.—The Great Western Power Company of California, operating in San Francisco, Oakland, Sacramento and elsewhere, has reported to the Railroad Commission that its operating revenue for the year 1921 was $6,404,621 and its operating expense $2,671,247, giving a net operating revenue of $3,733,373. The net corporate income was $1,676,216. The company declared dividends of $610,697 during the year, leaving an accumulated surplus of $5,259,688. The Southern Sierras Power Company, operating in Riverside, San Bernardino, Corona and vicinity, has reported that its operating revenue for 1921 was $2,029,129 and its operating expenses $862,980, giving a net operating revenue of $1,166,148. The net corporate loss for the year was $76,147, leaving an accumulated surplus of $98,860.

Iron-Stand Specifications Adopted by New York Underwriters.—Specifications for a stand for pressing irons heated by electricity, gas or otherwise, evolved by the New York Board of Fire Underwriters in conjunction with the Continental Insurance Company, have been adopted as standard requirements in the territory of the New York Fire Insurance Exchange. The requirements, which are met by a number of stands on the market at the present time, provide for the use of three parallel sheets of No. 20 gage or heavier metal, securely riveted together so as to leave an air space of ⅝ in. between the upper plate and the one below it and the same space between the latter and the one below. The upper sheet is to be slightly larger than the pressing iron and to have front and side turned up about ⅜ in. to prevent the iron from slipping. At least five rivets are to be used in the construction of a stand of ordinary size.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

National Fire Protection Association.—The annual meeting of this association will take place at Atlantic City on May 15-19, simultaneously with the sessions of the National Electric Light Association.

Electrical League of New Orleans.—Officers for the ensuing year have been elected by the Electrical League of New Orleans as follows: President, R. A. Riley; vice-president, M. J. Elgutter; secretary and treasurer, C. Discher. The league reports a large and enthusiastic membership.

New York Electrical Companies to Hold Convention.—The annual convention of the Metropolitan New York Section of the National Electric Light Association is to be held in New York on Friday, May 26. Business sessions covering the commercial, technical, accounting and administrative problems of the local electric light and power companies will be held in the morning and afternoon at the Engineering Societies Building. In the evening there will be an entertainment and dance at the Waldorf-Astoria.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia, May 6; Chicago, May 8, Cleveland, May 8.

A. I. E. E. Section Meeting—Detroit-Ann Arbor, May 12.

A. S. M. E. Spring Meeting—Atlanta, May 8-11. (For program see issue of April 15, page 750.)

Florida Engineering Society—Daytona, Fla., May 15-16.

N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see issue of April 22, page 797.)

National Fire Protection Association—Atlantic City, N. J., May 15-19.

National Electrical Credit Association—Detroit, May 18-19.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.

N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council of Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.

International Association of Municipal Electricians — New Bedford, Mass., Aug. 22-25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Municipalities to Have Longer Notice of Rate Increase Applications. — A recent rule of the Oklahoma Corporation Commission requires that copies of the applications for rate increases and copies of the exhibits shall be filed with the city attorney for the municipality affected thirty days before the date set for hearing of the application, instead of ten days as heretofore.

Rules Governing Combined Electric Plant and Lumber Mill. — The Montana Public Service Commission, investigating the P. L. Howe Lumber Mills at Eureka, Mont., decreed that such a company furnishing electricity as a public utility should charge to the lumber department a sufficient electric rate to care for return on the value of the plant and other property in addition to the actual cost of energy production. The cost of slab wood used as fuel in generating electricity for commercial use should be borne by the electric department when it shall appear that a cheaper fuel in the form of shavings and edgings produced by the mill would be sufficient to supply the boilers with fuel if it were not for the commercial electric production.

Return on Overbuilt Plant.—In determining rates for the Milford Electric Company, whose market is restricted to a population of approximately a thousand persons, the Michigan Public Utilities Commission declared that the customers of any utility are entitled to service at what such service is reasonably worth and not at what the service actually costs and therefore fixed the rate base at less than the estimated original cost of the plant or the cost of reproduction less depreciation. "Engineering reports," said the commission, "are helpful guides in arriving at values where a plant has been judiciously conceived and honestly constructed, but render little or no help in arriving at the value of a plant which never should have been built or where a different type should have been installed."

Production Cost of Electricity.—Advertising to "the false assumption that it is possible for the producer of electrical energy to determine the busbar cost of the various quantities of kilowatt-hours produced by it," the Indiana Public Service Commission in an electric rate case *in re* the Fort Wayne & Northwest Railroad Company went on to say: "The practical method of finding out what the bare production cost of electrical energy is per kilowatt-hour is to divide the cost of fuel, labor, etc., by the number of kilowatt-hours generated. The large power consumer has the advantage of getting part of its energy under the lower blocks of a graduated schedule, which is the method used in compensating it for the fact that its consumption is the element which enables the producing company to produce a large amount of energy at a decreased cost per kilowatt-hour. . . . The graduated schedule is the method used to give the large consumer the advantage of a lower rate per kilowatt-hour, which was made possible by the increased production due to its large consumption."

Utah Commission Forbids Discrimination.—The Morgan Electric Light & Power Company, which buys its power supply from the Utah Power & Light Company, has received permission from the Public Utilities Commission of Utah to raise its rates to the level of rates charged for similar service by the latter company. The Morgan company showed that it had been operating at a loss for several years past. A fifty-year contract held with the Morgan Canning Company was an issue in this hearing. It was signed in 1914 and provided that the canning company should have its power at cost. Of this contract the commission said: "The rate named in the contract with the Morgan Canning Company should be brought to the general level of rates for petitioner for like service of the Utah Power & Light Company. To do otherwise would be clearly discriminatory and illegal. We find nothing in this contract which would justly put it in a class exempting it from modification of the rate. It comes clearly within the scope of decisions heretofore made by this commission covering like cases."

Eight per Cent Not a Uniform Standard of Proper Utility Returns.—Holding that to fix a uniform rate of return for all utilities would be a discrimination against the utility which has been efficiently managed and operated and would reward beyond its deserts the poorly managed utility or one less fortunately situated, the New Jersey Board of Public Utility Commissioners, in fixing rates for the Somerville Water Company, said: "If a company has a long record of efficient operation during which it has earned a yield of 8 per cent or more upon the property devoted to the public service, the board is inclined to allow such company a higher rate than it will allow to a company whose history shows that it has rarely been able to earn an 8 per cent return under rates fixed by itself and admittedly satisfactory to it. So, too, it must not be supposed that because the board has at some time or other seen fit to establish an 8 per cent rate of return for a utility which theretofore had been taking from the public a much higher rate of return such decision of the board is to be taken as a precedent by another utility which is not earning and rarely has earned an 8 per cent return, upon which to make a claim that it shall be lifted to this level of net earnings."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Commission May Order Refund Because of Inefficient Service.—The United States Supreme Court has held, in Oklahoma Natural Gas Company vs. State of Oklahoma, that an order by the commission requiring a gas company to refund certain percentages of its charges to its customers because of insufficient pressure in its pipes did not deprive the company of its property without due process of law. This decision sustains that of the Supreme Court of Oklahoma. (42 S. C. R. 11.)

Employee Sustaining Compensable Injury Entitled to Sue Wrongdoer.—In Texas Compensation Insurance Company vs. Orange Ice, Light & Water Company, an action to recover damages paid under the state workmen's compensation law to an employee of a telephone company, it was held by the United States Circuit Court of Appeals in Texas that the employee had good cause of action not only against the telephone company for failure to furnish him with a safe place to work but also against the lighting company and a paper-mill company for causing the place to be unsafe, it appearing that the accident was caused by the man's coming into contact with a guy wire owned by the paper-mill company and charged with electricity because of a defectively insulated wire of the lighting company. (278 Fed. 8.)

Negligence Presumed in Case Where Telephone Exchange Caught Fire from Power-Transmission Wires. — Sustaining a judgment for the plaintiffs in Davidson vs. Alabama Power Company, where damages were sought because of the burning of a telephone exchange owing, as alleged, to the escape of electricity from the defendant's power-transmission wires, which were in contact with its telephone line to complainants' switchboard, the Supreme Court of Alabama held that the trial court did not err in submitting to the jury the question of whether defendant exercised due care in providing safety appliances, that a conversation between employees of defendant heard over the telephone was admissible as evidence, and that the lower court properly refused to charge that if defendant's telephone wire was no nearer its transmission line than the best regulated concerns of defendant's character placed them, and the transmission line was being operated as the best transmission lines are operated, defendant would not be liable. (90 So. 915.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Philip C. Jones has been appointed chief electrical engineer of the Goodyear Tire & Rubber Company and will have complete charge of the extensive electrical installation of that company. The plant of this company at Akron, Ohio, is probably one of the most highly electrified in the country, having an installed motor rating of 60,000 hp. and a monthly consumption of about 16,000-000 kw.-hr. in normal times. All the energy is generated in the company's private plant. Mr. Jones is a graduate of the Massachusetts Institute of Technology and has had an extensive experience, including connections with Swift & Company in Chicago, D. C. & W. B. Jackson, consulting engineers, and with the São Paulo Tramway, Light & Power Company in Brazil. He has been connected with the Goodyear Tire & Rubber Company for several years and until recently had charge of the electric installations in its Los Angeles plants.

P. C. JONES

W. J. Brown has been promoted to the position of chief engineer of the Oklahoma Gas & Electric Company. Mr. Brown has been with this company for the past fifteen years.

R. F. Reading, electrical engineer with the Houston (Tex.) Electric Company, has resigned and is now connected with the Southwestern Gas & Electric Company at Texarkana, Ark.

Harry Reid, president of the Interstate Public Service Company and vice-president of the newly formed Indiana Hydro-Electric Power Company, has been elected president of the Great Lakes Division of the National Electric Light Association.

John C. Boyle has recently been appointed manager of the Klamath division of the California-Oregon Power Company, with headquarters at Klamath Falls, Ore.

Thomas E. Crossan has been appointed chief engineer of the Ponce (Porto Rico) Electric Company, a Stone & Webster property. Mr. Crossan was formerly assistant chief engineer of the Houghton (Mich.) power station.

Earl E. Norman has been appointed superintendent of the Department of Public Utilities of the city of Kalamazoo, Mich. Mr. Norman was graduated from the University of Michigan in 1917 and for three and a half years was employed by the General Electric Company at Schenectady and also in construction work for that company at Atlanta, Ga. He resigned from the General Electric Company the first of this year to take up his present work.

Peter H. Bullock, chief engineer of the Massachusetts Reformatory, retires May 1 after a service of forty-two years. Mr. Bullock in 1884 installed the first electrical equipment in the reformatory, after a two years' argument with the directors in an effort to persuade them that, while electricity might be used for purposes of execution, yet it could also be installed in the reformatory without danger of harm to the inmates. Mr. Bullock has installed all types of apparatus as they have been perfected, from the early Edison bipolar machine to the turbine-driven generator of the present day.

E. R. Shepard, who is well known in connection with the electrolysis work of the Bureau of Standards at Washington, has retired from that institution in order to pursue the same line of endeavor under his own name. Mr. Shepard was born in Salt Lake City in 1880 and received his early education in Oregon. In 1904 he was graduated from the electrical engineering department of the University of California. and in 1906 received the degree of M. A. from Harvard University after two years of post-graduate work in physics and engineering. Upon the completion of his academic training Mr. Shepard entered the employ of Stone & Webster and was associated with the Columbus (Ga.) property of that firm for nearly two years. From 1909 to 1914 he was assistant professor of electrical engineering at the Oregon Agricultural College, resigning to take up his present work at the Bureau of Standards. Mr. Shepard's publications, his numerous electrolysis surveys and field studies and his activity in connection with the publications and research work of the American Committee on Electrolysis, of which he is a member, have given him a wide acquaintance and an enviable reputation in his chosen field. He will conduct his business for the present from 4111 Fessenden Street, Washington, D. C.

Rufus G. Gentry has been appointed commercial manager of the Denver Gas & Electric Light Company as a result of the recent promotions made by that company. Mr. Gentry goes to this new position after almost twenty-six years of experience in the business of salesmanship. He was born in Stephens, Ark., June 11, 1875. After completing a business and commercial course at Little Rock, he entered the employ of a commercial company as bookkeeper, but in 1900 entered the electric light and power field as solicitor and meter reader of the Denver Gas & Electric Light Company. In February, 1902, he was made assistant to the commercial manager as contract agent, and he continued in this position in its different phases until April 1, 1922, when he was promoted to the post of commercial manager. Mr. Gentry has served on the board of directors of the Denver Manufacturers' Association, and he also served as director and treasurer of the Colorado Manufacturers' Association, which office he holds at the present time.

R. G. GENTRY

Harry W. Osgood has joined the engineering department of McClellan & Junkersfeld, Inc., New York, as an electrical engineer. Mr. Osgood was with Stone & Webster, Inc., fourteen years and has had a varied experience in design and construction of power plants and distribution systems and other engineering work for public utility and industrial companies. In 1917 he was assigned by Stone & Webster to the American International Shipbuilding Corporation as electrical engineer for the design and construction of the Hog Island Shipyard at Philadelphia. In 1919 he became electrical engineer for plant construction for the Bethlehem (Pa.) Shipbuilding Corporation.

J. M. Pratt has been appointed assistant sales manager of the Rumsey Electric Company, Philadelphia. Mr. Pratt has been connected with the company for a number of years.

S. F. Bodler has been appointed Western representative for the radio lightning arresters manufactured by the Electric Service Supply Company, Philadelphia. He will make his headquarters in San Francisco.

J. G. Harvey, formerly in charge of the field force of the Westinghouse Lamp Company, Chicago district office, is now with the Luxam Electric Company, Fort Wayne, Ind., in a directing capacity.

John M. Bailey, who has been secretary of the Pittsburgh Testing Laboratory for the past thirty years, has resigned to become vice-president and secretary of the Standard Inspection Company, with offices in the Bessemer Building, Pittsburgh.

Arthur H. Crowell, who for seven years has been one of the road salesmen for the Washington Electric Supply Company, Spokane, has resigned to become connected with the Arthur Fowler Company. He will devote his time to that company's line of electric water heaters and accessories.

Ralph Barstow has resigned his position as general sales manager of the Greenfield Tap & Die Corporation and will engage in business for himself as merchandising counselor with Marquis Regan, Inc., 21 East Fortieth Street, New York.

Henry P. Rankin, who for the last few years has been Pittsburgh district manager for the Johns-Manville Company, has been made manager for both the Cleveland and Pittsburgh territories. His headquarters will be in Cleveland. Mr. Rankin was connected for a number of years with the Pittsburgh Crucible Steel Company.

Edward Blake, Jr., has been made vice-president of the Greenfield Tap & Die Company, Greenfield, Mass., and in that position will have charge of sales. Mr. Blake has been active at various times in the management of the Lincoln Twist Drill Company and the Wells Brothers' Company, subsidiaries of the Greenfield company.

Richard L. Foster has succeeded Thomas H. Taylor, retired, as assistant general sales manager of the American Steel & Wire Company in the Eastern district. Mr. Foster has been in the New York office of the company as manager of the merchant sales department for the past year. He has been connected with the wire industry since 1901. At that time he became connected with the J. C. Pearson Company, and in 1913, when the American Steel & Wire Company took over the business, became vice-president, and in 1915 president, of the successor, J. C. Pearson, Inc. In 1921 this business also was taken over by the American Steel & Wire Company, and Mr. Foster entered the New York office.

Mark S. James has been made second vice-president of the Treadwell Engineering Company, Easton, Pa.

W. E. Martin, recently placed in charge of marine work for the Westinghouse Electric & Manufacturing Company on the Pacific Coast, will make his headquarters in San Francisco. Before going West he was well known in Eastern marine circles. Mr. Martin has been interested in electric propulsion and auxiliaries for ships for many years. Since he joined the Westinghouse company in 1915 he has been an active proponent of the Diesel electric propulsion idea for certain types of vessels. Although born in Brooklyn, N. Y., Mr. Martin has spent many years in the West, having moved there in his early youth, and it was there that he received his degree in electrical engineering from the University of Colorado. Mr. Martin is an associate member of the A. I. E. E. and the Society of Terminal Engineers.

W. E. MARTIN

Obituary

Joseph L. McKernan, plant engineer for the Le Roy (N. Y.) Hydraulic Electric Gas Company, died recently as the result of a distressing accident caused by the breaking of a steam pipe line, Mr. McKernan being scalded by the escaping steam.

Alfred Clarke, widely known as an inventor and mechanical engineer, died at his home in Walpole, N. H., on April 27. He was born in Leicester, England, on June 4, 1849. He was educated in the public schools of Leicester and at the Department of Science and Art at Kensington, London. He came to America in 1874 and was chief engineer for a number of manufacturing companies. Mr. Clarke, in association with Arthur E. Childs, founded the Light, Heat & Power Corporation of Boston, which led to the formation of the Massachusettts Light Companies, owning some twenty-seven gas, electric light and power companies in Massachusetts of which Mr. Clarke was president when he retired seven years ago.

Major Thomas B. Lee, one of the most prominent of the veterans of the War between the States and a leader in his field of civil engineering in the South, died at his home in Charlotte, N. C., on March 13, at the age of eighty-seven years. By profession a civil engineer, Major Lee was in active practice up to the time of his death, and as a construction engineer had been connected with some of the largest and most important undertakings in the South. He was born in Camden, S. C., in 1835, and was educated at the Citadel, in Charleston, S. C. The first portion of his life was given over to the construction of some of the largest railroads in the South. In 1905 he became associated with his nephew, W. S. Lee, vice-president and chief engineer of the Southern Power Company, and with this company he was active for several years. In 1910 he again entered the railroad field as chief engineer of the Piedmont & Northern Railroad Company. After completing his work for this company he resumed private practice, which he continued without interruption until his death.

Sir John W. Benn, Bart., chairman of the board of Benn Brothers, Ltd., the largest publishers of technical and trade papers in Great Britain, died in London on April 10, in his seventy-second year. He was seized with hemorrhage of the brain on March 31 and succumbed ten days later to pneumonia. Sir John's first venture into the publishing field took place in 1880, with the launching of *The Cabinet Maker*. The venture succeeded, and the business expanded until at his death the firm was publishing thirteen business journals, including the *Electrician*, the *Gas World* and the *Chemical Age*. Side by side with the growth of the business of publishing trade and technical journals there also developed a very large business in high-class technical and art books. Though the close touch which he maintained with electrical matters through the medium of the *Electrician* had only been of a few years' duration, his connection with the industry was of a much more ancient character. He was an ardent supporter of municipally owned electric tramcars in London, and it is largely owing to his energy and enterprise that a wide network of communications is now spread over much of that metropolis. In non-electrical matters, such as housing, welfare measures and sanitation, Sir John's influence was wholly in the direction of better municipal government. His long experience in the London County Council, of which at the time of his death he was the "father," was of the greatest use both to his colleagues and to the officials, and it is not too much to say that the London of today is in part his creation. He was the leader of the Progressive party in London, chairman of the County Council, deputy lieutenant of the County of London and a member of Parliament.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Bookings Better for Both Large and Fractional-Horsepower Motors

THE demand for motors of both the large and the fractional-horsepower type has improved somewhat in the last month, it is learned. That orders for fractional-horsepower motors are better is not surprising in view of the fact that the market for motor-driven household appliances is again active. As reported in this section last week, the washing-machine industry reported March as its best month since October, 1920. Vacuum-cleaner manufacturers also report very good sales. The fractional-horsepower motor several months ago ceased to be the drug on the market it was a year previous, and now manufacturers are getting back into production on it. Competition is still strong, however, and prices have shown no indication of going up.

The field for industrial motors is being increased by the necessity of cutting down production costs. Where manufacturers can be shown that the use of one electric motor will dispense with the labor of two or three men it is not hard to sell the motor. This is the policy one manufacturer is going on, and he is meeting with success. Sales of industrial sizes seem to be well divided between the various territories. The East reports good sales throughout April, while a better demand is noted in New England for sizes of 5 hp. and below. The textile strike there is impeding movement to some extent as the mills are heavy users of motors Sales in Atlanta have been somewhat spotty, but inquiries are good and there is the prospect that demand will show a sharp upturn soon. Middle Western orders have been good since the first of March, one company reporting March sales to have been the best in eight months. On the Pacific Coast there are many inquiries for pumping-plant work, though the second-hand motor business there has been rather slow. Stocks are good in all sections of the country and prices are firm.

March Electrical Exports Go Ahead of Previous Month

ELECTRICAL exports for March showed a substantial increase over those for the preceding month, the total being $4,927,984 as against February's total of $4,184,677. This is still far below the amount for the corresponding month last year, which was $9,782,045, but it at least indicates that the bottom of the curve has probably been reached. Several factors will be at work during the next few months to increase exports, the most important being seasonal construction activity. South America and the Far East are buying more now, and Europe also will be more active as measures are taken to restore political peace

ELECTRICAL EXPORTS FOR MARCH, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	March, 1921		March, 1922	
	Volume	Value	Volume	Value
Electrical glassware, except for lighting, lb.	......	....	82,475	$16,071
Electrical porcelain, lb.	......	....	876,852	176,323
Carbons for lighting, electrodes and batteries, lb.	......	$51,583	619,158	54,451
Insulated wire and cable (iron and steel) lb	......	....	170,436	27,692
Other manufactures of aluminum, lb.	......	156,038	271,774	86,082
Copper wire, lb.	984,878	199,165	1,344,995	198,661
Insulated wire and cable, lb.	......	721,647	554,952	129,002
Generators:				
Direct-current—				
Under 500 kw., number	......	....	662	34,108
500 kw. and over, number	......	....	759	72,549
Alternating current—				
Under 2,000 kw., number	......	....	9	23,081
2,000 kw. and over, number	......	....	5	143,866
Accessories and parts of generators, lb.	......	....	70,690	22,148
Self-contained lighting outfits, number	......		85	25,165
Batteries:		412,019		
Primary, dry, number	......	....	446,739	110,108
Primary, wet, number	......	....	351	1,512
Storage, number	......	....	8,802	117,147
Transforming or converting apparatus:				
Power transformers, number	......	....	836	298,379
Other transformers, number	......	....	2,709	19,607
Rectifiers, number	......	....	90	2,907
Condensers, double-current and motor generators, dynamotors, etc., number	......	....	764	44,579
Transmission and distribution apparatus:				
Switchboards and panelboards, except telephones, number	......	....	182	65,125
Switches and circuit-breaker, number	......	....	138,106	150,212
Fuses and fuse plugs, number	......	....	110,283	11,187
Watt-hour and other measuring meters, number	......	....	6,340	51,954
Volt, watt and ampere meters, other recording, indicating ond testing apparatus, number	......	....	6,930	61,316
Lightning arresters, choke coils, etc., number	......	....	1,276	26,628
Motors, starters and controllers:				
Motors, under 1 hp., number	......	....	3,431	72,441
Stationary motors—				
1 hp. to 200 hp., number	......	....	1,723	178,902
Over 200 hp., number	......	....	22	66,682
Railway motors, number	......	....	18	5,420
Electric motors, number	1	4,400	......	
Railway, number	......	....	....	....
Mining and industrial, number	......	....	7	14,553
Other motors, number	......	1,571,601	396	19,738
Rheostats, controllers, etc., lb.	......	87,649	101,653	52,216
Accessories and parts for motors, lb.	......	....	206,848	87,827
Electrical appliances:				
Electric fans, number	6,607	180,039	6,163	112,302
Electric lamps—				
Arc, number	176	2,878	543	1,990
Incandescent—				
Carbon-filament, number	91,907	20,435	22,122	5,402
Metal-filament, number	894,530	296,177	583,237	164,681
Other electric lamps, number	......	....	15,432	11,908
Flashlamps, number	......	....	24,487	22,602
Searchlamps and projection, number	......	....	1,260	12,403
Motor-driven household devices, number	......	....	1,896	49,877
Domestic heating and cooking devices, number	......	180,693	13,912	48,123
Industrial electric furnaces and ovens, number	......	....	26	25,536
Therapeutic apparatus, etc., number	......	....	496	47,480
Signal and communication devices:				
Radio and wireless apparatus, lb.	......	....	8,608	21,180
Telegraph apparatus, including wireless, lb.	......	352,714	....	....
Telephone apparatus including switchboards, lb.	......	....	326,543	519,442
Police, fire and burglar alarm, lb.	......	....	784	524
Railway signals, switches, etc., lb.	......	....	84,399	43,857
Bells, buzzers and annunciators, number	......	....	3,187	3,554
Other electric apparatus:				
Spark plugs, magnetos, etc., lb.	......	112,534	88,613	94,413
Insulating material, lb.	......	....	237,679	80,139
Metal conduit, outlet and switchboards, lb.	......	....	149,869	16,832
Sockets, outlets and receptacles, number	......	....	69,639	16,079
Other wiring supplies and fixtures, lb.	......	200,096	156,866	77,357
Other electric apparatus not elsewhere specified, lb.	...	3,093,735	2,825,463	1,079,664
Total	......	*	......	$4,927,984

* Total electrical exports for March, 1921, amounted to $9,782,045. This figure is not included in the above table because of the incompleteness of figures for that month under the new classification.

there and also to bring Russia back into the economic fold. Increases over the previous month are shown by a large number of items, among the most important being copper wire, alternating-current generators, self-contained lighting outfits, batteries, transformers, stationary motors, fans, appliances of various sorts and the several kinds of wiring supplies. The most conspicuous decreases were registered by electrical porcelain, insulated copper wire and cable, transformers other than power, switches and circuit breakers, railway motors, and radio and wireless apparatus. The last-named item dropped from $283,950 in February to $21,180 in March. However, this was probably due more to inability to make deliveries than to lack of demand.

Such items as the new classification permits to be compared with the same month last year are found to be much lower than the March, 1921, totals. Insulated wire and cable were exported to the amount of $129,002, as compared with $721,647 the previous March; rheostats and controllers to the amount of $52,216, against $87,649; miscellaneous motors, $19,738, against $1,571,601; metal-filament lamps, $164,681, against $296,177; electric fans, $112,302, against $180,039, etc.

Importation of Irons Infringing Marsh Patents Restrained

On April 29, 1922, a final decree by consent was entered in the United States District Court for the Southern District of New York restraining the Benco Exporting & Importing Company, New York, from further infringement of the Marsh patent covering electric resistance elements. The defendant in this case was alleged to have been selling certain electric heating devices infringing the Marsh patent which were imported from Austria.

This news is particularly interesting in view of the fact that there has been much discussion recently of the volume of German-made electrical flatirons being imported into the United States. This decision, it is believed, should cut down the flow to some extent and should protect those manufacturers operating under the Marsh patent. However, it is probable that a large percentage of the electric flatirons being imported do not use the nickel-chromium alloy resistance element, and the importation of these, of course, will continue.

Good Business on Large Insulators with Strong Competition on Pin-Type

Manufacturers of insulators report good sales of the high-tension suspension type recently, with good inquiries for deliveries ranging over the next three months. This increase in business is ascribed only partly to the decrease in price on suspension-type insulators which went into effect about the middle of March. In fact, this demand would probably have been just as large if there had been no price cut at all. Many of the high-tension lines in the West and on the Pacific Coast have got beyond the talking stage and orders have finally been placed for insulators and other line material, irrespective of price. As one manufacturer points out, once a central-station engineer has found a particular insulator fitted to his line and climatic conditions he is apt to specify that insulator on new jobs, regardless of whether the price is a few per cent lower or higher.

It is possible, in the opinion of more than one insulator maker, that the present demand is seasonal to a large extent. However, it is hoped to book enough orders now to tide the operating plants over until late in the fall, at which time sales forces can get out after next spring's business. There is reason to believe that it will work out in that way, for now that central-station companies have started building they have embarked on a program that will take three to five years to complete.

A price increase of about 5 per cent on the suspension type would not surprise many observers of the market. At the time the last decrease was effected there was talk of it being unjustified by costs. Since that time labor costs have shown a tendency to rise, while raw material also is in a firmer position. The coal strike has not embarrassed manufacturers so far, but if prolonged several months may cause some trouble.

There is plenty of business to be had in the pin-type insulator, but practically all of it is at buyer's price It is the usual procedure for a buyer to call up and say that he will buy so many insulators at such and such a price, usually much below list, and secure shipment almost on his own terms. Some of the larger companies have been turning down business of this type rather than lose on it, but there are a number of smaller producers who operate under the advantage of a smaller overhead and can afford to accept these prices.

Metal Market Situation

The copper market in the past week has been quiet, but prices remain firm and the position of producers, at least as far as statistics are concerned, is improving steadily. Stocks of blister copper are down to the minimum that can be safely carried as a reserve, and stocks of refined are no longer so large as to menace the market. Current output is increasing but not at such a pace as to outdo both foreign and domestic demand. Electrolytic now is quoted at 13 cents per pound for prompt delivery and at 13⅛ cents for June, July and August delivery. The export price is 13 cents f.a.s. New York. France and Germany have placed most of the foreign orders of the last week, but a good-sized order for castings for China was placed also. Business in finished products is increasing steadily, though a conservative tone is still noticeable among purchasers. Wire and rods are stronger, and quotations have gone up ⅛ cent. In the outside market copper for interior shipment is meeting some demand and prices are firm.

Exports in March were much heavier than estimated Government returns showing an outgo of 78,236,480 lb. exclusive of outgo to Canada. Estimating April exports at 52,000,000 lb., the total of foreign deliveries during the first four months has been approximately 237,000,000 lb., exports during the first quarter having been 185,000,000 lb. March exports were the heaviest since May, 1920.

Steel orders have fallen off about 20 per cent in the last two weeks. During the first part of April consumers were rushing to cover, and now that the needs of the next ninety days are cared for demand is dropping off. This is not unexpected, and as a matter of fact some producers are worrying more about filling orders than about new business.

The lessened eagerness of buyers has brought out some cheaper offerings of lead in the Western outside market, prompt lead being quoted at 5.20 cents, East St. Louis basis, and it is probable that this price can be shaded. There have been various outside lots heard of in middlemen's hands in various parts of the country, such as usually crop up after an advance. The New York position is firm, though demand all around is momentarily quieter. The main features of the situation, however, are still unchanged, consumption evidently being in full volume and producers booked well ahead.

NEW YORK METAL MARKET PRICES

Copper:	April 25, 1922	May 2, 1921
London, standard spot	£ s d 59 0 0	£ s d 60 2 [illegible]
	Cents per Pound	Cents per Pound
Prime Lake	12.87½	13.00
Electrolytic	12.75	12.87½
Casting	12.50	12.50
Wire base	14.00–14.25	14.12½–14.37½
Lead, Am. S. & R. price	5.25	5.25
Antimony	5.12½	5.37½
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.35–5.40	5.35
Tin, straits	31.12½	31.25
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	April 25, 1922	May 2, 1921
Heavy copper and wire	11.00–11.12½	11.00–11.12½
Brass, heavy	5.25–5.50	5.25–5.50
Brass, light	4.87½–5.12½	4.87½–5.12½
Lead, heavy	4.25–4.37½	4.50–4.62½
Zinc, old scrap	2.50–2.75	2.50–3.00

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical industry still remains guiltless of high spots, with the exception of wiring material and radio demand, both of which are far ahead of other electrical items. Good building conditions are reported from all sections, with building trade troubles diminishing. St. Louis union carpenters have accepted a reduction of 15 per cent and the situation there is somewhat relieved. Contractor dealers are finding plenty of house wiring and some little commercial wiring to take care of, but industrial work still lags.

An opportunity to secure radio-transmitting vacuum tubes is offered by the Navy Department, which on May 15 will open bids for 30,000 type C. G.-1162 tubes. These tubes, which are several years old, can be used for receiving and amplifying by reslotting the receiving-tube socket. The tubes are to be resold by the purchaser only under certain conditions laid down by the government.

NEW YORK

Sales of the general line of wiring supplies continue to hold up well, and the jobbers report that business is gaining gradually. Individual orders are increasing somewhat in size, and some fairly large orders for conduit for future requirements have been placed. The revival of building activity offers still more encouragement as there seems to be no let-up to the new construction which is being put under way. Although the demand for electrical material from industrial users is backward, jobbers who specialize in this branch of the trade say that orders from their customers of this class are slowly increasing.

Stocks in all lines are fair to good, and so far as could be learned there is no shortage on anything except radio apparatus, and on this a shortage is to be expected. The only change in prices was on outlet boxes, on which quotations have been increased about 50 per cent. Conduit prices are somewhat elastic, as several jobbers are offering pipe in large quantities on the basis of card 49. This is accounted for, however, by the fact that the last increase in quotations was anticipated by both jobbers and contractors. Conduit manufacturers are reported to be rushed with work to catch up with these orders.

Rigid Conduit.—Some large orders have been placed for this material, and the increase in building in the business sections has materially stimulated the demand for it. Jobbers have been slow to put the new prices in effect as they had placed fair-sized orders before the last increase. It is expected that by the last of the week the new quotations will be pretty well established. Quotations ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-covered Wire.—Prices remain unchanged, and there is a fairly active demand. In 5,000-ft. lots No. 14, rubber-covered, sells for $6.25 to $6.38 per 1,000 ft. Quotations as low as $6.15 per 1,000 ft. have been made on lots of 10,000 ft. and over.

Flexible Armored Conductor.—Demand is active and steady, with jobbers' stocks in fairly good shape. Quotations on No. 14, two-wire, single-strip, are from $43 to $45 per 1,000 ft. and from $45 to $47 on double-strip.

Outlet Boxes.—An increase of over 50 per cent in the price of outlet boxes has been announced. Black boxes in standard-package lots on which the discount was formerly 75 per cent are now quoted at 60 to 62 per cent discount. On galvanized boxes in standard-package lots the discount has been reduced from 70 per cent to 55 to 57 per cent.

Metal Molding.—A fair demand is reported. In small quantities the three-wire size sells for $5.60 per 100 ft., while in quantities of 1,000 ft. or more a price as low as $50 per 1,000 ft. has been quoted.

Dry Cells.—Batteries are moving well. No. 6 regulars are quoted at $29 per 100 in barrel lots of 125 and igniters at $30 per 100 in the same quantity.

Radio.—There is a little more of this material available now, although jobbers report that they have no stocks on hand. It is expected that the summer months will afford an opportunity for the trade to catch up with the demand.

CHICAGO

Business for the past week has been steady and about equal to the activity in the electrical trade of the previous weeks. With each day's increase in building permits the demand for wiring materials has improved. While the volume of sales has been good, the unit of sale has been in small lots. Competition on conduit has resulted in jobbers maintaining the old price until their present stocks are sold. Manufacturers of high-tension equipment report another good week of business and state that inquiries are increasing. The farm-lighting equipment manufacturers have noticed an improved sentiment toward their equipment and state that the 1922 outlook is more encouraging than last year's. Along with the building boom comes a better activity in house lighting fixtures. Contracts for new passenger equipment to cost about $1,000,000 have been let by the Wabash railroad.

Wire.—Although no startling changes in the call for wiring materials occurred this week, the demand has equaled the steady stocking of this material during the past few weeks. Where one dealer will report a spurt of activity, others will state that the volume is good without any pronounced outstanding sale. Taken as a whole, the movement has been satisfactory and most jobbers are pleased with the better business prospects. Rubber-covered No. 14 is still available in 5,000-ft. lots for prices averaging around $6.25 per 1,000 ft. Stocks are ample. The demand for weatherproof and bare wire has also held its own, but prices have not changed.

Rigid Conduit.—The new prices on conduit have not gone entirely into effect since jobbers prefer to move their present stocks at the old prices because of the active price competition. Accordingly the price varies from $41 to $43 per 1,000 ft. of ½-in. black in 5,000-ft. lots. Stocks are reported good. The demand is steady and the volume of sales also is good.

Flexible Armored Conductor.—This is continuing its good movement and jobbers' stocks are fair. It is quoted at $42.50 per 1,000 ft. in 5,000-ft. lots.

Farm-Light Equipment.—While conditions in this industry still appear rather sluggish, several manufacturers have stated that the 1922 outlook appears much more encouraging than it did in 1921. At the present time the farmer is naturally very much interested in planting, but the organizations out after the business report a better feeling on his part. The increase in the value of his products has made him interested in this equipment, and dealers state that inquiries are increasing.

Poles.—The pole activity is being sustained by replacements and extensions of the utility companies. However, the demand is variable, and dealers report their business is good in certain spots only. Most of them are optimistic and report that they are receiving their share of the business. No price changes have occurred recently and stocks are good.

Pole-Line Hardware.—This naturally follows the demand for poles and is also moving well. Stocks are ample.

BOSTON

Business is uneven between different jobbers, but on the whole a marked improvement is reported as compared with a few months ago. The expansion of the building industry continues to be the brightest feature of New England commercial activity. For the week ended April 25 the total building and engineering contracts reported were $12,924,400, compared with $4,804,100 a year ago and $7,796,000 for the corresponding week of 1920. The present total is from two to three times the same week's showing in nearly every year back to 1902. Residential building is much more active than industrial construction, and considerable mercantile and banking work is being done by builders. The paper industry is busy in this section. Labor troubles still throttle progress in the textile industry in certain localities, and a lockout has been declared by Lynn shoe plants pending completion of existing orders and the acceptance of a 20 per cent wage reduction. Retail trade is better and the demand for radio apparatus grows like Jonah's gourd. Credit conditions are not so good as in March among electrical supply jobbers. Central-station earnings are holding up well, with strong tendencies toward increased outputs. Prices did not exhibit marked changes during the week, barring the stiffening of rigid conduit quotations indicated a week ago, which has now found its place on jobbers' sheets.

Lamps.—Continued good business in lamps of various sizes and types is reported. Interest in house wiring is spreading over wide areas as a result of vigorous publicity, central-station campaigns and such displays as the recent "Home Beautiful" show at Boston, which on a recent evening attracted an attendance of 10,000 persons. Prices of lamps are steady.

Radio Apparatus.—Deliveries are falling behind on vacuum tubes and telephone receivers for wireless service. So great is the popular demand that thefts of apartment-house telephones not designed for radio work are being reported. Broadcasting service is becoming more diversified, with corresponding enlargement of popular interest in equipment. Much material of dubious quality is now being marketed by non-electrical concerns lacking technical knowledge of radio requirements.

Motors.—A light business is being handled, with occasional streaks of encouragement. One Boston jobber recently disposed of $1,000 worth of moderate-sized motors in a single order, but on the whole this business is of the piecemeal character.

Rigid Conduit.—Prices have advanced around 5 to 10 per cent, and the new quotations effective last week may be typified by the following figures per 1,000 ft. and in 500-ft. to 5,000-ft. lots: Black, ½-in., $51.89; galvanized, $56.99; black, 1-in., $95.28; galvanized, $105.48. Elbows per 100, in 500-lb. to 5,000-lb. lots, are quoted: Black, ½-in., $10.84; white, $11.98. The corresponding 1-in. figures on elbows are $21.22 and $23.33. Couplings per 100, in the above range of lots, are quoted as follows: Black, ½-in., $5.18; galvanized, $5.50; for 1-in. elbows, $9.63 and $10.41. Prices above 5,000-ft. on rigid conduit are open in the smaller and more common sizes.

Wire.—Rubber-covered wire is moving moderately well at $6.25 per 1,000 ft. in 5,000-ft. lots, and weatherproof is doing fairly well at from 15 to 16 cents base, according to quantity. Little bare copper wire is selling except for radio aerials, and the recent scarcity of No. 14 bare is now being relieved by better deliveries.

ATLANTA

A break in the inclement weather has served to improve materially the outlook throughout this section, with a resultant stimulation in business in almost all lines. Planting has got under way, and payments for fertilizer and labor on the farm are being reflected in the increased volume of business of the small town merchants. They in turn are placing orders for larger stocks and are liquidating some of their back debts.

The larger electrical contracting firms report considerable industrial activity, with inquiries showing a heavy increase and actual orders being placed for expansions and improvements. One of the largest Southeastern power companies is actively undertaking the sale of large blocks of power to industrial plants in this section in anticipation of the completion of hydro-electric developments now in the process of construction. This will, of course, in a reasonable time stimulate the sale of electrical construction material, motors, high-tension transformers and so forth. In short, the outlook is brighter than for many months past.

Fuses.—A steady movement in this line is to be noted with the popularity of the renewable type on the increase. There still continues a steady demand for the standard and plug types, the price on plug fuses being quoted at $22.50 per 1,000 in large lots.

Armored Conductor.—The construction of small commercial buildings and the wiring of old houses is causing a brisk demand, the price on two-wire No. 14 being $52 per 1,000 ft., with an advance of about 5 per cent predicted. Local stocks are in good shape.

Bell-Ringing Transformers.—This specialty is for some reason moving more slowly than was anticipated, though the heavy residential construction in the section should materially stimulate sales soon. Reetailers' price on the small size is steady at $1.30.

Radio Sets.—All radio equipment continues in heavy demand with supplies insufficient to meet present needs. A growing tendency toward the higher class of equipment is to be noted with amplifiers making steady gains. A number of retail outlets have opened up recently, and one of the largest jobbers announces active entrance into the field beginning May 15.

Meters.—The movement of meters is fair to good, with the 5-amp. and 10-amp. types most in demand. Orders for high-tension equipment are rather slow. Jobbers' and distributers' stocks are in splendid shape with prices steady.

Outlet Boxes.—Sales are very satisfactory in all the popular sizes. A price advance of approximately 5 per cent is reported this week. Jobbers' stocks are ample for present purposes.

Flexible Non-Metallic Conduit.—Activities are reported fair to good with supplies on hand somewhat in excess of the near future demands.

Wire.—Both weatherproof and rubber-covered wire are active, particularly in the No. 12 and No. 14 sizes, with all sizes smaller than No. 6 weatherproof moving rapidly. Several very fair orders for heavy cable have been placed recently by local contractors. The general opinion is that wire prices are at their low ebb.

Wiring Supplies.—There is some increase in activity, with price reductions of 10 per cent announced in snap and push-button switches. Sockets are quite active and stocks throughout the line are good.

ST. LOUIS

Construction work is expected to be somewhat stimulated as a result of arbitration of carpenters' wages in St. Louis, a reduction from $1.25 to $1.10 per hour being agreed upon. Notwithstanding the reductions which have been made in building wages, there is still a marked feeling among those contemplating building that costs of labor and materials are too high, and a considerable amount of work is being withheld for lower prices.

A recent survey made by the St. Louis Federal Reserve Bank of the general character of trade in this territory indicates that conditions have become more stable in regards to stocks and prices and that the public is in need of commodities of all sorts. Stocks in the hands of retailers continue abnormally low, and, on the other hand, manufacturers are increasing their purchases of raw materials and are beginning to accumulate finished goods in anticipation of increased demand later on. Plentiful and easy money is tending to broaden manufacturing programs. The coal strike has had no appreciable effect on business so far. Marked improvement is noted in the steel mills and in the foundries, their operations being heavier now than they have been at any previous time in the last eighteen months.

Wire and Cable.—Actual sales were about the same last week as they have been for some time, but inquiries were more numerous and for larger amounts. The central-station companies are obtaining prices on bare and weatherproof, indicating early opening of line construction work. One power company is in the market for a large amount of 27,000-volt, three-conductor underground cable. Stocks of wire are conservative and prices are firm. No. 14 rubber-covered is priced at $6.25 per 1,000 ft. in 5,000-ft. lots.

Transformers.—Considerable improvement is found in the demand for distribution transformers, and there were a few sales in this territory last week of 13,200-volt transformers. Inquiries for all sizes and voltages are much more plentiful and indicate that there will soon be a very good demand.

Lightning Arresters.—From the inquiries received it appears that there will be quite a bit of protective equipment installed in this territory this spring. Orders have been received in increasing amounts for several weeks, and the volume of business this season is expected to be substantially better than last year.

Appliances.—Sales were comparatively quiet from the first of the year until Easter, but it is reported that there has been appreciable improvement in the last two weeks, and April sales are expected to compare favorably with those of last April. The new mode in hairdressing has resulted in heavy sales of curling irons. Flatirons, vacuum cleaners and washing machines are in good demand. Percolators are not moving so rapidly as was anticipated, but improvement is expected as spring weddings come on.

SAN FRANCISCO

The predicted wave of depression has not hit California seriously, and retail trade holds up very well compared with previous years. With summer approaching and crop sales near there seems good reason to believe that the worst of the depression has been passed.

Motors.—Farmers and growers who have held off purchasing pumping equipment as long as they dared are now buying well, and as nearly all crops are heavy and prices are high there is excellent business reported in motors from 5 hp. up to 25 hp. All motor business is, in fact, heavy. The California district contains an increasing number of industrial plants that also need motors, and there is much remodeling in accordance with the increased knowledge of scientific plant layouts. Coast stocks accumulated during a season of slack demand are still high but are decreasing very nicely.

Appliances.—Retail buying is better. Dealers and department stores are placing good stock orders in expectation of a "June bride" demand that is expected to be better than for several years past. Stocks of percolators are again being purchased by dealers who have hitherto managed to get along fairly well on carryover. Recent improvements in many standard lines have been a powerful incentive. Furthermore, considerable business has been created by amusement parks which operate concessions that give percolators as prizes.

Household Appliances.—It is probable that the recent interest in radio equipment has taken a good deal of money that would otherwise have gone into the purchase of some of the larger household appliances. Moreover, it is still necessary to gain the greater part of this business by door-to-door solicitation. This continual bother of solicitation is reflected in the fact that certain dealers have found it necessary to increase the commission rate from 20 to 25 per cent. Many experts believe that eventually this business will return to the stores which do not employ such soliciting crews, but for the present at least solicitation is necessary.

Ranges.—The building of distribution lines is reflected in the present good pole-line hardware business, and it will soon be reflected also in electric range and water-heater sales. Entire districts lying in pockets between the old distributing systems are now being reached by lateral lines and have been signed up for range service even before the service has reached them.

PORTLAND—SEATTLE

Business in general seems to be improving as a result of recent fine weather. A slow but gradual improvement continues to manifest itself in the major lines of industry. The lumber industry, of primary importance in the Northwest, is more nearly on a normal basis than at any time during the past eighteen months. Production during April was not over 7 or 8 per cent below normal, and production for the week ended April 22 was only 5 per cent below normal, with new business 17 per cent above production and shipments practically equal to new business. Building of all kinds, and particularly residence construction, highway construction and improvement and maintenance work by the railroads, is very active throughout the Northwest.

In the electrical trade business seems to be getting gradually better. Inquiries are increasing steadily, and the prospects generally look brighter. The lumber mills have used up most of their surplus stocks and are again active buyers. Motors, in sizes up to 10 hp. especially, have been moving more actively. Prices for the most part seem to have reached a condition of stability. A 5 to 6 per cent drop in pole-line hardware is reported to have become effective during the past week. The demand for house wiring and schedule material is good, owing to the large amount of residence and apartment construction. Dealers of Portland report a demand for vacuum cleaners and ranges.

Fuses.—There is a steady and somewhat increasing demand for material of this class. Prices remain steady as follows: 30-amp. plug fuses, $3; 30-amp. non-renewable fuses, $10.20; 30-amp. renewable fuses, $29; 60-amp. non-renewable fuses, $18; 60-amp. renewable fuses, $58. All prices are for quantities of 100 in lots of 500.

Tape.—This item is a staple and enjoys a steady demand. Present quotations run from $24.75 to $25.85 per 100 rolls in lots of fifty rolls or less. Rubber tape is quoted at $23.50 in similar lots.

Lamps.—The lighting season is about over, and present sales are accordingly slow. The past season has been considerably better than the season a year ago. The tendency toward the use of larger sizes has been particularly evident, the 75-watt and 100-watt sizes having assumed the position of best sellers formerly held by the 25-watt and 40-watt sizes.

SALT LAKE CITY

The labor situation at the coal fields has not been very favorable during the past week. A crisis arose in Utah that threatened an emergency call of the National Guard, but the agitation is dying down now.

Non-employment is growing less widespread as construction work gets under way. Home building is proceeding at a good rate. The housing problem by the end of this season should be pretty satisfactorily solved so far as emergency demand is concerned.

Unprecedented interest is being manifested in convenience outlets in both old and new homes. Contractor-dealers report more business in this line than in any year of their history. The increased demand is believed to be largely the result of the electric home demonstrations that have been conducted in the larger centers. Materials of all kinds are ample to meet the demand.

Washers.—The spring demand thus far has been good with prospects for disposal of many more machines. Improved models are now on the market at little or no advance in price. Stocks are good in most makes with manufacturers making steady deliveries.

Cleaners.—Sales made thus far in 1922 exceed sales for the corresponding period of 1921 by a good margin. Stock shortages have developed in one or two instances where big advertising campaigns were launched without adequate preparation. No price changes of recent date have been noticed.

Hollow Ware.—Dealers are stocking well in anticipation of good sales in May and June, the two months of weddings and wedding gifts. The regular trade is fair and stocks are ample.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wage Raise by Brass Manufacturer

The Ansonia Manufacturing Company, brass manufacturer, Ansonia, Conn., has announced a 15 per cent wage increase to become effective May 15. The increase affects between 500 and 600 employees. The company made a cut in wages about a year ago, but promised at that time to rescind the cut whenever business conditions justified.

Carter Electric Quarters Increased

The Carter Electric Company, 112 South Washington Street, Kokomo, Ind., recently moved into its new two-story building, which has a floor space of 10,000 sq.ft. The company has been in business since 1906 and was incorporated in January, 1920. The officers are: O. B. Carter, president; Hugh Duncan, vice-president, and John Carter, secretary-treasurer.

Westinghouse Increasing Output of Radio Outfits Rapidly

The Westinghouse Electric & Manufacturing Company, according to officials, is now turning out 500 complete radio receiving outfits daily, and production is being increased as fast as additional facilities can be provided. The company expects to have production up to 1,000 sets a day in the next two or three months. After that the management will be in a position to determine to what extent expansion should be carried out. Preparations are being made to turn out a large quantity of vacuum tubes at the New Jersey lamp factory as demand for tubes is still far ahead of supply. The manufacture of receiving sets has been concentrated at the Springfield (Mass.) plant.

Form Company to Manufacture Dishwashers

The formation of the Murdoch Dishwashing Machinery Company, Marion, Ohio, has been announced. The company has a capital stock of $250,000 and is backed by business men of Marion and Bucyrus, Ohio. Offices and factory space have been obtained in Marion, and the company will go into production of a complete line of power dishwashing machinery, the line to include commercial types and an electrically driven household machine. The officers are: H. A. McKinnon, president and manager; Millard Hunt, first vice-president; C. A. Murdoch, second vice-president; Fred B. Scherff, secretary, and F. B. Fidler, treasurer. C. A. Murdoch, designer of the machines, will have charge of the engineering sales department.

Wagner Electric Announces Plans for Reorganization

The Wagner Electric Manufacturing Company, St. Louis, is planning to issue $2,000,000 in preferred stock, which will be offered to the present common-stock holders pro rata at par. This information comes in a statement to the ELECTRICAL WORLD authorized by W. A. Layman, president. As under the laws of the State of Missouri preferred stock can be issued only with the unanimous consent of every shareholder of the corporation, and as considerable time would be required to gain such unanimous consent, it is probable the new financing of the company will provide for the formation of a corporation under the laws of some other state with provisions for both preferred and non-par common stock, with an exchange of shares by the stockholders of the present corporation for the stock of the new corporation. The details of the plan will be announced shortly.

The present company was organized in 1891 and has an authorized capital stock of $7.500 000, of which approximately $5,800,000 is now outstanding. The business of the company is reported to be making substantial improvement in all its branches. Since Jan. 1, 1921, the company's obligations have been reduced approximately 43 per cent, and with the new financing the floating debt of the company will be very largely paid off. Whether there will be any change in management of the company has not been announced.

United States Steel to Build Tube Plant

Plans of the United States Steel Corporation to erect a fifteen-million-dollar plant for the manufacture of lap and butt weld tubes at Gary, Ind., have been announced by Elbert H. Gary, chairman of the Steel Corporation. The plant is to be built by the National Tube Company and will be financed partly by the issue of $10,000,000 of bonds and partly from the cash surplus of the Steel Corporation. The capacity of the new plant will be about 350,000 tons a year, adding between 20 and 25 per cent to the corporation's present tube capacity.

Work is to be started immediately, and it is expected that production will be begun in about two years.

General Electric Orders Running Ahead of 1921

If the General Electric Company receives orders during the remainder of 1922 at the rate they were received during the first quarter, total sales for the year will amount to over $200,000,000. This total would be $20,000,000 larger than the total for 1921, but not quite up to the actual billings of that year, which were $221,000,000. This difference is due to the fact that orders on the books on Jan. 1, 1922, amounted to only $45,391,000, or just sufficient to keep the plant running ten weeks, as against sufficient unfilled orders at the beginning of 1921 to keep the plant in operation for six months.

It was stated recently at a meeting of officials of the Lynn works of the company that business, while still subnormal, is better by about 15 per cent than it was on the average during 1921. Good orders for large apparatus are being received, demand being noted for large steam turbines, large generators and large industrial motors. Small devices are not selling satisfactorily, with the exception of meters, while sales of induction and railway motors are still low. Orders for switchboard apparatus are almost up to normal.

Consider 1923 Fixture Market Location—Possibly Permanent

Among the problems discussed at the recent joint conference committee of the Associated Lighting Industries—the National Council of Lighting Fixture Manufacturers, the Lighting Fixture Dealers' Society of America and the Illuminating Glassware Guild—was that of the 1923 Lighting Fixture Market. Up to the present time each successive annual event has taken place in a different city, but the committee has decided that the "fixture market" has now grown to such dimensions that it is desirable to consider the establishing of a permanent location for this big annual event. The committee has therefore recommended that this idea of permanency should be kept in mind in the plans to be considered for the 1923 market, to be held the fourth week in January.

The idea of a permanent fixture market seems to appeal greatly to a large number of fixture men, the committee states. The strikingly successful prototype of the Lighting Fixture Market, the annual furniture market at Grand Rapids, proves that a permanent location gives to such events a stability and a prestige which a movable exhibit cannot attain, and that, moreover, a fixed location from year to year produces a larger dealer attendance than would otherwise be the case.

Before deciding therefore on the city to be selected for the coming market, a particularly careful survey is to be made of the railroad facilities, hotel accommodations and other requirements for a successful location among the various cities suggested.

An important point about a permanent fixture market, it is pointed out, is the reduction of the expense of booths and other installation costs, for under present conditions thousands of feet of lumber and other material are required for each market, and these cannot be used again. Moreover, with a permanent location it would be possible to maintain a completely organized department to look after the details of the market.

Mercury Company Reports Sales in Japanese Market

The Mercury Manufacturing Company, manufacturer of electric industrial tractors, 4118 South Halsted Street, Chicago, reports that the Japanese market is in a very receptive mood at the present time and that manufacturers of labor-saving machinery are finding an especially good demand there. The rapid rise of Japan as an industrial nation, the company states, has made it imperative to supplant man-power with mechanical means wherever possible.

AMERICAN ELECTRIC TRACTOR IN WAREHOUSE SERVICE AT KYOTO, JAPAN

The Mercury company has recently installed a fleet of electric tractors for the Sugimara Warehousing Company, Kyoto, Japan, through the Kawakita Electric Corporation, machinery importers, Tokio, Japan. One of the tractors is shown in operation in the accompanying photograph. The fleet consists of four Mercury tractors and a number of warehouse trailers.

Electrical Material Company in Larger Quarters

The Electrical Material Company has removed its offices and factory from 618 West Jackson Boulevard, Chicago, to 158 West Lake Street in that city. The company will occupy all four floors of the West Lake Street building. The move provides greatly enlarged quarters, made necessary by an increase in business. A. F. Henderson is president.

Radio Manufacturers Organize Chamber of Commerce

Leading manufacturers of radio apparatus and equipment held a meeting in New York on April 28 to perfect the plans for a National Radio Chamber of Commerce. The membership of the organization is open to all established and responsible companies. About fifteen concerns so far are members, among which are the De Forest Telephone Company, the Freed Eiseman Radio Corporation, the Jewett Manufacturing Company, the Home Radio Company, the Dubilier Condenser Company and the F. A. Andrea Telephone & Telegraph Company. In opening the membership to all established and responsible companies, it is announced, it is the purpose of the organizers to prevent as far as possible losses to the public through investment in unsubstantial enterprises, of which there are many.

Ansonia Electrical Holds House Warming at New Magnet-Wire Plant

A most interesting indication of the growth of the electrical industry was afforded on Thursday of last week at the house warming of the new enameled magnet-wire plant of the Ansonia Electrical Company. One of the oldest of electrical manufacturing concerns, this company developed in Ansonia, Conn., where it manufactured bells, annunciators and annunciator wire and cotton-covered magnet wire until it reached the point where it was so hedged in by the city that there was no more room for expansion. The officials of the company selected a few years ago a forty-five-acre tract outside Ansonia and built on it the plant just opened with a floor space of 54,000 sq.ft. Eventually all of the company's manufacturing operations will be removed to new buildings on this site. To the house warming were invited all of the company's Eastern and Middle Western agents. After inspecting the new plant dinner was served at the Hotel Taft, New Haven, where Thomas Wallace, president of the company, and William J. Tonkin, assistant secretary, were hosts. A number of interesting talks of economic and reminiscent nature were made, among them being addresses by Samuel Weldon, cashier First National Bank of New York City; Charles F. Brooker, chairman of the board of the American Brass Company, and R. S. Wildman, who is Ansonia manager of the Ansonia Brass Company.

The High Tension Insulator Corporation, Ballston Spa, N. Y., has been organized to manufacture high-tension insulators. The directors of the company include R. H. Dairson and William H. Namack.

The Simms Magneto Company, East Orange, N. J., manufacturer of magnetos, starting and lighting systems and a portable lighting and power system, has opened a branch office and showroom at 5781 Woodward Avenue, Detroit. L. F. Acker has been appointed manager, and it is intended to cover the states of Ohio and Michigan from the Detroit office.

The American Insulating Machinery Company, Philadelphia, has moved its Paris office from 10 Rue de l'Elysée to 8 Rue Auguste Chabrières and has placed Richard Waller in charge. All Continental business with the exception of Scandinavian matters will be handled from this office.

The Diehl Manufacturing Company Elizabeth, N. J., manufacturer of direct and alternating-current motors, generators, fans and exhaust wheels, has opened a Southern office and stock room at 45-A Trinity Avenue, Atlanta, under the supervision of J. H. Shahan, sales representative.

The Trumbull - Vanderpoel Electric Manufacturing Company, Bantam, Conn., has placed L. B. Underwood in charge of the Philadelphia office of the company, 139 North Fourth Street, the appointment taking effect May 1. Mr. Underwood has been in the New York and Connecticut territories for the company for the past two years. V. O. Lundgren will also be in the Philadelphia office. A complete stock of safety switches, radio switches and knife switches will be carried there.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, has appointed C. M. Hall, formerly in charge of the New York territory for the Dodge Transmission Company, to take charge of sales in Cincinnati and Dayton, Ohio, and the States of Indiana and Kentucky. He will have headquarters in Indianapolis. Malcolm Grant has also joined the Black & Decker organization in a selling capacity and will have the State of Ohio with the exception of the corner which includes Cincinnati and Dayton. He will have his headquarters at the Cleveland office of the company.

Foreign Trade Notes

SIEMENS-SCHUCKERT COMPANY TO ERECT A PLANT IN JAPAN.—A contract, it is reported, has been concluded between the Siemens-Schuckert Company, one of the largest electrical engineering and construction companies in Germany, and the Japanese copper king, Furehawa, whereby both firms will erect a large plant at Tokyo for the manufacture of all kinds of electric generating machinery. Twenty engineers of the staff of the Siemens-Schuckert Company, together with a number of technical experts, have already left Berlin for Tokyo.

MARKET FOR ELECTRICAL HOUSEHOLD APPLIANCES IN ONTARIO.—The extension of electrical lines of the Hydro-Electric Power Commission throughout the rural districts in Ontario, Canada, according to *Commerce Reports*, is creating a demand for electrical household appliances among farmers, and it is stated that recently hardware merchants have begun to add electrical departments to their stores, whereas formerly only small electrical dealers catered to the trade.

Foreign Trade Opportunities

Numerous inquiries for electrical goods have been received by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., of which detailed information may be obtained by referring to Nos. 1407-1427, 1432, 1476, 1481, 1499, 1501, 1510 and 1517.

New Apparatus and Publications

INDUSTRIAL OVENS.—The Paul Maehler Company, 2,210 West Lake Street, Chicago, is distributing a thirty-four page catalog covering the "Maehler" industrial ovens, including annealing, core drying, enameling, japanning and lacquering ovens and also burner equipment and potash boiler furnaces for gas, electric, oil or steam heating systems.

OUTLETS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a four-page pamphlet calling attention to the "Hubbell" convenience outlets and other "Hubbell" devices.

BATTERY TESTER. — The American Bureau of Engineering, Inc., 2,632 Prairie Avenue, Chicago, is distributing a leaflet describing the "Ambu" three-ball battery tester for auto or radio storage batteries.

DESK LAMP.—A new "Esrobert" desk lamp, know as No. 310, has recently been placed on the market by S. Robert Schwartz & Brother, 729 Broadway, New York City.

SAFETY SWITCH.—A new type of safety switch has recently been developed by the Square D Company, 6,065 Rivard Street, Detroit.

TROUBLE LAMPS.—The Appleton Electric Company, 1,701 Wellington Avenue, Chicago, has recently developed two new models of "AutoReelite," model F, for use with inclosed cars and model G for open cars.

CONDUIT FITTING.—A new entrance fitting, type "BF," for 2½-in. and 3-in. conduit has recently been brought out by the Killark Electric Manufacturing Company, 3,940 Easton Avenue, St. Louis.

ORNAMENTAL POSTS AND TOPS.—Circular 1,642 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its "Cutter" ornamental posts and tops.

BOILERS.—The Heine Boiler Company, St. Louis, is distributing a pamphlet entitled "Forty Years of Progress," announcing a change in name and several new developments in boiler design.

MOTOR STARTER.—The Monitor Controller Company, Baltimore, is distributing a four-page pamphlet describing the monitor "Thermaload" starter for single-phase and polyphase motors.

FLOOR SURFACING MACHINE. — The American Floor Surfacing Machine Company, Toledo, Ohio, is distributing a folder describing and illustrating the "American Universal" electrically driven floor-surfacing machine.

ROTARY RECTIFIER.—A rotary rectifier with a capacity of 1,500 watts and capable of charging fourteen or sixteen 6-volt batteries at 15 amp. or thirty 6-volt batteries at 6 amp. to 8 amp has been placed on the market by the King Electric Manufacturing Company, Inc., Tonawanda, N. Y.

RENEWABLE FUSES.—"Shurvent Protection" is the title of folder 4,472, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covering its vented renewable fuses designed for the protection of low-voltage circuits up to 600 volts for both alternating current and direct current.

SAFETY SWITCH.—The Mutual Electric & Manufacturing Company, Porter and Fourth Avenues, Detroit, has placed a new "Bulldog" safety-type switch on the market.

New Companies

THE OREGON POWER COMPANY, Perrysburg, Ohio, has been incorporated with a capital stock of $25,000 by A. B. Harris, Howard Lewis, Milo J. Warner, Charles H. Lemmon and Charles T. Lewis, Jr.

THE CLYDE RIVER POWER COMPANY, Newport, Vt., has been incorporated with a capital stock of $150,000. This company is a consolidation of several power companies in northern Vermont. The officers are: George E. Hunter, Boston, president; David Barry, Boston, vice-president and general manager, and Charles A. Prouty, Newport, treasurer.

THE RANDOLPH-ANDREWS ELECTRIC COMPANY, 1140 East Street, Trenton, N. J., has been chartered by Charles F. Andrews, agent; Arthur S. Randolph and Chalmers E. Van Anglin. The company is capitalized at $100,000.

THE CONSOLIDATED ELECTRIC COMPANY, St. Paul, has been incorporated with a capital stock of $50,000. The officers are: Carl J. Gardeen, president; John Schudell, vice-president, and J. O. Nelson, secretary and treasurer.

THE ARION MANUFACTURING COMPANY, Boston, has been incorporated by Royal R. Sheldon, Samuel W. Sharmat and H. Leon Sharmat, all of Brookline, Mass. The company is capitalized at $100,000 and proposes to manufacture electrical supplies and musical instruments.

Record of Electrical Patents

Notes on United States Patents

(Issued April 11, 1922)

1,412,376. Fault Locator for Electric Cables; Hugh M. Stoller, New York, N. Y. App. filed Aug. 17, 1920. Determines where test current stops flowing.

1,412,384. Combined Car and Electric Coupling; Thomas R. Brown, Sparkill, N. Y. App. filed April 4, 1917. Switch for securing proper circuit relation throughout train.

1,412,385. Signaling System; Theodore W. Case, Scipio, N. Y. App. filed Nov. 17, 1920. Transmitting and receiving light rays.

1,412,405. Method for Testing Transmitters; Raymond R. Herrmann, St. Paul, Minn. App. filed Nov. 2, 1920. Mechanical means of testing telephone transmitters.

1,412,414. Driving Mechanism for Ignition Generators; John L. Milton, Cleveland, Ohio. App. filed Feb. 6, 1918. Automobile magneto.

1,412,435. Telephone Trunk Circuits; John Wicks, Chicago, Ill. App. filed June 11, 1917. Trunk-system control between automatic and manual exchanges.

1,412,458. Message Registering System; Leo H, Darrow, New York, N. Y. App. filed Dec. 23, 1918. Automatic switching device for toll service.

1,412,463. Constant Current Arc-Welding Syytem; William B. Elliott and William O'Blenis, Westfield, N. J. App. filed March 14, 1918. By excitation adjustment of one generator by a second.

1,412,490. Signaling System; William A. Rhodes, New York, N. Y. App. filed March 22, 1918. Telephone system for making connections between rural, local and long-distance lines.

1,412,511. Electric Furnace; Ora A. Colby, Irwin, Pa. App. filed March 31, 1920. Resistance type.

1,412,512. Electric Furnace; Ora A. Colby, Irwin, Pa. App. filed April 23, 1920. Resistance type.

1,412,513. Electrolyte; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. For lightning arresters, comprising solution containing less than 2 per cent of ammonium carbonate.

1,412,514. Electrolyte; John Coulson, Wilkinsburg, Pa. App. filed Feb. 19, 1917. For lightning arresters comprising solution of ammonium malate.

1,412,539. Telephone; Robert L. Murray, Bushey Heath, England. App. filed Sept. 16, 1920. Transmitter and receiver mounted back to back.

1,412,545. System of Control; Norman W. Storer, Pittsburgh, Pa. App. filed May 26, 1917. Regenerative control of electric vehicle motors.

1,412,546. Means for Minimizing Commutator Flashovers; Norman W. Storer, Pittsburgh, Pa. App. filed Oct. 30, 1918. Discharge gap between terminals.

1,412,567. Means for and Method of Wave Transmission; John Mills, Wyoming, N. J. App. filed Dec. 30, 1916. Reduces static interference.

1,412,570. Electric Switch; Herman G. Pape, New York, N. Y. App. filed Aug. 9, 1919. Pull socket for lamps.

1,412,572. Machine Switching Telephone System; Lipa Polinkowsky, London, England. App. filed Dec. 6, 1918. Switching for combined manual and automatic system.

1,412,586. Recording System; Horace H. Welch, Milwaukee, Wis. App. filed May 2, 1919. For measuring, recording, and integrating pressures, temperature, etc.

1,412,589. Electric Controlling System; Thorsten Zweigbergk, London, England. App. filed March 16, 1920. Main motor-driven controller actuated by master controller.

1,412,636. Motor Control; John F. Tritle, Schenectady, N. Y. App. filed June 6, 1919. Acceleration of motor by automatic relays.

1,412,644. Combined Socket-Cover and Lamp-Ring Light Fixture; Robert S. Aspinwall, Detroit, Mich. App. filed March 30, 1921.

1,412,726. Influence Electrical Machine; Louis Vogel, Strasbourg, France. App. filed June 28, 1921. Static machine for therapeutic treatment.

1,412,734. Telephone System; Charles L. Goodrum, Brooklyn, N. Y. App. filed Jan. 30, 1917. Switching relays replaced by magnets on automatic system.

1,412,735. Electric Heating Device; Simon Halle, Arlington, Md. App. filed Dec. 26, 1918. Open circuits at predetermined temperatures.

1,412,748. Electrical Ceiling Fitting Connection; John A. McKay, Toronto, Ont., Can. App. filed July 1, 1918. Terminal block.

1,412,759. Cementless Strain Insulator; Frank J. Stevens, Rochester, N. Y. App. filed June 18, 1917. Successive disk held by clamping device.

1,412,764. Electric Furnace; Arvid Westerberg, Djursholm, Sweden. App. filed Nov. 17, 1915. Design of choke coils to limit fluctuations.

1,412,776. Magnetic Chuck; Oswald Coradi and Henri Graf-Buchler, Zurich, Switzerland. App. filed July 8, 1920. Magnets extend entirely across surface of chuck.

1,412,782. Stationary Induction Apparatus; William O. Dwyer, Pittsfield, Mass. App. filed Jan. 26, 1921. Construction of transformers to eliminate harmonics

1,412,791. Electrical Measuring Instrument; John H. Miller, Wilkinsburg, Pa. App. filed Oct. 13, 1917. Printing demand meter.

1,412,792. Electrical Ignition Machine; Knut H. Morck, Buffalo, N. Y. App. filed Jan. 4, 1919. Automobile magneto.

1,412,817. Reactor and the Like; Friend H. Kierstead, Pittsfield, Mass. App. filed March 27, 1920. Reactor and protective device combined.

(Issued April 18, 1922)

1,412,827. Steam Turbine; Karl Baumann, Urmston, England. App. filed Feb. 28, 1919. Supporting feet of turbine act as ventilating ducts to alternator.

1,412,853. Synchronizing System; Lloyd Espenschied, Hollis, N. Y. App. filed Sept. 30, 1919. For two independent generating stations by carrier current.

1,412,908. Synchronizing System; Karl S. Van Dyke, Chicago, Ill. App. filed June 10, 1920. For two independent generating stations by carrier current.

1,412,909. Electrolysis Suspension Hook; Edmund Voigt, Chicago, Ill. App. filed April 22,1921.

1,412,933. Automatic Flux Control for Ignition System; Hayner H. Gordon, Washington, D. C. App. filed Nov. 20, 1917. High-tension magnetos.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME. — The Penobscot River Company, recently organized, contemplates the construction of a hydro-electric plant on the Rockabema River, in the vicinity of Howland. The project will include a transmission and distributing system.

BRATTLEBORO, VT.—The Village Commissioners are considering establishing a municipal electric distributing system for street lighting. It is proposed to secure electricity from the Vernon station of the Connecticut River Power Company.

ST. ALBANS, VT.—The Public Electric Light Company has applied to the Public Service Commission for permission to build a hydro-electric plant on the Lamoille River.

ST. JOHNSBURY, VT.—The Twin State Gas & Electric Company is considering the erection of a transmission line from St. Johnsbury to Gorham, N. H.

BRISTOL, N. H.—The Bristol Electric Light Company has petitioned the Public Service Commission for permission to extend its service into Hebron.

TURNER FALLS, MASS.—The Turner Falls Power & Electric Company has applied to the Department of Public Utilities for permission to issue $3,000,000 in bonds, part of the proceeds to be used for new construction.

Middle Atlantic States

BUFFALO, N. Y.—An appropriation of $60,000 has been approved for replacing all gas lamps with electric lamps in the parks and parkways.

CROTON FALLS, N. Y.—George Juengst & Sons, owners of the local electric light plant, are installing a 200-hp. Worthington oil engine and a 160-kw. General Electric generator. George Juengst, Jr., is manager.

DOWNSVILLE, N. Y.—The Holmes Milling Company expects to install street lamps during the coming summer.

NEWFANE, N. Y.—The Newfane Electric Company has increased its capital stock from $20,000 to $100,000 for proposed expansions.

POUGHKEEPSIE, N. Y.—Plans are under way by the United Hudson Electric Company for the construction of a second power unit of about 20,000 hp. capacity at Rifton, to cost about $400,000; also for the erection of a transmission line from Catskill to Ravena to connect with its system into Poughkeepsie and other territory it serves.

ALLENTOWN, PA — The Pennsylvania Power & Light Company has contracted to supply power to operate the Wyoming Valley traction lines. Service will be furnished from the Harwood station.

HARRISBURG, PA. — Plans are being prepared for an underground conduit system in the uptown and hill sections for the municipal fire and police alarm system. Clark E. Diehl is city electrician.

HARRISBURG, PA.—The Lighting Department is preparing plans for the installation of incandescent street lamps in the section bounded by Front, Sixteenth, Market and Paxton Streets, to replace the present arc lamps. S. F. Hassler, city commissioner, in charge.

HARRISBURG, PA.—The Boad of Education will soon take bids for the erection of a central power plant for school service at Third and Division Streets, to cost $150,000. C. Howard Lloyd, Telegraph Building, is engineer.

HUMMELSTOWN, PA.—The Council has appointed a committee to obtain estimates of cost for a municipal electric power plant.

PHILADELPHIA, PA.—A power plant will be installed in connection with the new fifteen-story hotel (Sylvania) to be erected at Juniper, Watts and Locust Streets, to cost about $3,000,000. LeRoy B. Rothschild, 1225 Sansom Street, is architect.

PITTSBURGH, PA.—Bids will be received by the Board of Education until May 16 for electric lamps and other supplies for the local schools. G. W. Gerwig is secretary.

READING, PA.—The Metropolitan Edison Company will construct a transmission line from its power house at West Reading to the plant of the Pennsylvania Edison Company, Easton, to cost about $500,000. Transmission lines will also be built to connect with the system of the York Haven Water & Power Company, recently acquired.

TITUSVILLE, PA.—The Titusville Light & Power Company contemplates the erection of a 23,000-volt transmission line from Titusville to Oil City, a distance of 17 miles.

WILMINGTON, DEL.—The Department of Public Safety has approved plans for extensions to the conduit system for police and fire alarm lines.

BALTIMORE, MD.—The Board of Awards, City Hall, will receive bids until May 10 for 100,000 ft. of single vitrified clay conduit for the Electrical Commission.

BETTERTON, MD.—The Betterton Ice & Power Company contemplates the installation of another unit, consisting of a 20-kva. generator and a 25-hp. oil engine. Charles H. Brice is secretary.

HAGERSTOWN, MD. — The Louis H. Wiebel Company will rebuild its power house recently destroyed by fire.

SOUTH HILL, VA.—Bids will be received by the Town Council until May 10 for construction of waterworks, sanitary sewers and electric light plant, including the construction of power station, pole line and the purchase of the following machinery: Two 90-kva. generators directly connected to two "Unaflow" engines, one five-panel switchboard, two 100-hp. return tubular boilers, open feed-water heater, feed pump, one 50-gal.-per-minute deep-well pump and motor, two 750-gal.-per-minue simple duplex pumps, etc. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 9, for one 25-kw., 60-cycle transformer for the local navy yard. (Schedule 9599.)

North Central States

LANSING, MICH.—Work is now under way on the new 10,000-kw. municipal electric light plant. The building is designed for an ultimate capacity of 55,000 kw. W. B. Kirby is secretary of board of commissioners.

ROGERS, MICH.—The Consumers' Power Company, Jackson, has work under way on the rebuilding of its two-story power plant, recently destroyed by fire. The new station with machinery will cost about $400,000.

AKRON, OHIO. — The Northern Ohio Traction & Light Company will make extensions in its transmission and distribution lines and underground conduit system, to cost about $175,000. Plans are under consideration for power-plant extensions, etc., to cost, including the above work, about $1,000,000.

BUCYRUS, OHIO.—The Western Power Company, recently incorporated, will build a transmission line from Bucyrus to Newark. Amos Keller is secretary.

DAYTON, OHIO.—The Dayton Power & Light Company contemplates extensive additions to its system, including the installation of new boilers and a 27,000-hp. steam turbine and the erection of a 330-ft. smokestack at the Millers Ford plant; also to enlarge and double the output at the West Side substation, at a cost of $150,000. The total cost is estimated at $2,000,000.

KANSAS, OHIO.—A company has been organized by Lewis Jones and John Greiger, both of Kansas, to construct and operate a local light and power plant.

LIMA, OHIO.—Extensions to the boulevard lighting systems is under consideration. George L. Kirk is chief engineer of the municipal electric light plant.

PAYNE, OHIO.—The municipal electric light plant has been purchased by Cyrus Schumacher. The new owner is changing the system from direct to alternating current and is rebuilding the transmission lines. Electricity for operating the system is furnished by the North Western Ohio Light Company.

WARREN, OHIO.—The Ohio Public Service Company is preparing plans for the construction of a 132,000-volt transmission line from Warren to Alliance and Massillan.

MEXICO, IND. — The Mexico Electric Company will install a new 30-hp. water turbine this year. C. H. Black is owner and manager.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has increased its capital from $300,000 to $400,000 for extensions and improvements.

PARAGON, IND.—Bids will be received by C. M. Bowman, town clerk, until May 31 for the installation of an outdoor-type substation and distributing system.

VEEDERSBURG, IND.—The installation of a new motor-driven 500-gal. per-minute rotary pump is under consideration by the Light and Water Commission. C. H. Bish is superintendent.

ALBION, ILL.—The Albion Electric Company is extending its transmission lines to Browns, 4 miles east, and to Bone Gap, 6 miles northeast of Albion. Cale Gough is president and manager.

ALVIN, ILL.—The Alvin Grain & Electric Company is planning line extensions into rural districts. Frank E. Yeazel is president.

CHICAGO, ILL.—Extensive additions and improvements are contemplated by the Commonwealth Edison Company, including the installation of two 30,000-kw., 12,000-volt, 60-cycle turbo-generators, six new substations equipped with lighting and railway converters, transformers and storage batteries, and necessary extensions to transmission and distribution systems.

HINSDALE, ILL.—The Village Board is planning to change the municipal electric lighting system from 1,100 volts to 2,300 volts during the coming summer. George H. Williams is village clerk. Through error this item appeared under Hinsdale, Mich., in the issue of April 15.

KEWANEE, ILL.—A special election will be held on June 5 to vote on a proposition to establish a municipal electric plant in Kewanee.

MILLSTADT, ILL.—New equipment will be installed in the municipal power plant, for which bonds have been voted.

RICHMOND, ILL.—The McHenry County Light & Power Company, operated by the Southern Wisconsin Electric Company, Lake Geneva, Wis., contemplates extending its transmission lines to furnish electrical service in Big Foot and Alden. Joseph Denison, Lake Geneva, Wis., is purchasing agent of the Southern Wisconsin company.

SIBLEY, ILL. — The installation of a storage-battery outfit in the municipal electric light plant is under consideration. W. R. Preston is clerk.

FLORENCE, WIS.—The erection of a transmission line to the Brule Settlement, a distance of 7½ miles, to furnish electricity to the farmers in that section from the municipal electric light plant is under consideration by the Water and Light Commission. O. Trempe is superintendent.

MARSHFIELD, WIS.—The boiler room of the municipal electric light plant is being enlarged and a 557-hp. Erie City boiler installed. A new 750-kva. electric generating unit will be installed some time this year. A. L. Brownell is superintendent.

TONY, WIS.—The Ashland (Wis.) Light & Power & Street Railway Company contemplates the construction of a hydro-electric plant on the Flambeau River, near Tony, to cost about $3,000,000, with transmission lines.

BAGLEY, MINN.—The Water and Light Commission contemplates the installation of a larger generating unit in the municipal electric light plant and erecting additional lines. G. M. Hanson is manager.

LAKEFIELD, MINN.—The installation of a new 150-kw. steam-driven generating unit in the municipal electric plant is under consideration. J. J. Hartneck is manager.

BATTLE CREEK, IOWA.—The Charles E. Churchill Electric Light, Heat & Power Company contemplates some improvements to its plant, including water softener, extra water-heating devices, etc. Charles E. Churchill is general manager.

DAVENPORT, IOWA.—The United Light & Railway Company will make extensions and improvements in its local distributing system, to cost $65,000.

DES MOINES, IOWA.—The Des Moines Electric Company has issued $958,000 in bonds, part of the proceeds to be used for extensions and improvements.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company has appropriated about $75,000 for extensions and improvements to its electric and gas systems.

GLIDDEN, IOWA. — The Hall Electric Company contemplates rebuilding and extending its system. C. H. Hall is purchasing agent.

MOUNT AYR, IOWA.—The Iowa Southern Utilities Company contemplates the installation of a 600-hp. boiler and a 4,000-kw. turbine. E. F. Bulman, Centerville, is manager.

ANNAPOLIS, MO.—The Annapolis Lead Company will build an addition to its power plant. M. C. Rhodes is president.

BOLIVAR, MO.—The Council is considering calling an election to submit the proposal to issue bonds for a new municipal electric plant to the voters.

JEFFERSON CITY, MO.—The State Capitol Commission has plans under way for the installation of an ornamental lighting system on the Capitol grounds. Egerton Swartwout, 18 West Thirty-fourth Street, New York, is architect.

KIRKSVILLE, MO. — Plans have been drawn for extensions and improvements to the power plant at the Northeast Missouri State Teachers' College, including the installation of new equipment.

LINN, MO.—The Linn Electric Light Company is considering installing an oil engine, meters and establishing a twenty-four-hour service. G. W. Tainter is secretary.

MALTA BEND, MO. — J. E. Lunbeck, owner of the local electric light plant, is considering installing a smaller generating unit to handle a day load.

NEW MADRID, MO.—The installation of ½ mile of series street-lighting lines is under consideration by the Municipal Light and Power Commission. L. A. Richards is manager.

PATTONSBURG, MO.—The Pattonsburgh Light & Ice Company expects to make considerable line extensions and install additional power equipment. George E. Silver is president.

POPLAR BLUFF, MO.—The Iron Exploration Company will install a power house in connection with its proposed crushing, washing and screening plant.

ST. CHARLES, MO.—At an election held April 22 the proposal to issue $250,000 in bonds for the installation of a municipal electric lighting system and extensions to the municipal waterworks system was defeated. Carr Edwards is city engineer.

ST. JOSEPH, MO.—The National Biscuit Company will build an addition to the power house at its local plant.

ST. JOSEPH, MO.—At a recent election the proposition to issue $300,000 in bonds for an addition to the municipal electric plant was defeated.

WAVERLY, MO.—The Waverly Electric Light Company contemplates installing a steam-driven plant this fall and also some pole-line extensions. William C. Bartlett is owner and manager.

ARTHUR, N. D.—The Farmers' Elevator Company contemplates the installation of a new storage battery. J. A. Burgum is secretary and treasurer.

WHITE LAKE, S. D.—The White Lake Light & Power Company contemplates installing new equipment this year. W. J. Peters is owner and manager.

OAK, NEB.—The Meyer Hydro-Electric Power Company is making investigations relative to increasing its water-power capacity. Ernst Meyer is president and manager.

FOWLER, KAN.—A special election has been called to vote $18,000 in bonds, for the construction of a transmission line. J. O. Bevis is engineer.

Southern States

CONCORD, N. C. — The Locke Cotton Company will build a transmission line to connect its Locke and Buffalo mills.

OTEEN, N. C.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until May 16 for the installation of two electric passenger elevators in the United States Veterans' Hospital.

RALEIGH, N. C.—The Caroline Power & Light Company contemplates erecting a double-circuit steel-tower transmission line, designed to carry 75,000 hp., from Baden to Sanford, via Swift Island and Almans Ferry, to cost about $3,000,000. P. A. Tillery, Capitol Apartments, is general manager.

WILMINGTON, N. C.—The property of the Tidewater Power Company has been acquired by A. E. Fitkin & Company, 141 Broadway, New York. The new owner contemplates extensions and improvements to the system.

CHARLESTON, S. C. — A power plant will be installed in the new twelve-story hotel to be erected by the Francis Marion Hotel Company, to cost $1,200,000.

FORT VALLEY, GA. — A. J. Houser, owner of the local electric light plant, is considering the installation of a 120-kva. generating unit this fall.

ST. PETERSBURG, FLA.—At an election to be held May 13 the proposal to issue $300,000 in bonds for the construction of a municipal electric light plant will be submitted to the voters. C. T. Baker has been engaged as consulting engineer.

GREENVILLE, ALA.—The Council contemplates an ornamental lighting system on Commerce Street and other streets in the business section.

LUCEDALE, MISS.—The Lucedale Light & Power Company is contemplating installing an ice factory in connection with its electric plant. P. P. Bailey is manager.

SPRINGDALE, ARK. — The Springdale Light & Power Company contemplates erecting an 11-mile transmission line to furnish electricity to the Rogers (Ark.) Light & Water Company. V. McDaniel is treasurer and manager.

ALEXANDRIA, LA.—Plans are being prepared by the Louisiana Gravity Canal Company for five hydro-electric generating plants to be located at Lake Charles, Washington, Jennings and in the vicinity of Alexandria, with a total capacity of about 125,000 hp. The cost of the project is estimated at about $650,000. Welman Bradford is president.

MELVILLE, LA.—Plans are under consideration by the City Council for remodeling the municipal electric light plant, including the installation of new machinery, to cost about $35,000. The Swanson-McGraw Company, United Fruit Building, New Orleans, is engineer.

NEW ORLEANS, LA.—The United States Engineer Office, Custom House, La., will receive bids until May 11 for a turbo-generator, motor, switchboard, controllers, etc., for the United States pipe line dredge "Gulfport."

SHREVEPORT, LA.—The Lighting Commission is considering the installation of an ornamental lighting system on Milam Street. The plans call for seventy-two standards.

WINNSBORO, LA.—The Council is considering the installation of a municipal electric plant in connection with a new waterworks system, for which $80,000 in bonds have been voted.

CARTER, OKLA.—A special election will be held on May 9 to vote on the proposal to issue $23,500 in bonds for an electric substation and distributing system. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

HEAVENER, OKLA.—Jet condensers for both units will be installed in the municipal electric plant this fall. A transmission line will be erected to the town of Hodgens this summer. R. M. Edwards is manager.

RED ROCK, OKLA.—Bonds to the amount of $55,000 have been voted for the installation of an electric distributing system. Ray Purvis is city clerk.

SENTINEL, OKLA.—A new electric generating unit is being installed in the municipal light and water plant. About a mile of new transmission line will be erected to the new waterworks. L. W. King is manager.

WELEETKA, OKLA.—The Council has awarded a contract to the Ladd Construction Company, Scarritt Building, Kansas City, Mo., for a new transmission line, extensions and improvements in distributing system and electric pumping plant, to cost $72,000. Contract for power-house extensions, etc., will be awarded later. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CUERO, TEX.—The Cuero Light & Power Company contemplates extensions and improvements to its plant.

KILLEEN, TEX.—J. L. Bailey, Temple, Tex., owner of the local electric plant, contemplates improvements to the station, including the installation of new equipment.

LOCKHART, TEX.—The Citizens' Light & Water Company contemplates installing a 150-kw. generator. Arthur Seeliger is secretary.

PIONEER, TEX.—A franchise has been granted to J. A. Jackson, Pioneer, to construct and operate an electric plant here.

WACO, TEX.—The Texas Power & Light Company has tentative plans under way for the construction of a transmission line from Waco to Austin, about 108 miles. The company is reported to be negotiating for the municipal plant at Austin. If it is taken over, it will be enlarged to furnish service to the entire district.

Pacific and Mountain States

KALAMA, WASH.—The Oregon-Kalama Lumber Company, recently organized with a capital of $500,000, will equip its proposed new mill for electrical operation. W. D. Moreland is head.

SEATTLE, WASH. — The Puget Sound Power & Light Company has arranged for an issue of $1,100,000 in capital stock, part of the proceeds to be used for extensions and improvements.

SEATTLE, WASH.—Work is now under way on the first 48,000-hp. unit of the Skagit River development of the municipal electric system, to be finished in 1923, which includes the installation of two 24,000-hp. turbines, timber crib dam, rock tunnel, a 105-mile, 165,000-volt transmission line and a step-down substation in Seattle. J. D. Ross is superintendent.

TACOMA, WASH.—The City Council is considering the construction of two steam-electric plants for emergency service, to be located near the factories of the St. Paul & Tacoma Lumber Company and the Wheeler-Osgood Company, on the tide flats, which will also furnish power to these mills.

MILTON, ORE.—The Council has been granted permission to construct and operate a municipal power plant on the Walla Walla River.

CORNING, CAL.—W. H. Samson is organizing a company to construct and operate four hydro-electric power plants in Shasta County, with total capacity of 28,000 hp., to cost about $1,500,000.

DAVIS, CAL.—The Pacific Gas & Electric Company, San Francisco, will build a number of one-story buildings in Davis for general repair shops.

LOS ANGELES, CAL.—The Los Angeles Railway Company, Pacific Electric Building, preparing plans for a substation on Kingsley Drive, to cost $30,000.

LOS ANGELES, CAL.—Bids will be received by the Department of Public Service, Room 602, Public Service Building, until May 12 for lead-covered cables and accessories in accordance with Specification No. P-270. James P. Vroman is secretary.

OAKLAND, CAL.—Bids will be received by the Supervisors of Alameda County, Oakland, until May 15 for construction of power house and laundry building, etc., at the farm site of the Alameda County Hospital. G. Gross is county clerk.

ORANGE, CAL.—The Board of Trustees will install an ornamental lighting system on West Pine Street from East Chapman to East Palm Avenue. C. C. Bonebrake is city engineer.

PASADENA, CAL.—The City Directors have approved an ordinance for the installation of ornamental lamps. The plans provide for a total of seventy-three lamp standards. E. P. Dewey is city engineer.

SACRAMENTO, CAL.—Plans for the new hospital to be erected on L Street, near Twenty-eighth Street, by the Sutter Hospital Association, to cost $500,000, include a power house. Frederick H. Meyer, Bankers' Investment Building, San Francisco, is architect.

BOISE, IDAHO.—The Pacific Power & Light Company, Portland, Ore., has applied to the Federal Power Commission for permission to construct a hydro-electric plant on the Snake River, with ultimate capacity of 400,000 hp. A series of ten dams will be constructed for the water head.

GLENDIVE, MONT.—The Northern Pacific Railroad Company, St. Paul, contemplates the erection of a new power plant here, to cost about $50,000.

COLORADO SPRINGS, COL.—The Colorado Springs, Light, Heat & Power Company is preparing plans for extensions and improvements to its steam-driven electric plant.

Canada

FORT SASKATCHEWAN, ALTA.—Improvements are contemplated to the municipal electric light plant, including changing the system from two-phase to three-phase and respacing overhead lines from 24-in. centers to 36 in. to conform to the new Alberta rules. E. Barnott is superintendent.

NELSON, B. C.—The City Council is considering extending a 12,000-volt, three-phase transmission line 10 miles to furnish electricity to small settlements, farmers and fruit ranches. G. T. McGuire is manager of the municipal electric light plant.

WINNIPEG, MAN.—Bids will be received by the Committee on Public Utilities until May 15 for three 1,000-kva. transformers for the city power plant, Rover Avenue.

BROCKVILLE, ONT.—The Hydro-Electric Power Commission of Ontario has begun work on the erection of a new transmission line on the St. Lawrence system between Morrisburg and Brockville.

NIAGARA FALLS, ONT.—The Municipal Hydro-Electric Commission has awarded contract for a new substation to the Robertson Construction Company, Niagara Falls, to cost about $67,190

PAISLEY, ONT.—The erection of a transmission line from Chesley to Paisley to supply electricity from the system of the Hydro-Electric Power Commission of Ontario in Paisley is under consideration.

WINDSOR, ONT.—The transportation committee of the City Council has recommended that Ontario Hydro-Electric Power Commission be requested to erect an auxiliary steam power plant in Windsor.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary. H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Niagara Falls, Ontario, June 26-30.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 26 to July 1.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, Spring Lake Beach, N. J., June 19-25.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual meeting, Cleveland, Ohio, Sept. 11-15.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada. Annual convention, Ottawa, June 15-17.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Hot Springs, Va., May 24-26.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Daytona, May 15-16.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto. Annual meeting, Boston, Sept. 25-28.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Convention, New Bedford, Mass., Aug. 22-25.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa. Annual meeting, Lake Okoboji, Iowa, June 20-22.

Kansas Public Service Association. Secretary-treasurer T. T. Parker, Kansas Electric Utilities Co., Emporia, Kan.

Kentucky Association of Public Utilities. Secretary, E. F. Kelly, Louisville Railway, Louisville, Ky.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Middle West Division, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Convention, Atlantic City, May 15-20.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 5-7.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting, St. Paul, Minn., June 13-15.

Northwestern Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 11-14.

Oklahoma Utilities Association. Acting secretary, O. D. Hall, Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal. Annual meeting, Los Angeles, May 31-June 3.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November, executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Secretary-treasurer, Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington, W. Va.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Utilities Association. Executive secretary, John S. Cadby, Madison, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

Electrical World

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New York, Saturday, May 13, 1922

Volume 79

Number 19

Aspects of the Convention

PERHAPS no convention of the National Electric Light Association has held the significance and the opportunity which mark the gathering in Atlantic City next week. Forty-four other such meetings have passed into history, but the circumstances of this one are unique. And the men come with an unusual degree of purpose and expectation.

BEFORE this great convention will be presented for consideration this combination of conditions that affect us all:

1. The American people have lifted themselves out of the backwash of the war to the point where good times are clearly coming back again and the work of extension and expansion may be actively taken up once more.

2. The entire electrical industry, inspired by the N. E. L. A., has stepped forth in a movement to "electrify" the homes and industries of the nation, for the elimination of waste, the stimulation of economic health and the greater service of mankind, through the enjoyment of all the comforts and advantages of a broader use of electricity.

3. The great subject of superpower development and the interconnection of distributing systems is before the engineer and the executive, with new vision and new possibilities.

4. The restoration of more normal conditions in the money market has opened up a favorable source of ample funds for new financing.

5. The rapid evolution and adoption of the new idea of customer ownership of utility securities has wrought a revolution in the common conceptions both of the value of public sentiment and of the duty of the executive toward his community.

6. The coming of radio broadcasting has introduced interesting new problems for the operator and a picture of a possible opportunity for service to the public in a quite unexpected field.

These are the interests uppermost in the minds of electrical men right now. These will be the topics talked about in the meetings and among the groups who gather to exchange the personal experiences that give so great a value to these great national meetings of central-station personnel. And it is an inspiring thought that back from Atlantic City to all the communities across the land these men will carry the potential progress of the coming year in terms of electricity.

THE cost of such a convention in time and money is as nothing compared with the profits that can be taken from it both for the central-station industry and for the people whom it serves. For there is no source of education like contact with other minds all eager in the common problems. And in this business both knowledge and imagination must be sought abroad.

To President Bump and the members of the National Electric Light Association at Atlantic City the ELECTRICAL WORLD extends its greetings and its heartiest congratulations. This year and this convention will be rated high in the annals of the industry. The year to come promises great things.

Sidney Z. Mitchell

A pioneer in public utility work and one of the foremost financiers in the industry.

FEW men in the public utility business possess such an intimate grasp of all its phases as Sidney Z. Mitchell. Whether as pioneer, operator or financier, Mr. Mitchell's ability is everywhere acknowledged. One has but to consider the magnitude of the undertakings that come under his supervision and the initiative skill and vigor displayed in their management to comprehend the man in part.

Mr. Mitchell's connection with the electrical industry started soon after his graduation from the United States Naval Academy in 1883. The fall of 1885 found him pioneering in the Northwest as agent for the Edison incandescent lighting system. In order, however, that no detail of the Edison system should escape him, Mr. Mitchell first served a sort of apprenticeship in the company's Goerck Street shops in New York. On reaching Seattle, Mr. Mitchell organized and financed the firm of Mitchell, Sparling & Company, which held the exclusive right of erecting Edison plants in Alaska, British Columbia, Washington, Idaho and Oregon.

Just as the year 1885 was about to pass into history Mr. Mitchell contributed to its annals by starting on Dec. 30 in Seattle the first incandescent-lighting central-station plant west of the Rocky Mountains. The city had then a population of about four thousand, and the incandescent lighting-load was fed from a No. 10 25-kw. Edison machine. Service was at the rate of $3 per lamp per month. From that time Edison stations were installed in rapid succession, and such was Mr. Mitchell's success that the General Electric Company brought him to New York in 1905 to organize the Electric Bond & Share Company. As head of that company Mr. Mitchell's genius for organization had greater scope, and as a result he directs to-day the activities of the largest aggregation of central-station organizations in the world, embracing such systems as the American Gas & Electric Company, the American Power & Light Company, the Utah Power & Light Company and a number of others. Of late years Mr. Mitchell has concentrated his attention principally on problems of finance, and his knowledge of this, coupled with his schooling and experience in the public utility business, has made his counsel and advice especially valuable to the National Electric Light Association, of whose public policy committee he has been chairman for the past two years.

Editorial Comment

Electrical World, May 13, 1922

Volume 79 Number 19

Respite for the Industry Is Over

WHEN the industrial depression settled down over the country last year it was felt that the central generating and distributing companies would have a brief respite from the constantly accelerating growth which has characterized the industry during the past decade. The data which have been published during the past six months indicate that this respite has indeed been brief. In fact, thirty-three of the seventy-six companies having an output during 1921 of more than a hundred million kilowatt-hours reported an output in excess of that reported for 1920, and in February of this year the average daily output exceeded that of any previous month in the history of the industry. The industry must now hasten its building program if it is to be fully prepared, for with the return of industrial activity to normal and the addition of about twelve hundred thousand new domestic lighting customers energy requirements next winter will tax its generating capacity to the utmost.

As indicated in this issue, it is estimated that the industry will spend $325,000,000 for additions and extensions to existing systems during 1922 and will add 1,772,000 kw.-hr. to the generating units of the country. This is the largest amount ever spent by the industry for extensions in any one year, and the added generator rating is also far in excess of any previous yearly addition. How far this new equipment will exceed or go toward fulfilling the added needs of the country for energy is, of course, entirely dependent upon the degree to which industry in general will return to normal productivity next fall. The industry, however, is evidently on its toes and arming itself in no small way for the materially increased call for energy which is certain to come.

Service to Farming Communities

ALTHOUGH the rapid spread of interconnected high-tension networks necessarily brings the farmer and rural communities nearer to electric power circuits and dependable twenty-four-hour service, it is nevertheless expedient for the industry to reach out in other ways after the farmer wherever it is economically possible to do so. The farmer, of course, can do much on his own behalf, but he can hardly appreciate a thing he has never experienced or miss a thing he never possessed. Only those farmers who have installed farm-lighting outfits have any comprehension of the conveniences of electricity or any adequate idea of the value of central-station service. It is possible for a number of farmers to combine and erect at their own expense standard circuits for electric service if they are provided with the specifications. Experience has shown that farmers in a great many cases put up better pole lines in quicker time than erecting crews of electric light and power companies. This is one way of encouraging the farmer and of keeping down the cost of extensions to a minimum. It does not solve the problem entirely, however. The house and barns must also be equipped. Inasmuch as all cities, not industrial, are dependent on the farming communities which surround them, anything which helps the farmer to become more productive necessarily means that much added prosperity to the city. One who cannot discern this relationship must be lacking in intuition. Hence the advantage of electricity on farms and the wisdom shown by the National Electric Light Association in devoting so much attention to rural-line extensions.

Selective Selling and Salesmen's Compensation

ONE of the inevitable issues that will develop with the quickening of business activity and selling effort among the utilities will be the old, old question of how to pay the salesmen. Shall it be a straight salary, a combination of salary and a bonus, or a commission with a nominal salary base? Shall the salesman be left to sell the thing that is easiest, or to specialize on his particular hobby—as, being human, he will do—or shall it be made automatically interesting and profitable to him to direct his energies to the creation and development of the kinds of load that are the most valuable and satisfactory to the company?

The old ways of the old days, when the thought uppermost in the salesman's mind was to find somebody to whom something could be sold, have to be laid aside. It is not just a question of disposing of the capacity or of getting the greatest number of contracts signed. After all, the purpose is to sell the output of the stations for the most profitable return by selecting the classes of business that will combine efficiently to provide a creditable load curve. It is the purpose also to obtain this business in locations where the expense and investment entailed in connecting and serving it are as small as possible, and to do this it is necessary to exercise both discretion and intelligence in the selective development of new business, that out of it may come the maximum service to the community and generous profits to the stockholders.

To bring all this about there must be more than conversation, more than the analysis of the local market. There must be some practical provision that will stimulate the salesman to work for the best class of business by rewarding him according to his achievement. Commissions paid on appliance sales only have not been found to be the influence that is needed. Should it be a combination based on both sale profit and energy consumption? The whole matter is one of no small importance.

Savings Bank Investments in Utilities

THE constitutions of some states permit saving banks to invest in high-grade public utility securities, but in the great majority of the states such permission is withheld. Obviously it is necessary to safeguard the savings of people who by thrift and hard work have managed to accumulate a small amount of money for a rainy day. The history and constancy of earning power of some utilities, especially electric light and power companies, have been such, however, that many persons of means seeking sound investments have looked rather favorably on them. It was felt that if the securities of well operated and managed public utilities were considered sound enough for conservative investors, there was no reason why savings banks should not also be permitted to put some of their accumulated funds in such bonds. Certainly, if there was any doubt about the soundness and stability of the investments, reputable utility men would not suggest them to savings-bank officials and the latter would be the last to wish to jeopardize the funds intrusted to their care. It is significant, therefore, that both the Association of Mutual Savings Banks and the National Electric Light Association should seek to remove the constitutional inhibitions against investments by savings banks in public utility securities. Thus far considerable progress has been made, and there is every reason to believe that within the next few years the securities of public utilities properly safeguarded may become legal investments for mutual savings banks. Incidentally, this work shows the advantages of co-operation through national associations, whereby hundreds of millions of dollars may be made available for public service, with mutual benefit to the borrower and the lender.

Scheduled Inspection Will Forestall Service Interruptions

EVERY progressive electric service company and industrial plant insists on regular inspection and maintenance of its equipment, and some companies put their schedules on paper. Relatively few, however, go into the details of outlining exactly what conditions shall be particularly observed and what degree of abnormality will be tolerated, the judgment of the inspector being relied upon instead. If he has had long experience, this practice may be right, but every company must shape its plans to include the cadet or newcomer as well. Furthermore, the responsibility for inspection should be definitely fixed, and the records should show the condition of all equipment at any time.

A system which meets all of these requirements is discussed in this issue by Alex. Bauhan of the Pennsylvania Water & Power Company. He describes means of obtaining better maintenance which can be applied to any kind of industrial undertaking. The scheme is to keep the men responsible for upkeep interested in their work by providing for them a method of continuously watching its progess. At any time by simply looking at a chart on the wall the status of each man's work and of the detailed inspection can be checked up to date.

This system is based on a comprehensive outline which is widely distributed among the men. This outline is complete in all details, telling exactly what must be looked for and what kind of report is wanted on each class of equipment. The responsibility is divided among all, and interest is aroused by the fact that the work is constantly verified and under criticism by means of visible charts. A systematic "follow-up" of repairs, using similar charts, is also provided for. A study of the various charts will at any time indicate what maintenance work must be done in the future, show when this work is done and provide means of bringing about improvements based on absolute records of performance. An inspection system to insure upkeep built upon more correct fundamentals is difficult to conceive.

Some of the Higher Strategy of Engineering

SOME scoffer once defined an engineer as a man who could do for fifty cents what any fool could do for a dollar. This is overstressing the economic side of engineering, because sometimes it is necessary for the engineer to spend several dollars to accomplish what any fool thinks he could do for fifty cents. However, the economic problem is one which constantly confronts the profession. A paper by L. R. Lee in the current issue brings up in a very suggestive way the sort of thing with which the engineer has to struggle—with more or less success according to his skill and to his economic environment. The latter is no small item, not in what constitutes good engineering, but in imposing limits of one sort or another upon those things which the engineer is at liberty to do and in which he must, within those limitations, reach the best possible results.

Looking at the matter broadly, there are two radically opposite economic situations which the engineer has sometimes to meet. First, he may find himself confronted by the fact that his clients are engaged in a desperate financial struggle even to keep their noses above water, let alone to swim high and comfortably. He finds the line of operations which is clearly indicated by the necessities of the case entirely blocked. He would like to build a station giving the necessary output at the best possible figure, but discovers that there is no money in sight which can possibly carry out his plans on an adequate scale. Whether he likes it or not, he must economize, giving his clients not the kind of station which ought to be built but the best expedient for which they can by the utmost effort raise money to pay. The problem may take various forms. It may be necessary to cramp the capacity in a station, to sacrifice something of efficiency, to give up the hope of homogeneous equipment, even to forego the installation of copper that is really needed; but if the engineer knows his business, he can balance one factor against another, always with an eye to the possibility of future financing, and achieve a plant that will at least give reliable service and permit of later improvement.

A directly opposite situation, although not quite so common, falls within the experience of almost every engineer sooner or later in his practice. The financial backers, when the engineer comes to analyze their real demands, wish to obtain as imposing and showy a plant as possible to serve as the basis for a bond issue considerably bigger than is necessary to carry out the dictates of sound installation practice and to put the plant in first-class earning condition. In the one case the necessary thing is to keep down expense, in the other to keep expense up to the limit that the bond market will stand for. The condition of an engineer thus transferred from poverty to riches is a very curious one. His plant must be above all things conservative, following only lines which other plants carrying huge bond issues have followed, and no expense must be spared for which any ostensible reason can be drummed up. Far-sighted economic practice must take a back seat. It is not "standard." This may sound like a fancy picture of a constructor's elysium, but it is not.

Providentially, neither extreme is now so common as the middle ground of trying with somewhat limited means to do the very best possible for the system, and this more than anything else involves a really prophetic spirit as well as limitless finesse in equipment. For instance, a combined steam and water station is under way. Will the market outrun the conservative minimum capacity of the hydraulic privilege in one year or in twenty? Will the load ten years from now stand any chance of justifying the immediate development of the privilege to a fair maximum value, backed by a steam station? If so, where shall the station be situated with reference to the coal prices in 1932, and will it pay to go in at once for a high-efficiency steam plant on the theory that it will be pretty steadily required at the later date? May it not be wiser to look forward to linkage with a somewhat distant hydraulic plant of large capacity from which power can be bought at a price comparable with the then probable price of steam power?

If a transmission line has to be built, is it better to have one steel-tower line running direct or, at the same expense, a ring circuit of cheaper construction with wooden poles, and in either case what will prove to be the most desirable voltage in view of possible interconnection later? Shall we play the limit now or take the conservative view and probably have to reinsulate later? These are the sort of questions for which every engineer has sooner or later to seek answers, and they are the kind of thing for which no formal training will ever qualify one. The power to analyze these complicated situations and pick out the wise line to follow in dealing with them are the things which separate the skillful engineer from the duffer. Mr. Lee has done the profession a good service in marshaling some of the things which engineers have to face in an array which, if not always encouraging, is indubitably instructive.

Change to the Three-Phase, Four-Wire System Not So Difficult

THE ELECTRICAL WORLD has advocated repeatedly the more common use of the three-phase, four-wire system of distribution. The fundamental advantages of this system have been pointed out from both the operating and the economical standpoint. This system is in both respects the most advantageous possible for any given voltage. It has often been asked in these columns why so much hesitancy has been shown in adopting it. The answer seems to be that opposition to the change is due in great part to the seemingly difficult and expensive work of cutting over from one system to the other. This obstacle is not so serious as many think, and it can almost always be overcome.

It is gratifying in this connection to call attention to the article in this issue showing how the West Penn Power Company made a successful change in Connellsville from the two-phase system to a three-phase, four-wire system under conditions that were apparently of more than usual difficulty. We hope a study of this successful change will encourage others who are facing the necessity of improving their distribution conditions and are afraid of departing from present practice.

Something New in Service —the Load-Curve Barometer

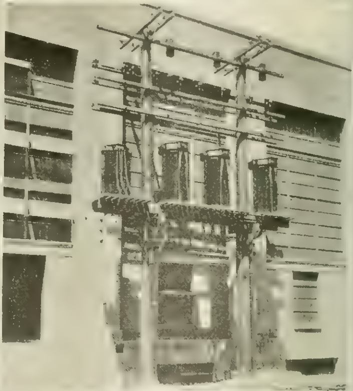
IN CLEVELAND and in Utica the bankers and business men are habitually studying the load curve of the local central station as a practical barometer of local business. Could there possibly be any more impressive manifestation of the vital nature of the service which this utility renders to the community? The fact that the power used is in direct proportion to the number of operatives and machines at work and therefore to the output makes this index a closer tally on actual business than either bank clearings or sales, and the power load provides a diversity of contacts that makes the record most dependable. The details of the experience in these two cities are given in this issue.

There is something more in this, however, than a gratuitous service to business men. Above all, it is a demonstration of the adaptability of electric service to the needs of industry and the well-nigh universal dependence upon the central station for that most fundamental resource of all lines of business—power. To impress this thought upon the public and establish a more observant and interested recognition of this economic element which every light and power company contributes to local industry is worth any amount of effort on the part of the management. But it is a matter of no difficulty whatever to prepare a load-curve chart and an interpretation for the business man, and to maintain it and distribute it each month to all who will be interested. It will not only tell the story, but will serve to recall continually to the mind of the business man just what the power company means to him.

Interconnection of Small Systems

ONE excellent result of the discussion which has centered around interconnection is that it has served to clarify the situation. There is no question of the economy of interconnection and of the enormous other benefits accruing to users and utilities alike where large systems are involved, and hence the initiative for most interconnections has come from the operators of large systems. It is only because the economic and operating conditions inherent in such a scheme are not so instantly apparent to the operators of small systems unless it involves supply from a superpower station that among them the practice has been permitted to lag. However, operators of small stations will find it not only convenient but profitable to interconnect. Service is thereby improved in quality and decreased or stabilized in cost, and not infrequently, owing to the diversity of the interconnected system, added loads can be taken on without increasing the equipment. In all cases of interconnection the amount of reserve necessary to guarantee service is reduced. There seems to be an erroneous idea to the effect that interconnection involves heavy expenditures if the economic benefits latent in particular situations are to be realized, but it is surprising to note the improvements that may be had by the outlay of only trifling sums and the operating advantages which accrue from unified operation and control. In fact, interconnection shows up to advantage on smaller systems, and there is no reason why it should not be followed as a reasonable policy when justified on engineering and economic grounds.

OPPORTUNITIES



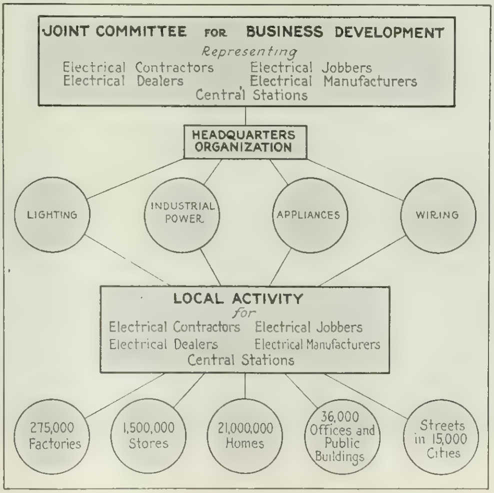
WITH water powers undeveloped and superpower stations at coal mines still to be built, with power houses and systems to be interconnected and industries, farms and homes waiting to be equipped; with commercial departments more or less dormant and new applications being found daily, the opportunities of industry are immense.

Business Development—What It Means to the Central Station

By EARL E. WHITEHORNE
Commercial Editor Electrical World

The New Conditions and Their Import—The Electrical Industry Not Ready—How the Central-Station Company Must Build Up Its Selling Staff and Help to Organize the Local Electrical Trade

THE electrical industry has embarked on a great movement for business development. Business development is to be the keynote of the convention of the National Electric Light Association in Atlantic City. It has been the outstanding feature of the administration of President Bump. It is to be the chief objective of the incoming administration of President Smith, and this monster meeting at Atlantic City will launch the program that is intended to result in a continued effort to be maintained through five or ten years and to set up a permanent progressive policy of creative business development activity that will embrace the entire industry in all its branches.



BUSINESS DEVELOPMENT IN THE ELECTRICAL INDUSTRY

This chart pictures the purpose of the big movement for business development following from the joint committee through the subcommittees on the four major subjects, through the local electrical men to the consumer.

Such is the purpose. It was proposed by President Bump in January to a gathering of men representative of central-station companies, manufacturers, jobbers, contractors and dealers who had been called together to discuss the opportunity. It has been indorsed by the organized associations of all interests. The principle has been unanimously accepted, and a joint committee for business development has been established to develop the plan and carry it forward. This committee has formed sub-committees, and these subcommittees have produced and published five guide books, one on organization and one each on lighting, appliances, wiring and industrial power. The inevitable period of preliminary general conversation has passed and the time for action has come.

The question is: What shall be done first? And the answer is a double one. First of all, we must concentrate on tuning up the industry to fit the conditions in the country, and, second, we must tune up the habits and the functioning of the different branches of the electrical industry so that they will harmoniously coordinate in this great common purpose. "Billy" Sunday, when he used to pitch his "gospel tent" and start a new series of revival meetings in another town, would stretch a banner behind the pulpit platform and on the banner were the words "Get right with God!" The meaning was clear, and there could be no argument about it. The electrical industry needs a banner in its own campaign tent right now. It would be well if it could be displayed before every meeting of electrical men of every class that will be held this summer. The banner should read "Get right with the times!"

For conditions have been changing very rapidly. Out of the world war we came into first a boom and then a valley of depression. After excited years in which the art of selling demoralized into habitual order taking we have swung back into a natural market where goods must be sold by intelligent creative work. After an abnormal period in which manufacturers and jobbers were continually oversold and exercised their ingenuity not in the development of business but in the avoidance and selection of it we have restored competitive conditions. During the war the demand for central-station service, for electric power and heat and light and appliances was overwhelming. Capacity was sold and oversold, and it became a problem of prevention and conservation, not expansion. So central-stations reduced their selling staffs and finally in very many cases eliminated the salesman entirely. Today, with the war load gone and with costs reduced so that more business becomes both desirable and profitable, the central stations of the country, with certain notable exceptions, are either undermanned and underorganized or altogether lacking in readiness to play their vital part in the great movement for business development which the conditions in the country now justify and both the service of the public and the prosperity of the industry demand.

For good times have returned to America, and we—the people—are slowly beginning to realize it as we watch the continuous encouraging procession of the symptoms of better economic health that are now approaching on the horizon. Every newspaper we read tells more about it—larger industrial production, increased employment, cheaper money, bigger sales totals, lower cost of living, more car loadings, railroads placing orders, farmers getting back upon their feet, building construction steadily accelerating, record business on the stock exchanges, expressions of confidence and satisfaction from the big men of every trade and class, plus a continual contact with personal acquaintances and friends who cheerfully testify that "business is picking up." Clearly the public is taking heart, and we but wait the full, gradual realization of all these things by every man and woman before building and buying will be restored to free activity and the people of America will proceed to repair and replenish and restore all those things for which they have been prudently waiting so long.

The reaction upon the electrical industry of this expanded demand through all the channels of business will be tremendous. There are 5,350,000 homes still unwired along existing central-station lines. How many of the householders in these homes have decided that when times are better they will have electric light at last? Nobody knows, but it requires little imagination to realize that there is an infinite number. In the background beyond the lines and in the country there are 8,000,000 other homes. How many will desire to buy farm-lighting plants? How many will be clamoring to be connected from the nearby power lines? Over 1,100,000 lighting customers were added to the central-station load in 1921. It is estimated that 1,231,000 will be connected this year, and 1,179,000 next year, and 1,179,000 in 1924. The bulk of the new business, it is safe to say, will be in homes.

It is known that during the war, when domestic servants were so hard to get, a great impulse was given to the popularity of electric household appliances. All these newly wired homes will need and want and can be made to buy appliances, and practically all the other millions of already connected houses are underequipped and offer to the industry a market past all calculation. And what of the proportionate volume of commercial lighting business, of street lighting that has waited for good times, of industrial power, of industrial heating, of electric vehicle load?

In every field the normal development has been retarded in the last few years. It lies before the salesman now. Truly as an opportunity it makes a picture that the mind's eye cannot span.

The Industry Not Ready

The market is ready. But the industry is not ready, and so this movement of business development has been initiated. The joint committee has been set up to tie all classes of electrical men into the work, and the National Electric Light Association has led in the movement as an example to every individual central-station company. For the accomplishment of this development must be achieved locally—in the educational activities, the publicity and selling of individual electrical utilities, manufacturers, jobbers, contractors and dealers to the people of their own communities. And in each town the central-station executive, the central-station commercial staff and the central-station policy will form the keystone of the arch on which the local movement will either stand or fall.

PROMINENT DISPLAY SPACE IS VITAL

The successful central station salesroom must be not only a display room but a practical store that makes it easy and comfortable for people to get acquainted with all the old and new ways of "doing it electrically" and to buy what they want. This is the model "floor" of the Nebraska Power Company in Omaha.

What should the central stations do in this great industry movement—each in its own town? There is nothing difficult about the answer, because the records of the most successful of our central stations point the way. The point is that these things cannot be merely talked about; they must be done by systematically proceeding to set up a properly functioning sales department by a series of progressive steps.

What the Commercial Manager Must Be

First, the central station must secure a commercial manager, and this is perhaps the hardest step, for there are unfortunately fewer trained and able commercial managers in the industry than there were ten years ago. During the war and after it many were cast out and scattered. Many went into other departments and other businesses. New material will have to be attracted to the work. Electrical men of marked merchandising instinct and ability must be put into these positions and trained for the leadership which they must exercise in their communities. Or other men with merchandising instinct and sales experience in other lines must be schooled for the work.

For the opportunity is greater than the scope of our existing organization. New commercial managers must be recruited. Let them come from the ranks if there are proper men at hand, but the first consideration is to get the job done soon and well, and if the right man is not available within the organization, he must be secured from some other source. First of all, he must be an executive, a salesman and a friend maker. This instinct and this power must be in him, and it is better to take him from outside and school him with electrical knowledge than to pick an electrical man just because he is such, if he lacks these qualities that are essential to success. Then this commercial manager must have men—

A lighting salesman who will go to factories and stores and offices and homes and sell a better standard of illumination and build up more and better lighting business.

A power salesman who will go to factories and shops and stores and all the local industries and introduce electric power and industrial heat for every possible application and build up more and better power business.

An appliance salesman who will go to the homes and to the offices and to the stores and sell the idea of "doing it electrically"—to outfit every customer with electric labor-saving and comfort-buying appliances and build up more and better appliance business.

An advertising-lighting salesman who will go to every merchant and business man in town as a specialist on advertising by illumination, to sell them the profitable uses of window lighting, signs, outlining, ornamental street lighting, illuminated bill boards and floodlighted buildings and build up more and better advertising-lighting business.

A wiring salesman who will co-operate with the local contractors and actively sell wiring to both old and new homes and additional lighting and convenience outlets to every domestic and commercial customer and build up more and better load and a more complete electric service for all connected customers.

An electric vehicle salesman, in all large cities, who will educate the merchants and the manufacturers to the advantages of electric road trucks and industrial trucks and tractors, co-operating with the vehicle manufacturers to build up more and better storage-battery business.

EQUIPPING THE COMMERCIAL STAFF

The commercial staff must then have things to work with—quarters for the salesmen, with desks, charts, a quota dial, a blackboard and card files, an appliance store and the right policies. A power survey must be made, and an appliance survey, so that the selling may be done in known quantities and not by guess. For the commercial department that is to be right with these times must be made up of "net salesmen" and not "gross salesmen." The old idea that any kind of business is good that will absorb capacity has got to go. For it is not enough to contract for a thousand kilowatts to one big industry and have it safely sold at the minimum rate, while there is small-power business, store-lighting and sign business and residence appliance business waiting and ready to be more profitably developed.

By all means, open the doors to business of all kinds, but build up the load balanced for net returns and not for gross output. It does not pay to carry goods to the new far-distant customer, when, more profitably and easily, you can develop other equally good business that you are now passing as you go down each street.

The commercial department which will function properly in these new times must be an organization that

EVERY SALES STAFF NEEDS GOOD QUARTERS

The successful central station commercial department must be equipped with every facility for good work. This is the headquarters of the selling staff of the Pennsylvania Power & Light Company, in Allentown, a model office, complete in all details, with salesmen's desks, district maps, prospect card racks, blackboard and quota dial.

is in business to make money as any other business does. And the profits of the sales at proper prices of appliances and equipment can be made to carry the expenses of the department, rent, salaries, overhead and other costs. It has been done. It is being done. It can be done in other cities. It must be done if the central-station sales department is to measure to its opportunity and function as it should in the local trade.

ORGANIZING LOCALLY

For in this great nation-wide movement for business development initiated by the electrical industry everything depends on the local organization. But the central-station company is the keystone of the arch—not the whole arch. Even as the N. E. L. A. has led out for the industry, so must the individual central station lead out for the local family of electrical men in each community. No electric light and power man or men can do the job alone. And in the five guide books which have been prepared by the joint committee are suggested the steps by which the work of organizing an electrical league in each city should be carried out—first a meeting of a small group of the recognized leaders of the local group, next a general meeting to appoint committees to set up ways and means to start the work, with practical provision for administration, financing and a permanent program.

In this local plan not only electrical men must be engaged, but in so far as possible the local chamber of commerce, the press, the pulpit, all other public utilities and the other trades which will naturally be interested in helping in any movement that in the end will tend to bring about more building and buying. Architects, builders, carpenters, plumbers, painters, decorators and lumber and hardware people all can assist, and all will if they are shown the bigness of the plan.

The purpose of this movement is obviously greater and broader than any mere drive for orders. The clear-cut objective of the initial phase of the development must not be to carry the slogan "more business, better business," as was first suggested, for the electrical industry is not going to the people of America with an appeal that says just "buy my goods!" The real need is to carry to the public a confident belief in the fact that good times are indeed here and a willingness to lay aside fear and go ahead. Therefore, as a permanent slogan and a word of inspiration both to electrical men and to the country, there has been set up for universal use in the movement the call, *"Electrify!"* The industry will set to work with cheerful assurance, careful preparation and thorough work to electrify the factories, stores, offices, streets, farms and households of America. It will quicken the pulse of local business, restore and expand the prosperity of the electrical industry and render a service to the nation and to mankind of a value beyond conception. It will be not a campaign but a continued development that will hold through the years, reacting to the continued change and evolution of this fast-unfolding electrical era.

THE HEADQUARTERS FUNCTION

From the headquarters of the joint committee will come the national guidance and co-ordination of the work. Coming into contact officially with the associations that represent the different classes of electrical men, and directly with the many local workers who may not be affiliated with these organizations, this committee, which is composed of the elements of all four branches of the industry, must continue to function as the executive director of the work. H. O. Lane, who is officially the director of the movement, is most fortunately experienced for the office.

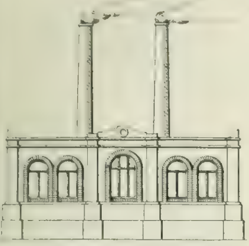
The tender of the services of the entire staff of the Society for Electrical Development provides a force of trained publicity and promotion men and women that should serve as the workshop of the industry to produce the data, the literature, the motion-picture films, the public speakers and the infinite variety of other material aids that will be needed. It is this kind of work for which the society was orginally conceived and established—a work that can best be conducted by a neutral agency serving and supported by all classes of electrical men, without bias or favor.

Such is the vision of this opportunity. And the time is now come to take up the work in each community.

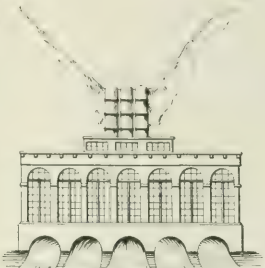
The Joint Committee for Business Development

Chairman: R. H. TILLMAN, Consolidated Gas, Electric Light & Power Company, Baltimore.
R. H. BALLARD, Southern California Edison Company, Los Angeles.
A. K. BAYLOR, General Electric Company, New York City.
A. A. BROWN, Westinghouse Electric Company, New York City.
MILAN R. BUMP, President N. E. L. A., Henry L. Doherty & Company, New York City.
E. L. CALLAHAN, Westinghouse Lamp Company, New York City.
LE ROY CLARK, Safety Insulated Wire & Cable Company, New York City.
REX COLE, Duplexalite Works, New York City.
C. L. COLLENS, 2d, Reliance Electric & Engineering Company, Cleveland.
S. E. DOANE, National Lamp Works, Cleveland,
F. R. FARMER, Beardsley Chandelier & Manufacturing Company, Chicago.
R. E. FISHER, Pacific Gas & Electric Company, San Francisco.
M. T. GLEASON, Gleason-Tiebout Glass Company, Brooklyn, N. Y.
C. E. GREENWOOD, Edison Electric Illuminating Company of Boston.
C. E. HILLIS, Electrical Appliance Company, San Francisco.
A. J. HIXON, National Association of Electrical Contractors and Dealers, Boston.
F. A. KETCHAM, Western Electric Company, New York City.
E. W. LLOYD, Commonwealth Edison Company, Chicago.
C. K. NICHOLS, New York Edison Company, New York City.
GEORGE OSBORN, Edison Lamp Works, New York City.
W. R. PUTNAM, Idaho Power Company, Boise, Idaho.
W. E. ROBERTSON, Electrical Supply Jobbers' Association, Robertson-Cataract Electric Company, Buffalo.
FRANK W. SMITH, vice-president N. E. L. A., United Electric Light & Power Company, New York City.
L. R. WALLIS, Edison Electric Illuminating Company of Boston.
P. B. ZIMMERMAN, National Lamp Works, Cleveland.

Additions to Systems During 1922 Will Total $324,016,000



STEAM-ELECTRIC GENERATING PLANTS
$100,543,000



HYDRO-ELECTRIC GENERATING PLANTS
$63,790,000

TRANSMISSION SYSTEMS
$75,588,000

DISTRIBUTION SYSTEMS
$84,095,000

"Electrical World" Survey Indicates that $100,543,000 Will Be Spent for Extensions to Steam Generating Plants—North Central States Lead in the Amount to Be Expended

IN ORDER that the increasing demand for electrical energy may be met, the electric light and power industry of the United States will spend more than $324,000,000 during the year 1922 for extensions to generating and distributing systems. This record figure for extensions, which is in excess of the total income of the industry for 1913, is over 51 per cent greater than that spent for similar purposes in 1921.

These figures are based on a survey of the new construction plans of the country just completed by the Electrical World, the details of which will be found in the accompanying tables. Returns were received from 237 companies distributed throughout the country. The best returns were those from the Pacific Coast, from which section reports come from companies representing 86 per cent of the installed generator rating.

The total value of the new additions to the central generating, transmission and distributing systems during the present year is estimated at $324,016,000. The estimated new generating installation totals 1,772,000 kw., of which about 58 per cent is for steam plants and 42 per cent is for hydro-electric plants. How far this new equipment will go toward filling the needs of the country for energy is questionable, depending largely upon the extent to which the industrial and lighting requirements increase during the year. Reports received for February of this year indicate a record energy output by the central stations of the country, and the industrial load at the present time is undoubtedly on the increase. It is estimated that 1,231,000 new residential lighting customers will be added to the central-station lines during 1922. These two ascending loads point to a material increase in energy requirements during the last quarter of this year. The total amount to be spent during 1922 for extensions to the transmission and distribution systems is estimated at $159,683,000, or 49.2 per cent of the total value of all estimated additions this year. In 1921 it was estimated that $119,144,000 was spent for extensions to the transmission and distribution systems, or 55.4 per cent of the total value of all additions made that year.

The greatest expansion during 1922 will take place in the North Central States and will reach a total of $96,700,000, of which about 54 per cent will be spent for new transmission and distributing systems and for extensions to those now existing. The Middle Atlantic States follow with an estimated new investment of $86,300,000, of which about 48 per cent is for steam-electric generating plants. It appears, therefore, that about 57 per cent of the total expenditures for extensions will be made by the companies supplying territory that contains the most intensely industrial sections, as well as the largest cities of the country.

It appears that the additions to the generating equipment of the New England States will be comparatively small during 1922. Twenty-eight of the largest companies of that section reported a proposed increase of only 45,000 kw. in steam-electric generating plants and 29,500 kw. in hydro-electric plants. Last year eighteen companies reported an increase of 65,000 kw. in the steam-electric plants, or 20,000 kw. over the 1922 additions reported by the twenty-eight companies. Whether this is indicative of a surplus amount of generating equipment in the central stations of this section is questionable, but it is significant in view of the fact that during 1921 only 80,000 new residential lighting customers were added to the systems in this section, one of the smallest proportionate increases reported by any section of the country. However, it appears that the extensions to the transmission and distribution systems of the New England States will materially exceed those during 1921.

The figures on the South Atlantic States are based on

TABLE I—SUMMARY OF REPORTS FROM 237 COMPANIES (OVER 2,500 KW. GENERATOR RATING), GIVING ADDITIONS TO GENERATING AND DISTRIBUTING SYSTEMS DURING 1922

Country and Sections	Companies Reporting		Steam-Electric Generating Plants			Hydro-Electric Generating Plants			Total Value of Proposed Additions to Steam and Hydro-Generating Plants During 1922	Value of Proposed Additions to Transmission Systems During 1922	Value of Proposed Additions to Distribution Systems During 1922	Total Value of All Proposed Additions During 1922
	Number	Total Generator Rating Jan 1, 1922, Kw.	Total Generator Rating Jan. 1, 1922, Kw.	Proposed Additions During 1922, Kw	Value of Proposed Additions	Total Rating Jan. 1, 1922, Kw.	Proposed Additions During 1922, Kw.	Value of Proposed Additions				
New England States	28	818,176	606,340	45,000	$3,466,000	211,836	29,500	$2,800,000	$6,266,000	$1,612,000	$1,942,000	$9,820,000
Middle Atlantic States	36	1,619,559	1,166,539	287,166	20,745,500	453,020	182,250	3,587,400	24,332,900	9,570,899	8,406,143	42,309,942
South Atlantic States	33	729,339	569,855	40,000	3,610,000	159,484	57,150	1,400,000	5,010,000	2,197,450	2,157,250	9,364,700
North Central States	60	1,412,698	1,158,188	207,630	12,018,244	254,510	26,775	3,381,640	15,399,884	6,416,122	8,793,256	30,609,262
South Central States	32	493,578	411,303	37,750	3,119,950	82,275	0	3,000,000	6,119,950	2,013,850	2,533,245	10,667,045
Mountain States	24	536,577	91,700	8,500	360,000	444,877	0	280,000	640,000	113,254	730,531	1,483,785
Pacific States	24	1,328,969	454,561	46,250	3,651,714	874,408	104,000	23,031,780	26,683,494	18,392,333	18,768,751	63,844,578
Total for United States	237	6,938,896	4,458,486	672,296	$46,971,403	2,480,410	399,675	$37,480,820	$84,452,228	$40,315,908	$43 331,176	$168,099,312

estimates to a larger extent than those from any other section, inasmuch as one of the largest generating and distributing companies of that section did not report its proposed extensions. This estimate has been carefully made, however, based on conditions in that section as reflected by reports from other large companies, and the total of $27,975,000 is believed to represent with fair accuracy the value of the extensions in that section during 1922.

The estimated value of extensions to the electric systems of companies operating in the Mountain States totals only $2,241,000. Of this amount 49.2 per cent will be spent for extensions to transmission and distribution systems and 36.9 per cent will go for extensions to equipment in steam-electric generating plants. No new hydro-electric extensions were reported by the companies of this section, and it is believed that no such extensions are contemplated in this section during 1922.

The Pacific States are the only section in which the expansion will fall below that of 1921. Of the estimated total of $73,745,000 to be spent this year, almost 64 per cent will be spent by the Southern California Edison Company and the Pacific Gas and Electric Company. It is estimated that the generator rating of this section will be increased by 175,000 kw. during the present year. There are two projects at present being constructed under a license from the Federal Power Commission which will have an ultimate development of over 690,000 kw. and will cost more than $112,000,000.

A study in detail of the reports submitted as summarized in Table I brings out some rather interesting comparisons. The cost of the proposed installations in steam generating plants during 1921 averaged $56 per kilowatt, while in 1922 it averaged $70 per kilowatt, although the average cost of construction and equipment is now undoubtedly below that of 1921. This apparent inconsistency is probably explained by the fact that several companies this year reported proposed extensions to their stations, such as new boilers, stokers, etc., with no additional generator units. For this reason comparative figures giving the cost per kilowatt for the two years are hardly justifiable. A similar condition exists in the cost of new additions to the hydro-electric plants.

It must be borne in mind that these estimates are for additions to generating and distributing systems which were operating prior to Jan. 1, 1922, and do not include the systems of new operating companies organized in 1922.

TABLE II—VALUE OF ADDITIONS TO ALL CENTRAL GENERATING AND DISTRIBUTING SYSTEMS DURING 1922 AS ESTIMATED BY "ELECTRICAL WORLD"

Country and Sections	Total Rating of all Generating Plants, Jan. 1, 1922	Steam-Electric Generating Plants		Hydro-Electric Generating Plants		Total Value of Estimated Additions to Steam and Hydro Central Generating Plants During 1922	Value of Estimated Additions to Transmission Systems During 1922	Value of Estimated Additions to Distribution Systems During 1922	Total Value of Estimated Additions to Transmission and Distribution Systems During 1922	Total Value of All Estimated Additions During 1922
		Estimated Additions During 1922, Kw.	Value of Proposed Additions	Estimated Additions During 1922, Kw.	Value of Proposed Additions					
New England States	1,303,825	76,000	$5,870,000	39,000	$3,690,000	$9,560,000	$2,570,000	$3,095,000	$5,665,000	$15,225,000
Middle Atlantic States	3,410,000	332,000	41,250,000	256,000	7,240,000	48,490,000	20,130,000	17,680,000	37,810,000	86,300,000
South Atlantic States	1,707,038	76,000	6,890,000	222,000	10,900,000	17,790,000	5,140,000	5,045,000	10,185,000	27,975,000
North Central States	4,850,959	388,000	34,700,000	78,000	9,800,000	44,500,000	22,000,000	30,200,000	52,200,000	96,700,000
South Central States	1,017,000	78,000	6,460,000	32,000	6,000,000	12,460,000	4,150,000	5,220,000	9,370,000	21,830,000
Mountain States	701,000	20,000	828,000	0	310,000	1,138,000	148,000	955,000	1,103,000	2,241,000
Pacific States	1,549,539	58,000	4,545,000	117,000	25,850,000	30,395,000	21,450,000	21,900,000	43,350,000	73,745,000
Totals for United States	14,539,361	1,028,000	$100,543,000	744,000	$63,790,000	$164,333,000	$75,588,000	$84,095,000	$159,683,000	$324,016,000

Reliability of Radio Shown by Broadcasting Experience

By J. C. MARTIN
Western Editor Electrical World

Experiences Met in the Operation of the Station of the University of Wisconsin Bear on Central-Station Problem—Difficulties Encountered and Experimental Work Necessary

NUMEROUS letters from distant points have testified to the receipt of programs from the various broadcasting stations in the United States. A study of the experiences of the owners of these receiving stations should give an accurate idea of the reliability of the radio telephone at various distances, but up to the present time no careful effort to gather data for the study of this problem seems to have been reported. Early this year, however, Prof. E. M. Terry and M. P. Hanson, who have the active charge of the radio-telegraph and radio-telephone station of the University of Wisconsin at Madison, sent out a questionnaire that was answered by 115 persons who had been operating receiving sets at distances ranging from less than 20 miles (32 km.) up to 250 miles (400 km.). These people dwell in Wisconsin, Illinois, Iowa and Minnesota. The station is heard with fair regularity as far south as Texas, and reports of reception of the market reports and entertainment programs that are broadcasted have come from states on the Atlantic seaboard. The questionnaire was sent at a time when the number of receiving sets was considerably smaller than at present and to persons who were close enough to be directly interested in the market reports of the Middle West and to whom their regular receipt would be valuable. For this reason the analysis of the answers to the questionnaire given here will be of real interest to the central-station operator who may be expecting to experiment with the radiophone as an aid in his work.

Without going into a complete technical description of the station, the principal point of interest to the prospective radiophone user is the amount of power required to broadcast. At the time the questionnaire was sent out the station had been operating with four 50-watt tubes, two being used as oscillators and two as modulators. The antenna input was approximately 100 watts. The circuit used is a slightly modified Heising circuit. Up to a short time before the questionnaire was sent out the operation had been at 800 m.,

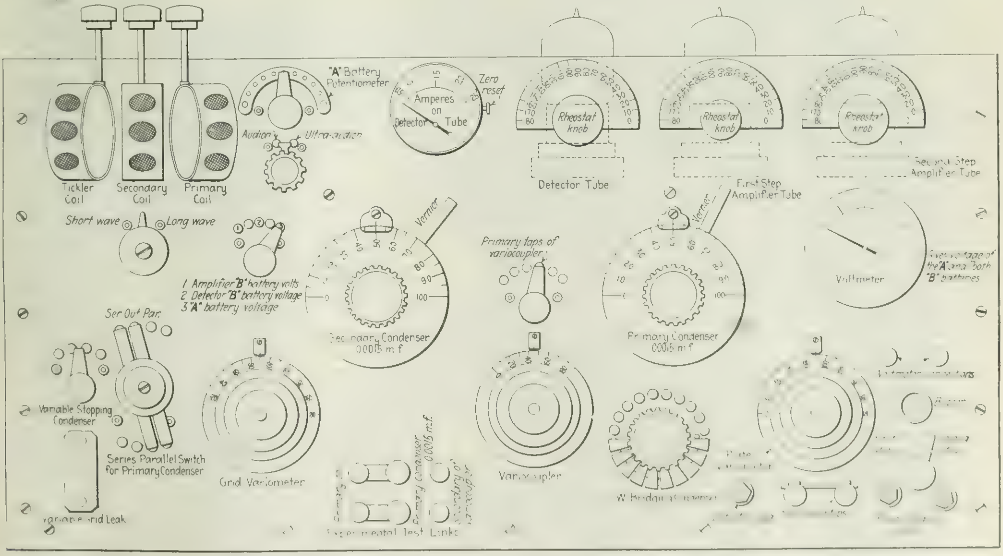
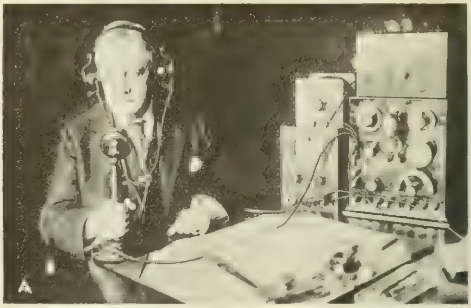

"A" Battery Potentiometer
Zero reset
Amperes on Detector Tube
Tickler Coil
Secondary Coil
Primary Coil
Audion
Ultra-audion
Rheostat knob
Rheostat knob
Rheostat knob
Detector Tube
First Step Amplifier Tube
Second Step Amplifier Tube
Short wave
Long wave
Vernier
1 Amplifier "B" battery volts
2 Detector "B" battery voltage
3 "A" battery voltage
Secondary Condenser 0.0015 m f
Primary taps of variocoupler
Vernier
Primary Condenser 0.0015 m f
Voltmeter
Gives voltage of the "A" and both "B" batteries
Ser Out Par.
Variable Stopping Condenser
Series Parallel Switch for Primary Condenser
Grid Variometer
Primary condenser 0.0015 m.f.
Variocoupler
Variable Grid Leak
Experimental Test Links

FIG. 1—RADIO-TELEPHONE RECEIVING SET USED BY GEORGIA RAILWAY & POWER COMPANY

Designed for long and short wave reception. Variometers and variocouplers are used for short wave reception and honeycomb coils for long waves. The circuit arrangement is shown in Fig. 2. This apparatus and the transmitting set illustrated in Figs. 3 and 4 are being used in experimental work to determine the feasibility of the radio telephone for interstation communication and direction of field men. Continuity of reception during emergencies is a most important consideration.

Radio Is Weaving Itself Into Every Fabric of Human Life

NO GROUP of pictures can adequately illustrate the extent to which radio telephony has woven itself into human life. However, the illustrations on this page may slightly indicate its ramifications. If some systematic compilation could be made of the receivability of messages by various amateurs, the operating conditions at the time and the equipment involved, the data should be very helpful in improving the reliability of radio communication. A shows Senator New of Indiana participating in a political debate with Senator Beveridge via radiophone, thousands of amateurs listening. B and D show the broadcasting station of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, D being the transmitting apparatus and B a receiving set for checking transmission. C—This vocal and organ recital in New York was heard by passengers on a Long Island Sound steamer 50 miles away and by many amateurs around New York. E shows an army officer directing the training of distant cavalrymen by radio.



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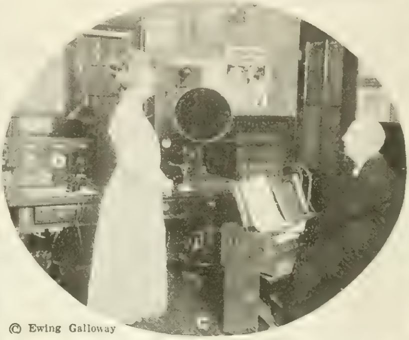

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but it was reduced to 485 m. for the market reports and 360 m. for the concerts. This was done to comply with the temporary regulations established by the government when broadcasting became a problem in the radio world. This change in wave length might have been expected to bring out no little comment, and, owing to some of the difficulties universally experienced with the shorter wave lengths, many complaints might have been expected. It is remarkable that only a few were received, and these did not seem to be of serious moment. They will be touched on later in the discussion of the answers to the questionnaire.

The table gives the principal data compiled from the answers. They have been roughly grouped by "miles distance" in an air line from Madison. The types of receivers show whether vacuum tube or crystal detector sets are used and the number of steps of amplification. As was to be expected, three and four steps of amplification are few in number because of the difficulties experienced when audio-frequency amplification is carried beyond three steps. This difficulty is due to the reaction between the various steps, which can be only partly eliminated by extremely careful shielding of the panel and the various steps from each other. The difficulties as well as the expense involved make more than three steps of audio-frequency amplification impracticable for the average amateur at the present time. Radio-frequency amplification has not been sufficiently developed, particularly for the shorter wave lengths, to be a factor in a study of this kind.

ANALYSIS OF TROUBLES REPORTED

The following comments are confined to the radiophone results. In the groups up to 50 miles (80 km.) distant the absence of reported trouble is rather remarkable. Complaints of trouble from those at greater distances are more frequent, but even these are not very numerous. One complaint of the "fading" of the radiophone broadcasting comes from a point about 30 miles (48 km.) distant where a vacuum-tube detector only is used. A station at about the same distance reports faint reception of the broadcasting at 360 m., a vacuum-tube detector only being used. One instance of the slight blurring of words is reported. The interference that might be expected from spark sets on the shorter wave length seems to be rather slight.

In the groups distant 50 to 100 miles (80 km. to 160 km.) one case of trouble was reported due to the hum of the generator at the transmitting station which supplies the plate voltage for the transmitting tubes. This brings up an important point that must be borne in mind at every radiophone station. If filter circuits are not properly arranged to damp out the commutator ripple from the direct-current generator or the ripple from the rectifying device, the proverbial threshing machine will seem a quiet operating device as compared with the racket which will be created in the receiver by the ripple of an improperly designed radio-telephone plate supply. Numerous cases have been noted in amateur radiophone transmission where the ripple in the plate circuit has actually drowned out the transmission of speech. One man in the 50-to-100-mile group complains of interference from the government stations along the Great Lakes. He was using a crystal detector at about 55 miles (88 km.). The form of crystal detector at present in common use is more susceptible to interference troubles than the vacuum tube, a fact that must be remembered in the design of equipment. It is also less sensitive, and, while reception at distances running up to 100 miles is noted in the answers to this questionnaire, the crystal is not ordinarily considered dependable for more than 15 to 20 miles (24 km. to 32 km.). Other complaints of interference from the same source were made.

PRINCIPAL CHARACTERISTICS OF SOME OF THE RADIO-TELEPHONE SETS RECEIVING BROADCASTING FROM THE UNIVERSITY OF WISCONSIN

Distance (Miles)	Number Reporting	Type of Receiver Crystal	Vacuum Tube	Amplification No Step	One Step	Two Steps	Three Steps	Four Steps
0 20	12	4	8	5	1	6		..
20 30	5	1	4		2	3		
30 40	12	.	12	5	3	3	1	
40 50	13	1	12	7	2	4		
50 60	12	1	11	7	1	2	1	1
60 70	9	.	9	6		3		
70 80	12	.	12	1	3	6	2	
80 90	8	1	7	3	4	1		
90-100	12	1	11	5	2	5		
100-150	13	..	13	5	2	4	2	
150 200	5	..	5	3		2		
200 250	2	..	2	1	1			
Totals	115	9	106	48	21	39	6	1

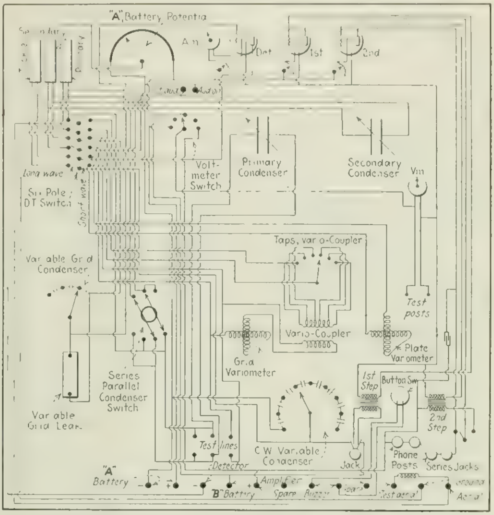


FIG. 2—RADIO-TELEPHONE RECEIVING CIRCUITS (SEE FIG. 1)

In the groups over 50 miles distant there is only one case noted where complaint of irregularity of reception is made. All through the answers run statements that reception is irregular, but these irregularities are due almost altogether to the fact that other duties prevent the individual from listening in regularly. In the list of occupations given thirty-five describe themselves as students. The remainder are scattered among all sorts of occupations, from the banker and business man to the mechanic and laborer. Even the answers from the students show that the market reports which form the most important part of the work of the broadcasting station are utilized in school work or for the benefit of others near by.

Among other suggestions made to better the service was one for improvement of modulation. The writer of this article can testify from personal experience that the modulation at this station is as good as the art yet knows how to make it, and no difficulties in reception are apparent from this source. The suggestion none the less brings up an important point. Imperfect modulation can cause the absolute failure of an otherwise first-class radiophone station. While perfect modulation is not yet attainable, it is possible for such purposes as those which interest the central-station company to reach a degree of perfection in which the expert technical observer will be the only one to be seriously annoyed by the distortion that cannot be eliminated. It is also well to remember that transmitting apparatus is not the only source of distortion; unless receiving apparatus is carefully designed, it is capable of spoiling the work of the most carefully designed transmitter. In the particular case noted the receiver was equipped with four steps of audio-frequency amplifications. In the present state of the art this is quite likely to be a source of distortion. The same is also true where loud speakers are used, as they may be for some operating purposes. Much remains to be done in developing these devices. So far the phonograph tone chamber seems to be the best of the loud speakers, as well it might be, since manufacturers have spent huge sums of money and much time in its development.

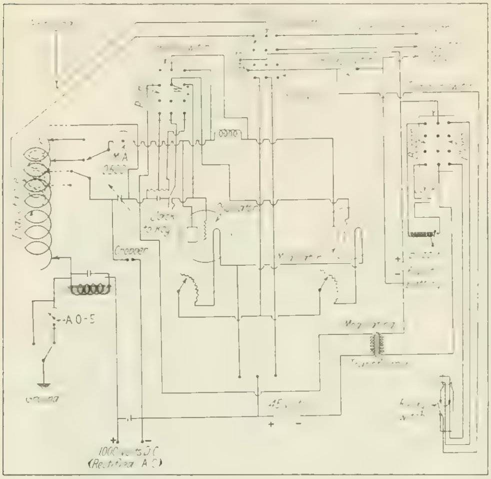


FIG. 3—CIRCUIT DIAGRAM OF 100-WATT RADIOPHONE BUILT FOR GEORGIA COMPANY

Of the two tubes one is used as an oscillator and one as a modulator. The set is also equipped with buzzer modulation and interrupted continuous wave for code work. The arrangement of equipment on panel is shown in Fig. 4.

Some Difficulties of Reception

Perhaps the greatest difficulty that is encountered in short-wave reception is the so-called "fading" or dying out of signals, particularly when long-distance reception is involved. The troubles do not seem to occur on the longer waves, some authorities saying that above 500 m. the difficulty disappears rapidly. Rather extensive tests were made by amateurs some time ago in an effort to determine the cause. The tests did not solve the difficulty, and while it seems probable that atmospheric conditions have much to do with the trouble, some recent observations extending over several months indicate that interference from other stations is a contributing cause that grows in importance as the number of telephone transmitting stations increases. In these observations a distant station has been repeatedly picked up when the "fading" of signals took place at intervals. By careful work in every case it has been possible to tune in and detect one or two other stations each of which was heterodyning the others. In some instances, when all but one of the stations has ceased operation, the remaining station is at once picked up. No sign of "fading" has remained. Other experiences with reception from a nearby transmitting station while a distant station was interfering indicated "fading" tendency on the part of the nearby station, although, because of its proximity to the receiving station, the signals were too strong to be completely overridden by the distant station. In radio-telephone work the interference of one radio-telephone transmitter with another may appear in the form of a general blanketing of the transmission of two stations working on the same or nearly the same wave length, rather than be shown by the direct interference by a mixture of signals such as often occurs in telegraphic radio work, particularly when spark or arc stations only are involved. Whatever the condition of the atmosphere may have to do with the trouble, the central-station operator is quite likely to find that the causes outlined above will be present and must be looked out for. A large amount of development and experimental work to minimize these effects as far as possible must be carried out if radio telephony in the service of the central-station company is to be of the maximum benefit. Among the reception difficulties complained of was that of induction from nearby machine shops and a telephone central rectifier. This indicates some of the central-station receiving difficulties that may be met when large generators or other rotating or transforming equipment is near receiving stations.

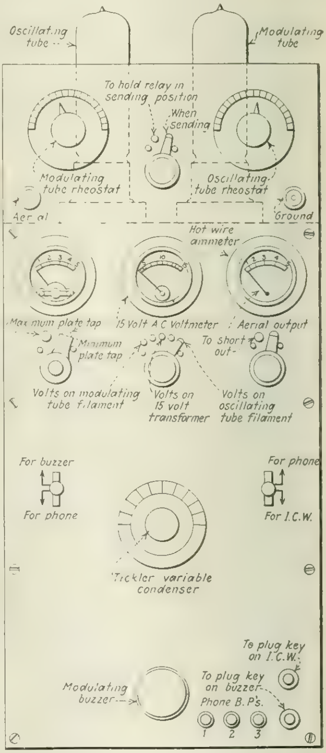


FIG. 4—RADIO-TELEPHONE TRANSMITTING PANEL (SEE FIG. 3)

One fact that is brought out in the experience of the university station in broadcasting market reports is the possibility of arranging code methods of communication that will be effective even under severe atmospheric disturbance. Regular forms on which to copy the radio market broadcasts are supplied to those who wish them. Each item that is quoted has a code designation. In selecting the code designations words made up of letter sounds that carry well are used. These sounds are those classed as hard, the softer-sounding letters being avoided as far as possible. The code is modeled after government standard practice in these matters, and it has been found that these code words will be copied under circumstances where the actual names of the items would not be understood at all. This points the way toward experiments in getting messages through under conditions that might be otherwise impossible.

In this connection it might be well to remember that, even under the best conditions of modern wire telephony, a surprisingly large part of the conversation of the person at the other end of the line is not understood word for word. This is not due to any defects in transmission or in the telephone plant itself, but to the fact that in the majority of instances the listener has a good knowledge of the subject of the conversation and instinctively avoids the mental effort needed to comprehend and register each word. The effect of this individual trait is more clearly seen when transmission is actually bad but when, notwithstanding, conversations of which only a few words can be caught are understood, because the receiver of the message knows much of what is to be said from previous familiarity with the subject. The same thing is observable in the case of a telephone line on a long high-voltage transmission line. The operators will easily and without serious effort carry on conversations that would be impossible to those who did not know the subjects under discussion. While this way of maintaining communication by radio telephone is not to be recommended as a regular practice, the radiophone is most likely to be called on when all other means of communication have failed and when communication of any kind may mean not only the saving of dollars and cents but perhaps the restoration of a service on which the safety of the community depends.

The analysis of the questionnaire proves little beyond the fact that more than a hundred persons have listened to market reports over a period running for some of them into approximately a year. Distances range up to 250 miles (400 km.). No serious complaint of any character was voiced in the answers. Undoubtedly, as every one who has had experience with questionnaires knows, some troubles were not reasonable. However, it is hardly possible with so many answers that serious difficulties could exist without their being voiced. Though the questionnaire answers no problem definitely, it does give an additional basis for confidence in the reliability of the radiophone for some classes of service, and it suggests some things that need to be taken into account in future experimental work by central-station men.

Credit is due to both Professor Terry and Mr. Hanson of the University of Wisconsin staff for assistance in the preparation of this article. Their hard work has made the university broadcasting station a real factor in the business world of a good many agricultural communities in the Middle West, as well as a source of education and entertainment to scores of people. Credit is also due H. L. Wills, electrical engineer and operating manager of the Georgia Railway & Power Company, for the details of the transmitting and receiving radiotelephone sets which are included in this article.

A Brief Review of Residence Wiring Experience

Selling Wiring at a Fixed Price with Fixed Terms Attracts Customers with Less Destructive Competition

STATISTICS on housing conditions, the number of unwired homes existing at present along established central-station lines and the growing value of a residence customer to an electric light and power company are overwhelming in their evidence that the field for house wiring is tremendous and worth while. But such statistics of opportunity are never so stimulating as actual records of achievement. It is not what can be done but what some one has already accomplished that stirs men to action. There have always been a vast number of unwired houses open to conquest.

There have for years been many thousands of wiring contractors in the country, all of them—until the war time—busily engaged in installing electric wiring. Many central-station companies in co-operation with the local wiremen conducted house-wiring campaigns with good result. Then came the war and a practical cessation of all building construction except for war industries, and the bottom dropped out of the wiring business. Electrical contractors, finding the backbone of their business broken, sought for the means to maintain themselves in the absence of construction work. They interested themselves more largely in appliance selling, began to call themselves more generally contractor-dealers, and let their attention wander from what in former times had been their prime function—the wiring of houses.

WHERE CAMPAIGNS OCCURRED

It is a matter of no little moment, therefore, that in certain cities the business of house wiring during this period boomed. No new houses were being constructed, but the local central station sensed the situation as an opportunity to interest the contractors in the wiring of the already-built residences located along the lines, and by highly organized co-operative effort the message of electric service was carried to the dwellers in these homes and they were induced to wire their houses and enjoy the comforts which electric light and appliances contribute to any household. Within the last few years of war-time and post-war conditions such campaigns have been successfully conducted in Portland, Me.; in Boston, in Hartford, in Brooklyn and New York City; in Philadelphia, Reading, Lancaster, Lebanon and Pittsburgh, Pa.; in Elmira, N. Y.; in Cleveland, Cincinnati, Dayton and Marion, Ohio; in Muncie and Kokomo, Ind.; in Chattanooga and Nashville, Tenn.; in Roanoke, Va.; in Columbus, Ga.; in Cedar Rapids, Iowa; in Barbourville, Ky., and in many other cities. And the fact that in Cincinnati alone, in a period of one year and a half, 25,000 houses were wired and connected to the circuits—this being the period including 1921, when business depression was at its worst—shows to what an efficient and successful basis this job of house wiring has been reduced by organization and what splendid possibilities it offers.

Out of these campaigns there have developed some interesting data and some very definite practice. In the first place, it has been established that the way to sell house wiring is to present it as a definite proposition at a fixed price and with fixed terms of payment. The average householder fears the plumber and he fears the wiring contractor, for he does not know to what expense the job will run once the work starts. There may be an estimate, but, alas! experience has proved too many times in the popular memory that there may be extras too. This reluctance, this persistent refusal, has been broken down, however, by making an offer at a flat price of so much per outlet, to be paid for so much cash down and so much in a series of easy monthly payments, and Cincinnati and Boston have added a thirty-day free trial offer, which brings much business and costs nothing because no one wants to quit once they have service.

THE PRICE PER OUTLET

In Cincinnati the price for a five-room house complete was $90, payable at $5 a month for eighteen months. In Boston a fixed schedule of prices was offered with a minimum installation of $14.35 and monthly payments ranged from twelve of $2 to twenty of $5. In Brooklyn prices were fixed with a two-dollar minimum and twelve months to pay. In Philadelphia payments were spread on from twelve to twenty-four months. In Roanoke, Va., flat offers ranged from $15 to $27.50, payable 10 per cent down and in twelve installments. In Reading they sold at a flat rate of $4 a room and a flat rate on the consumption. In Columbus, Ga., with fixed prices, 10 per cent was paid cash down and the rest in four months' time. In Lebanon, Pa., the first six outlets cost $19.20 and the remainder $2.60 each, plus fixtures. In Barbourville, Ky., the company gave the labor for wiring free and one month's service and sold all the material at cost. In Hartford no flat price was made, but the lighting company paid the contractor for his job, collecting on a period of twelve months. The details vary, but the principle is much the same in most cases—fixed prices per outlet and twelve months to pay.

In every case apparently the campaign offer has been developed through co-operation between the central stations and the local wiring contractors on a varying basis under which the lighting company assisted to a greater or less degree in the financing of the wiring contracts. By the Cincinnati plan, under which nearly 25,000 houses have been wired, the Union Gas & Electric Company threw the offer open to all contractors, but was finally compelled to assist and establish a single contractor who did the bulk of the work, so great was the demand. The company has financed all the contracts. In Boston at first the contractors were paid in full by the Edison company, but subsequently the financing was put in the hands of a regularly constituted financing corporation, thus freeing the funds of the central station. Moreover, they are now offering a thirty-day free trial in Boston, as in Cincinnati, and agree to pay the customer's net bill less 5 per cent cash discount if the installation is not accepted. The contractor must be able to carry up to $5,000 of partial-payment accounts, and he contributes 2½ per cent of the total wiring bill to a co-operative advertising fund.

In Cleveland the contractors work on a somewhat different plan, under which they receive a commission for soliciting wiring business and assign all money due under the contract to the bank. When the work is complete the bank advances 50 per cent of the value of the job and the contractor gives a note for the full amount. Then, as monthly installments are paid into the bank by the customer, one-third of each payment is credited to the contractor's checking account and the balance to the reduction of the note. This plan also relieves the central station of investment responsibility. In Dayton they used two forms of contract. Under one the contractor financed the plan on a basis of 20 per cent when the contract was executed and five monthly payments. By the other, contracts were secured by the central station and the contractor performed the work for 15 per cent less than the regular schedule of prices. The company offered 5 per cent for cash on completion of the work or allowed twelve monthly installments, with 10 per cent cash down.

In every case the obvious purpose is to help the householder wire his house and to relieve the contractor from the burden of carrying the account. For, naturally, in a big campaign the volume of business exceeds the ability of the average contractor to finance. But the loss involved in these transactions is, by the common experience, almost nothing. In Cincinnati there have been no bad debts. Dayton wired 7,000 houses in three years, with no regrets. Hartford wired 1,200 in a single month, Portland wired 700 in nine months, Chattanooga 3,000 in two years, Lancaster 865 in six weeks, Roanoke 600 in six months, Elmira 1,300 houses in a year, Cedar Rapids wiring contracts totaled $2,500, and the bills have been paid. It has become standard practice to allow 5 per cent for cash, and it is surprising how large a proportion of customers, although easy payments are offered, prefer to pay the bill entire. In Lebanon 90 per cent paid cash. Elmira reported 60 per cent.

REDUCES PIECE COMPETITION

One great advantage of the fixed-price campaign has been proved to be the elimination or reduction of the price competition that has existed to so large a degree between wiring contractors. Too often the householder calls in a contractor and obtains an estimate. He sends for another contractor to get a second bid to check against. The second man asks if he has had any one else figure, proceeds to talk the owner out of this switch or that baseboard outlet, so that the total of his estimate may come below the other fellow's bid, and when the job is done many elements of comfort and convenience have been sacrificed by this misguided, destructive price competition. But this fixed-price campaign offer tends to establish standards and provide accommodations that reduce the tendency toward this kind of price cutting and at the same time provides a larger volume of business and relieves the urgent stress of competition.

Under the influence of a well-organized campaign activity, house wiring also becomes an all-year business under constant process of development. The value of a campaign over the independent work of individual contractors is, in a word, the value of organization in any effort. The Society for Electrical Development has just published a most interesting and suggestive monograph, entitled "Building Housewiring Business," which outlines in detail the steps to follow in working out a house-wiring plan, arranging the basis of financing, developing the "prospect" list and getting the plan into operation. The Joint Committee for Business Development has also issued a guide book on wiring which outlines the important features of many recent campaigns and presents a bibliography of the subject. On both these publications this article has drawn for information.

Operating Interconnected Hydro Plants for Best System Economy

By J. W. ANDREE
Engineer Operating Department, Southern California Edison Company

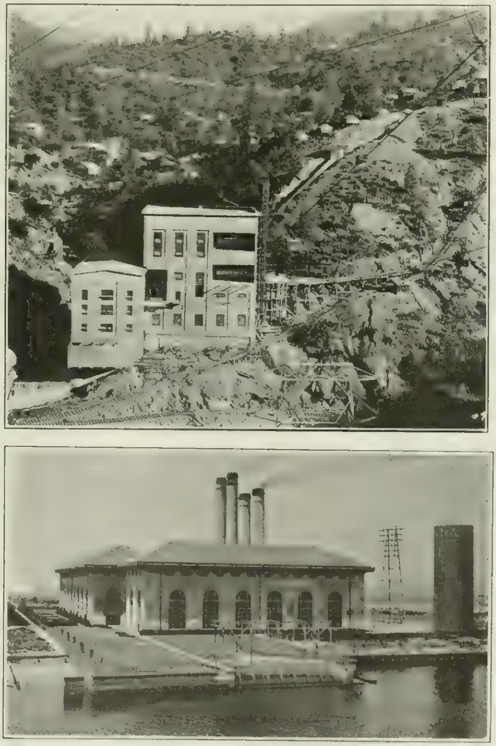
Requires Careful Balance Between Steam Stations, Storage and Base-Load Hydro-Electric Plants—How Southern California Edison System Minimizes Use of Steam Standby

A REDUCTION of the spare generating capacity in operation on the system of the Southern California Edison Company to about 8 per cent of the total load, or the equivalent of one of the largest generating units, has been accomplished without risks to the rendition of service. This is an important factor in the economical operation of the system. Furthermore, this spare capacity is carried in hydro-electric stations rather than steam stations, this being made possible by advantageous arrangements of the hydro-electric stations utilizing storage water. Although the specific means of accomplishing these results are, of course, peculiar to this system, the fundamentals will hold true for other systems.

The layout of the transmission system is of prime importance in insuring a high degree of continuity of service, and in this regard the system of the Southern California Edison Company follows the leading features of correct engineering. All important plants have duplicate transmission lines, generally on separate poles or towers, and all important load centers are fed from two or more directions. The transmission system is capable of separation into two or more parts to facilitate the handling of serious cases of trouble, and the lines are equipped with relay systems which will automatically cut out sections of lines on which trouble occurs.

On reference to the map of the transmission system shown it will be seen that Big Creek plants Nos. 1, 2 and 8 all tie into the 150,000-volt double-circuit line extending in a southerly direction toward the Eagle Rock substation near Los Angeles. At the Vestal substation the double lines from Kern River plant No. 3 are connected to this line. Here also load is diverted to the Mount Whitney system, which is fed from a single 60,000-volt loop line from which any substation may feed from either direction around the loop. The Kern River plant No. 3 is also connected to the Borel plant, situated a few miles down the river. From Borel duplicate lines run south to Monolith substation, from which a single line continues south, furnishing load to Lancaster and finally connecting to the Kern River lines at the Castaic substation. Load on this line may be carried from either direction.

From the Kern River plant No. 1 60,000-volt duplicate lines extend south to Los Angeles. From the Castaic substation a 60,000-volt line extends west to the Saticoy substation, where it is met by another 60,000-volt line which leaves the Kern River line at the San Fernando substation. From the Saticoy substation a double, 60,000-volt line extends to Santa Barbara, thus giving all load in this territory a duplicate source of supply. At the Macneil substation, further south, the Sherman line is connected with the Kern line. This is one end of the 60,000-volt loop line which extends around the city of Los Angeles and feeds into the city from all sides. The first of these feed points is the Culver City substation, which carries all the load in that section of the city and the west coast load. This substation is also fed by a 60,000-volt line from the Eagle Rock substation. From Culver City


FIGS. 1 AND 2—STEAM POWER IS USED ONLY WHEN ESSENTIAL

Energy is normally generated by water power exclusively on the Southern California Edison Company system. Big Creek No. 8, which is the latest addition to the hydro-electric plants, is shown at the top, while Long Beach steam standby plant is shown at the bottom. Operation of steam stations has been reduced to a minimum on this system by careful co-ordination of individual power resources.

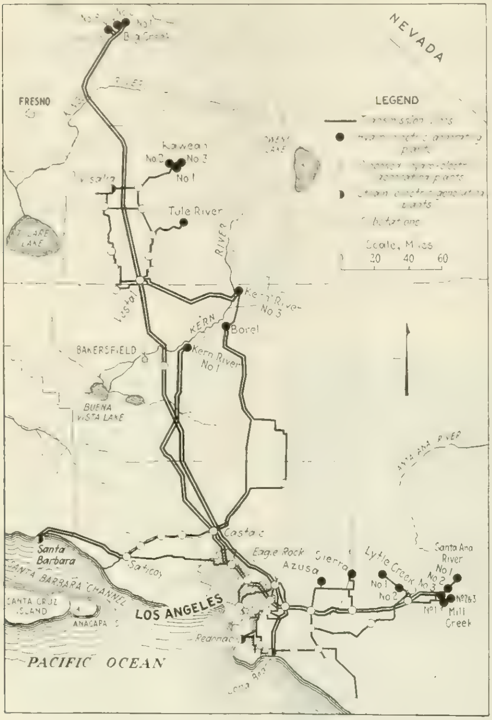


FIG. 3—DUPLICATE SOURCES OF SUPPLY ARE PROVIDED FOR ALL LOAD CENTERS

the loop line continues through Inglewood to the Westflor substation, from which a large amount of railway and industrial load is supplied. From Westflor south is a 60,000-volt line to Torrance substation, another large load center with two additional 60,000-volt sources of supply, one directly from the Redondo steam plant and the other from the Long Beach steam plant. The loop line extends east from Westflor to the Vernon substation, which is in a large industrial center that may also be fed directly from Eagle Rock substation or from taps to each of the Long Beach-Newmark lines which are the main outlets for Long Beach steam-plant power.

From Los Angeles station No. 3, which also has a direct connection to the Eagle Rock substation, the Kern River lines may be considered as continuing east to Colton, the principal load center of the eastern part of the system. At Newmark these lines are intercepted by two lines from the Long Beach steam plant and two from the Eagle Rock substation. This same flexibility of system and duplication of sources of supply is carried out in the remainder of the transmission system.

PROTECTION GIVEN BY RELAY SYSTEMS

The reverse-power and balanced-relay systems which this company has put into service are in a large measure responsible for the low percentage of spare generating capacity that it is necessary to keep in operation. Balanced relays which have been installed on many of the parallel transmission lines are proving very effective in reducing the number of outages due to transmission-line failures. About 80 per cent of the cases of trouble on transmission lines which are protected with such relays are eliminated without interruption to the service. It is believed that this percentage will be even higher after some of the mechanical imperfections of the relays themselves have been eliminated. The reverse-power relays for transmission loop lines are proving very satisfactory in this respect, and in the Mount Whitney territory a complete installation of this nature has just been completed in which eight substations in a 60,000-volt loop are each protected with this type of relay. Many of the large generators are equipped with reverse-power relays which trip out the main unit and the field circuit in case of trouble in the machine itself. This greatly reduces the damage to the generator and cuts down the time required for repairs and getting the unit back into service.

THE GENERATING SYSTEM

The location of steam plants is in most cases subject to some flexibility. They should be near the load center or where the railway facilities and fuel, boiler-feed water and cooling-water supply are most advantageous. These conditions are met in both the Redondo and Long Beach plants of this company. The units in these plants were installed at intervals over a long period, and hence in each are embodied different features of design. As a consequence these units are given preference in operation inversely with their age. These plants, being at different locations, feed into different parts of the transmission system; hence interruptions which affect one are sometimes not felt by the other at all.

Although the locations of the water-power plants of this system are, of course, fixed, there is some flexibility in the design and in the water-storage facilities. Many of these plants are built on streams where there are no facilities for annual storage of water. Usually on such streams daily storage of water is not permissible, because the water of these streams is used for irrigation and during the irrigating season the full discharge of the stream is needed at all times. Hence it is not permissible to cause fluctuations in the natural flow of the stream. Plants operating under this restriction have been designated as base-water plants to distinguish them from plants where storage of water is possible, such as the Big Creek plants. Huntington Lake reservoir is of a capacity sufficient to store the full annual discharge of Big Creek, the stream upon which it is located, and permit of this water being used as desired at any time during the year through all of the Big Creek plants.

Big Creek plant No. 1, which takes its water directly out of Huntington Lake, has a capacity of 32,000 kw. At the tailrace of this plant is a small reservoir which permits of daily storage of the water discharged. Big Creek plant No. 2 takes its water directly from this small reservoir. Advantage is taken of the water storage to make the capacity of plant No. 2 50 per cent greater than that of plant No. 1, thus providing capacity for regulating and for carrying peak loads, besides spare capacity. At the tailrace of the No. 2 plant is another such reservoir from which plant No. 8 takes its water. Similarly, plant No. 8 has a larger water capacity than plant No. 2, allowing it to draw on its storage in the same way as the latter. During the period of non-peak these intermediate reservoirs are filled, and they are drawn on during the peak-load period or are held as reserve capacity.

With the regulating reservoirs, annual storage and steam plants available, the next problem is to operate this combination of plants to obtain the maximum annual efficiency. The base-water plants usually operate at full load from about March 1 to Aug. 1. From precipitation records and past operation the power available for the rest of the year can be fairly well estimated by April 1, at which time the inflow into Huntington Lake starts. At this time the water level in this reservoir must be at its lowest permissible value.

If at this time precipitation records and snow surveys indicate that the inflow into the reservoir will not be sufficient to fill it, the inflow is carefully conserved and the most economical steam units are operated in preference to using water from the reservoir. If the records indicate that the reservoir will be filled, or if there is any probability of its overflowing, as much water as possible is used out of the reservoir and the steam load is reduced to a minimum.

Numerous small streams discharge into Big Creek below Huntington Lake. These have their maximum-flow period at the time of the inflow into the lake. This water is diverted into the small storage reservoirs at the forebay of No. 2 plant and is used through plants No. 2 and No. 8. During a large portion of the season the flow of these small streams is sufficient to operate plants No. 2 and No. 8 at full load, and the small regulating reservoirs are put to good use to regulate the daily fluctuations of the stream flow and the demands for power. Very little use is made of plant No. 1 at this time except for reserve capacity or in the way already mentioned. Shaver Lake reservoir, on Stevenson Creek, which has a present storage capacity of 6,000 acre-ft. (720 hectare-meters), normally discharges into the main stream below power house No. 8, but has been diverted into the regulating reservoir for power house No. 2. This reservoir is at the present time not large enough to store the accumulated flow of Stevenson Creek, hence some water must be withdrawn from it during the run-off period to prevent overflow. At the beginning of the run-off period it is always the intention to have this reservoir at a low level so as to avoid the necessity of withdrawing too much water from it. At the end of the run-off period, which is about June 15, when it is definitely known how much power will be available from Huntington Lake and when also a very close estimate can be made on how much will be available from the other water-power plants, the problem of the most economical use of the power available is ripe for solution. From studies of past records the load for the coming year can be very closely estimated. Characteristic daily load curves, such as are shown herewith, are plotted, one for each month of the year. These curves are made by taking an actual daily load curve of the same month of the past year, the integrated area of which when multiplied by the number of days in the month will give the actual kilowatt-hour output for the month. These curves are then divided into their component parts. The lower area of the curve represents the power available from base-water plants. This area is readily determinable. The area directly above the base-water area is the storage-water power available. The determination of the amount to be carried each month by storage water is not so simple. From a purely financial viewpoint it is advisable to draw heavily on the storage water at the first of the season and defer fuel bills until later. The total area of the curve above the base-water power represents the storage-water power plus the steam power. The problem is then to determine the amount of steam power to carry each month to insure that the most economical steam units will carry the bulk of the steam generation and that enough storage-water power

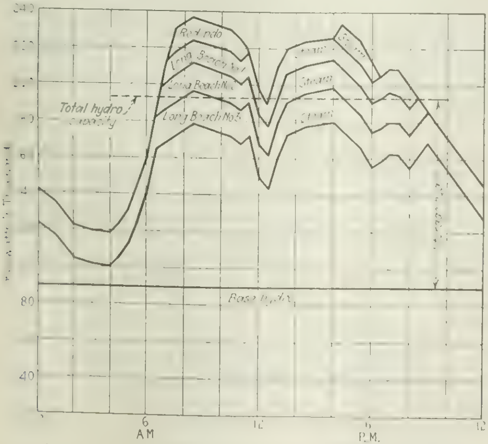


FIG. 4—TYPICAL CURVES ARE PLOTTED TO FORECAST THE LOAD FOR THE COMING YEAR

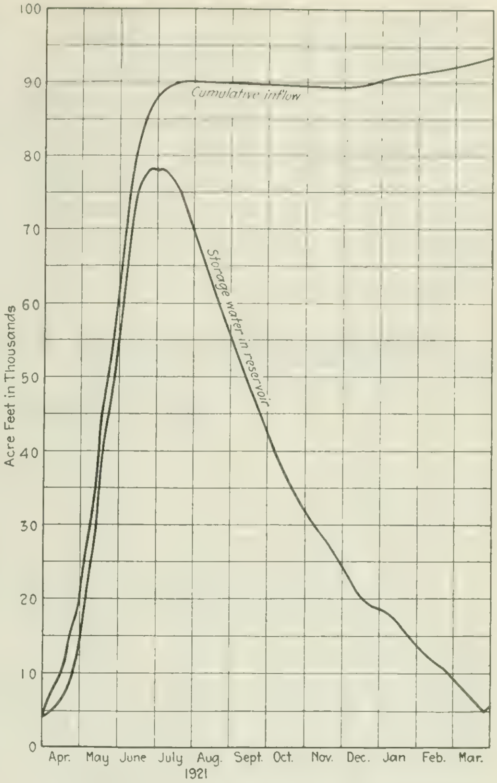


FIG. 5—WITHDRAWAL FROM HUNTINGTON LAKE RESERVOIR IS ADJUSTED TO EMPTY IT BY THE BEGINNING OF THE INFLOW PERIOD

will be used to leave the reservoirs empty at the end of the season and enough retained for pulling the peak load at all times and for regulating purposes.

The first requirement of operation is to have enough capacity to carry the load; hence on each of the twelve curves the peak capacity of the sources of power is plotted, beginning with the base-water power at the bottom, then superimposing the storage-water capacity, then the most economical steam unit, then the next, and so on until sufficient capacity is in operation to carry the load. At off-peak times the storage-water load is replaced by steam load until the area of the storage-water curve represents the total kilowatt-hours available from storage water. This steam area is then apportioned to the various units and plants according to their economy of operation.

The withdrawal of storage water may be varied or shifted from one month to another in order to produce better operating conditions, and considerable time is spent on this problem to obtain the best possible operating schedule. Sometimes variations in load conditions during the year make it necessary to make slight changes in the operating schedule, but such changes are not objectionable.

Central-Station Output a Barometer of Local Industry

By G. E. MILLER
Sales Manager Cleveland Electric Illuminating Company

Methods of Measuring Industrial Output — Power the Best Yardstick of Production—How Cleveland Bankers Regard It—The "Hundred Customer Index"—Interpreting the Curve

IT IS well known among experienced engineers and manufacturers that in a shop or manufacturing plant driven by electric power the volume of finished product may be very accurately measured by the amount of electricity consumed in its production. For instance, the experienced manager of a steel mill can translate the kilowatt-hours of electricity used in his mill over a definite period of time into tons of steel rolled for the same period with surprising accuracy. He is able to do this because the electricity used represents work done in making the finished product.

So in almost any line of manufacture where electricity is used for power, and where data are available over a sufficient period of time, the output of the plant may be accurately measured by the kilowatt-hours of electricity used.

In a large industrial center such as Cleveland, where electric power supplied by a central station is used almost universally to drive the wheels of industry, it is possible to judge very accurately the relative amount of finished products made in that community during any period of time by comparing the total amount of electricity generated by the central station in that period with that generated in some other period.

Statisticians have learned to collect data of various kinds and from various sources and, after proper evaluation, to put the results into tabulation or graphic form and thus depict business conditions past, present or future. For this purpose data on bank clearings, payrolls, street-railway traffic, post office receipts, building permits, real estate transfers, freight tonnage, etc., have been used.

Power the Best Yardstick

Outside of the three large steel mills in Cleveland, a very large percentage of the power used in its factories and commercial activities is supplied by the Cleveland Electric Illuminating Company. It follows, therefore, that a study of our load curves, representing the total kilowatt-hour output, may be of value as indicating the trend of business.

It seems superfluous, except for purposes of comparison, to point out that the bank clearings of a particular day or week do not measure fairly the productive capacity of industry for that period, as obviously they may reflect business done by selling goods from stock when the plant producing the goods is completely shut down. Many other factors enter which make the dollar an untrustworthy unit of measure with which to gage the industrial output of the community for any particular period.

On the other hand, kilowatt-hours generated today measure the work done today and, consequently, goods produced today. Electricity cannot be stored up and used out of stock, so to speak; there is no time lag between its production and use. Electricity generated in a given period of time is also used in doing work—making goods—in that same period of time.

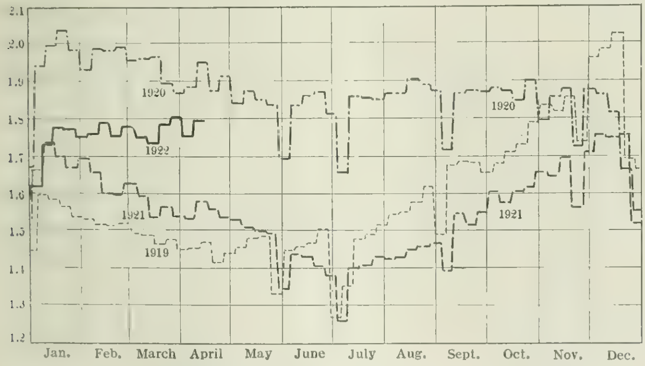
Showing the Bankers

Some months ago I was requested by the Union Trust Company, which is the largest banking institution in Cleveland, to appear at one of its board meetings and present our load curves and similar data that we might have which would indicate the trend of business in Cleveland. For that purpose I had some load curves prepared showing the total kilowatt-hours generated by us for the years 1919, 1920, 1921 and 1922 to date. These curves were made up on tracing cloth about 4 ft. square. The curve for each year was plotted, showing the average daily kilowatt-hours for each week. Each curve was in a different color, with each curve drawn about $\frac{3}{16}$ in. wide and put up on an ordinary shade roller, housed in a box so that they could be rolled up just like a window shade.

By means of these large curves, which were put up on the wall, the bankers in attendance at the meeting got at a glance the variations in total power generated by us during the periods in question. A comparison of one curve with another showed the difference between any two periods of time, and by explaining briefly what these curves mean and that the kilowatt-hours generated indicate work done in some form at the particular time these data became of the greatest interest. After these curves were shown to one of the vice-presidents of one of our largest banking institutions, who ranks as one of the leading statisticians in the country, he made the statement to me that in his judgment they were the best barometer of Cleveland's business that he knew of.

The Hundred-Customer Index

In addition to that set of curves, which is reproduced here, I had another set prepared, which, for want of a better name, we call our "hundred-customer index." These curves are made up in the same way as the others and are made from the kilowatt-hour consumption of a hundred of our largest consumers who use our power for their entire requirements and who have been using it for a number of years. These hundred customers are considered by us as a fair index of Cleveland's commercial and manufacturing industries, and therefore the fluctuation in their use of electricity is a splendid barometer of actual production for the periods covered by the record. The variations in the "hundred-customer index" are followed with the keenest interest by these groups of business men, and I am now supplying this information to the Union Trust Company weekly and to the Cleveland Chamber of Commerce monthly. The Chamber is sending out to its members various data on business conditions made up in the form of curves and graphs, and the information which we supply to them is included therewith.



A FOUR-YEAR PICTURE OF THE USE OF ELECTRIC POWER IN CLEVELAND

This curve, showing in terms of weekly periods the gross output of the Cleveland Electric Illuminating Company expressed in millions of kilowatt-hours, with a comparison of four years, is furnished by this company to the financial men of Cleveland as a barometer of local industry. Through the Chamber of Commerce it is also provided to all member business men who are interested.

Interpreting the Curve

This curve on total output has been reproduced with the following interpretation of its significance as a barometer of local business in the May issue of *Trade Winds*, the monthly house organ of the Union Trust Company. It indicates the manner in which I have translated the load fluctuations to our bankers and business men:

In this chart the total kilowatt-hour output from the Illuminating Company's plants is plotted for the years 1919, 1920, 1921 and 1922 to date. The figures on the vertical line at the left represent total daily kilowatt-hours generated, and the curves, for simplicity, have been plotted by weeks on the basis of daily averages. Each small horizontal line in a curve represents the daily average of kilowatt-hours for one week. For instance, the daily average for the last week in October, 1920, was 1,900,000 kw.-hr., and that week is represented by the short horizontal line in the curve for 1920.

A glance of these curves will show considerable variation throughout the year. This variation in load is very noticeable in the curves for the years 1919 and 1921. These two curves are characteristic of central-station load curves and show the effect of longer summer days when less electricity is used for lighting.

The 1919 curve, beginning the first of July at about 1,300,000 kw.-hr. per day, rises steadily throughout the remainder of the year to a maximum of over 2,000,000 kw.-hr. per day by the middle of December, when it drops sharply. This drop is due to factories closing down for the holidays.

After Jan. 1, 1920, the curve rises again to a maximum of approximately 2,040,000 kw.-hr. per day for the third week in January.

The 1920 curve as a whole is not a characteristic curve, as it drops less than normal as midsummer approaches, and beginning Nov. 1 it drops sharply to the end of the year, which is also an abnormal condition. The whole curve for 1920, however, shows clearly that an abnormal business condition prevailed throughout that year.

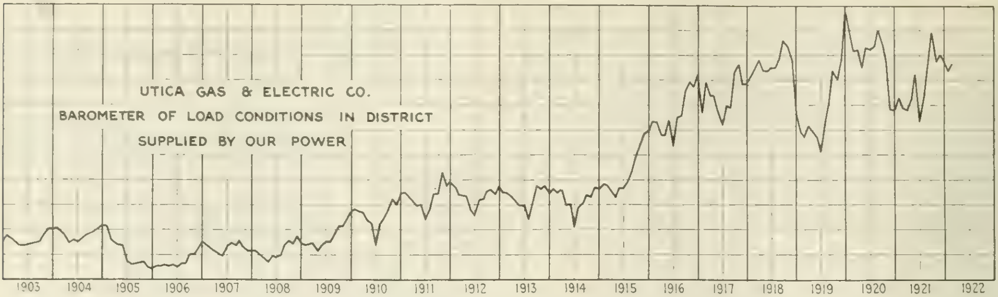
By 1921 we dropped back in industrial activities, and the curve for that year indicates about the normal seasonal variations.

The interesting part of this chart, however, is the curve for 1922 up to date. This curve starts at the beginning of the year, rising sharply to about 1,775,000 kw.-hr. per day during the second week in January, and from that point the trend is almost horizontal across the sheet—quite contrary to what would be expected under normal conditions of business.

In comparison with the 1919 and 1921 curves we should have expected the 1922 curve to drop about the middle of January, but instead it fluctuates up and down, with the trend horizontal. Now there has undoubtedly been a proportionate reduction in the use of electricity for lighting since the middle of January, 1922, due to longer daylight, similar to that indicated by the 1919 and 1921 curves, but for some weeks prior to the end of March shops and factories of all kinds were using more electricity for power purposes because they were running longer hours and putting additional machinery into production. This in turn means the employment of more men and, consequently, the output of a greater volume of manufactured product for the whole community.

In other words, business in Cleveland is improving. The chart says so and the kilowatt-hour meter indulges in no guesswork—it records facts.

I believe that in all the larger communities where the central-station company has taken its proper place in supplying the needs of the homes and the industries for electric service there would be a ready welcome on the part of banks and business institutions, as well as wide-awake chambers of commerce, for such data as this depicting the fluctuation of load on the central-station plants from time to time. It seems to be an opportunity for the central station to render a very practical service, which will be greatly appreciated.



A TEN-YEAR GRAPH REFLECTING BUSINESS GROWTH IN UTICA

The Utica Gas & Electric Company has prepared a curve which pictures the trend of power consumption in Utica over a period of ten years, and this has been distributed to all the leading local business men. It is extended each month and the new complete curves are sent out, so that it is possible to follow the fluctuations of industry in terms of electric power.

Utica Barometer Curve Sent to All Business Men

A Chart of the Load Curve Is Carried in a Continuous Graph That Is Made Available to All Local Business Interests

By E. P. Peck
General Superintendent Electrical Department
Utica (N. Y.) Gas & Electric Company

It has long been in my mind that it would be a practical benefit to the community to use the central-station load curve as a barometer of local business conditions. My idea is that business men in a community can use to advantage and will appreciate information which shows the actual business conditions in their community at the moment, with a comparison between present business conditions and those in the past. There is no indicator of business conditions which is more accurate than the central-station company's load curve in the particular district it embraces. The load curve does not follow the changes in general business activity, but changes instantaneously with the changes in activity in local manufacturing. Therefore the central-station load curve is a true barometer of the existing business conditions in the community.

There is, of course, one feature in connection with the use of central-station load curves which should be kept in mind, that a group of large customers may be transferred from isolated-plant to central-station operation. This would show an increase in business on the load curve but would not represent an increase in the community activity. Increases of this kind, however, are generally of small magnitude compared with the total business and have a rather small effect on the load curve. If a load of this kind is picked up which is large enough to have an appreciable effect on the load curve, a note can easily be made on the chart to explain the apparent increase in business.

Our plan, which was put into effect last month, is to send to the business men and bankers in Utica and its vicinity a copy of two curve sheets which are reproduced here. One of these shows the load curve by months from 1903 to 1912 inclusive, the other the load curve by months from 1913 to April, 1922, inclusive. Each point on this curve shows the average daily kilowatt-hours per month. It is our intention to bring the second curve up to date each month and mail copies to those who indicate that they are interested in it. We have purposely left the figures off the scale which show the total amount of load carried, as we believe they are not essential to a proper use of the curve, and these figures might be used for purposes other than that intended.

It has been suggested that it would be well to split the curve up into commercial, industrial and residence curves. This is not possible, however, in our system, as our residence lighting load and our general small power consumers are all on one group of circuits, each circuit carrying both lighting and power load. We therefore have no way of segregating the different loads.

It is doubtful whether this would be possible on most systems. I question, however, whether it is important anyway, for the reason that the element which represents the lighting load is not particularly susceptible to rapid fluctuations and the influence of the season on lighting can be interpreted as it influences the general curve.

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New Tungsten Arc Lamp Has One-Point Source of Light

A new type of tungsten arc lamp giving virtually a point source of light has been developed recently by the Philips Glowlamp Works of Enidhoven, Holland, the smaller sizes of which are now ready for the market. It is a lamp particularly adapted for projection, microscopy and general laboratory use.

In this lamp, for which patents have been asked, an arc discharge takes place between two small tungsten spheres in an atmosphere of a rare gas. In order to insure the striking of the arc a third electrode is mounted in the terminal glass midway between the feed wires. This electrode is connected through a high resistance to one of the lead-in wires. The material and form of this third electrode have been chosen in such a way that a glow discharge sets in first between it and the electrode next to it, thus starting the discharge between the tungsten spheres.

The distance between the spheres and the glass wall may be very small (2 cm. to 2.5 cm.), so that an optical condenser with a short focal distance can be used where the lamp is applied to projection purposes. A funnel-shaped screen is provided, on which the evaporated and sputtered tungsten is deposited in order to prevent the blackening of the bulb. The lamp has the advantage, it is claimed, that it can be run on a 220-volt alternating current circuit, and except for a series resistance, no auxiliary apparatus is necessary.

Business Conditions in the Electrical Industry on the Upgrade

By ROBERT M. DAVIS
Statistical Editor Electrical World

Electrical Industry as a Whole Is Operating Only Slightly Below What Would Have Been the Point of Demand if Growth Had Been Normal

BUSINESS conditions in the electrical industry are decidedly on the upgrade. This statement applies not only to the industry as a whole, but also to each of its three main branches—the electric light and power, the electrical manufacturing and the electrical merchandising.

Conditions in the electrical industry are distinctly more favorable than in the industrial world in general, and probably more favorable than can be found to exist in any other primary industry. The electrical industry has a large advantage over other primary industries in that it is essentially one exhibiting continual growth even under conditions of extreme general industrial depression. Moreover, the drop from the high point of business prosperity as recorded in March, 1920, to the low point of business depression of July, 1921, was materially less than that experienced in the industrial world taken as a whole. And because the electrical industry has this big advantage over virtually all other industries, indications point to steady improvement and an early return to near normal conditions.

After careful study and consultation with various authorities and prominent statisticians, the ELECTRICAL WORLD has evolved a "Barometer of Business Conditions in the Electrical Industry," extending from 1913 to the present. This "barometer" is reproduced below and will be continued monthly. It is believed these curves indicate quite accurately conditions existent in the industry.

The basis for them is believed to correlate with conditions in the industry and to present accurately any outside influence affecting it. The method used in obtaining the curves is explained at the end of this article. It is not claimed that this barometer is the best or most reliable possible, but it is believed to be the best barometer obtainable with the data available at the present time.

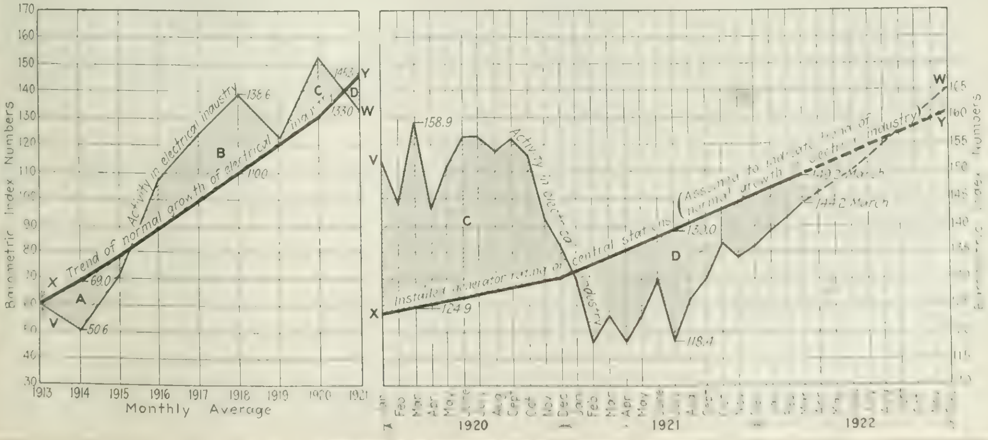
Probably the most reliable and scientific barometer of general business conditions is that presented weekly by the Babson Statistical Organization. The Babson barometer, or "Babsonchart of American Business Conditions," will be used as a basis when comparing business conditions in the electrical industry with those in all industries taken as a whole.

MARCH, 1920, THE PEAK

The "ELECTRICAL WORLD Barometer" indicates that the highest point of activity in the electrical industry was reached in March, 1920, when a reading of 158.9 was recorded on the barometer index scale. Immediately following this record activity came a sawtooth series of fluctuations, tending to decreased activity and reaching

ELECTRICAL WORLD

Barometer of Electrical Business Conditions



the low point in July, 1921, when 118.4 was recorded on the barometer index scale, making a total drop of 40.5 points. The line showing the "trend of normal growth in the electrical industry" was crossed in January, 1921.

The electrical industry took an abrupt upward turn in July, 1921, and at no time since that date has a decreased activity been recorded with the exception of November, 1921, when probably all industries of the country experienced a slump in activity following a spurt in October. In March of the present year the electrical industry was operating at 144.2 on the barometric scale, or only five points below normal as indicated by the line *X-Y*, or "trend of normal growth in the electrical industry." The line of normal growth has been extended through December, 1922, and the line of activity in the industry has also been extended on the basis of past performance and certain unusual conditions existing at the present time, such as the coal strike. The indications are that the line of activity in the electrical industry will cross the line of normal growth during August of this year and that by the following October the industry as a whole will be producing at the same rate as during March, 1920, which was the month of record productivity. In other words, by next fall the electrical industry will have regained all the business lost since March, 1920, and will be rushing forward for new records in electrical energy output, volume of manufactured electrical machinery, apparatus and supplies, and electrical merchandising.

Some very significant comparisons can be made between business conditions in the electrical industry and conditions existing in American business as a whole, as shown by the "Babsonchart." During 1921 there was a drop in the net gain or growth of American business totaling about 33 points on the barometric scale of the "Babsonchart." On the other hand, during 1921 the "trend of normal growth of the electrical industry" showed a gain of about 15 points on the barometric scale of the "Electrical World Barometer," and the gross income of the electric light and power industry during 1921 was $61,650,000 in excess of any previous annual income.

Comparative Conditions in Electrical Industry and American Business as a Whole

Babson believes that the area on the "Babsonchart" corresponding to the area "D" on the "Electrical World Barometer" will be the same as the area "C," although the shape of area "D" may be entirely different from that of area "C," and that the size of these two areas on the "Babsonchart" for general business should be approximately the same. Such is not the case with the electrical industry. It appears that area "D" on the "Electrical World Barometer" will undoubtedly come to a close before it is equal to area "C." This unusual condition is probably brought about by the continuous growth being experienced by the electrical industry, a circumstance which is not at all comparable to conditions in general business, especially during the past eighteen months.

Babson believes that for general business the readjustment is not yet half completed. In the electrical industry it would appear that readjustment is about two-thirds completed.

Babson asserts that if the general business plot corresponding to the Electrical World plot "D" continues to work upward close to the *X-Y* line, he looks for another dip and expects the area to be prolonged over a longer time than would be the case if the readjustment were more intense. The "Electrical World Barometer" does not indicate such conditions for the electrical industry. Its continuous growth should eliminate all chance of a decided dip in activity, at least until the next downward turn in the business cycle.

How the "Electrical World Barometer" Is Compiled

By "electrical industry" are meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

Without doubt the most reliable barometer of business conditions in the electrical industry would be one based on reports of monthly operations of electrical manufacturers, electrical merchandisers and electric light and power companies. Such reports are not available at the present time with the exception of reports from the electric light and power companies. It is necessary, therefore, to turn to sources outside the electrical industry and to base the barometer of business conditions in the electrical industry upon the influence which conditions in these other industries exert on the activity in the electrical industry. The big problem in such a procedure is in arriving at a proper weight for each of those basic industries as regards its influence on the electrical industry.

The primary industries used as a basis for the activity curve of the electrical industry must be those which exert a primary influence upon it. Nine primary industries have been adopted as follows: Textile operations, iron and steel production, mining, paper and printing, glass, vehicles for land transportation, lumber, brick, and food manufacture. The Department of Commerce gives monthly index figures for each of these industries.

The industrial survey being conducted by the Electrical World and *Power* has been drawn upon in weighting these industries in regard to their influence on the electrical industry. In this countrywide survey to ascertain the extent to which electrical energy is being used by the industrial plants of the country, over 80,000 questionnaires have been sent to the larger establishments. Complete returns have been received from practically all the important industrial states. The estimated horsepower of the motors installed in the plants of the various industries named above has been taken as the basis for weighting the industries. This includes motors run by central-station energy as well as those run by energy generated by private plants. The following weights have been given to the nine basic industries:

Textiles	7.59	Automobiles	1.72
Iron and steel........	17.68	Lumber	2.28
Mining	6.88	Brick and cement.....	3.70
Paper and printing...	2.55	Food	4.67
Glass	3.70		

The line *X-Y*, or "trend of normal growth of electrical industry," is based on the growth in the rating of the installed generators of the central stations of the country. By multiplying the barometric index scale by 100,000 the total generator rating for any month may be obtained.

Care must be taken in using this barometer if incorrect conclusions are not to be reached. For instance, assume that in March of this year activity in the industry was registering 144.2 on the index scale, and for the same month the "line of normal growth" read 149.2 on the index scale, or that the industry as a whole was operating at 5 points below the "line of normal growth." If, then, in April the industry was operating at the same rate as in March in respect to the "line of normal growth," it would not register 144.2 on the index scale, but, say, 146.2, because during April the industry had grown two points on the index scale. In other words, the ordinate between the "line of normal growth" and the line of activity in the industry indicates the extent to which the industry is operating in excess or under the point of normal demand as indicated by the "line of normal growth." In March, 1920, the industry was operating at 158.9 on the index scale, 34 points above the "line of normal growth." In August, 1922, the barometer indicates that the industry will again be operating at 158.9, but such an activity will be entirely normal, since the "line of normal growth" by this time will have reached 158.9 on the index scale. The industry must, therefore, be producing at such a rate if the normal demand for electrical energy, apparatus and supplies is to be fully met.

How Should the Public Utilities Be Financed

By H. M. ADDINSELL
of Harris, Forbes & Company

Relation of Cost of Money and Allowable Rate of Return to the Construction and Extension of Properties, and the Necessity of a Liberal Rate to Make Financing by Junior Securities Attractive

According to reliable compilations, the electric light and power companies' new construction during 1921 totaled $214,000,000, and it is estimated that during 1922 $324,000,000 will be needed for additions, improvements and extensions. This enormous amount of new capital will have to be obtained from the investing public. What are the terms upon which that public—the real "financial interests" owning the public utilities—will make this large additional investment in the electric light and power business, and what assurances will it require as to the ability of these companies to earn a fair return on the capital invested in them?

These are questions that are not susceptible of definite determination, but they perhaps offer an interesting field of speculation. We know, however, that interest rates are lower now than they were a year ago. The average yield to the inventor of new utility bond offerings during the first quarter of 1922 was less than 6½ per cent, as compared with nearly 8 per cent for the first quarter of 1921. We also know that utility commissions and courts throughout the country have recently rendered decisions recognizing 8 per cent as the reasonable rate of return that utilities should be allowed to earn in order to make their securities attractive to the public. Interest rates may, and they probably will, go lower, but at the prevailing rates does an 8 per cent permissive return afford a practicable basis for raising the large amount of money that will be required this year by the electric light and power companies alone?

Financing Through Stock Sales

In approaching this question the obvious fact must be borne in mind that no corporation can long or safely operate on borrowed capital alone. Experience has demonstrated that, generally speaking, not more than approximately three-quarters of the required capital can conservatively be expected from mortgage bonds. Inevitable discounts reduce to a lower percentage of the actual cash requirements the amount of cash actually realized by a company from the sale of bonds. The bondholder, furthermore, must be assured of the ability of the company to raise through the sale of junior securities the required balance; else both he and the company are in the position of having built a bridge that only reaches three-quarters of the way across the span of the company's requirements, a bridge that must be completed or it will fall of its own weight. If the bondholder, who is a mortgage creditor, can be interested today in, say, a 6 per cent return, preferred stock, the holder of which is a partner in the enterprise—a partner with a preferred position, but still a partner sharing to some extent the risks of the business—will have to be offered at about 7 per cent to find purchasers; and on what terms will the common stock be attractive to prospective purchasers who will take the last position in all the risks of the business? Bearing in mind that whatever rate of return is granted it is merely permissive, and not guaranteed, it is obvious that the common-stockholder will have to have at least the possibility of a materially higher return.

Stability of Operation a Factor

The public utility business is one of the great paradoxes of the business world. No matter how bad general conditions may be, the utilities usually seem to go ahead, showing a sustained volume of business and frequently actual increases in both gross and net earnings. People do not stop using electric lights, gas stoves, trolley cars and telephones during hard times. Fuel gas and electricity for power are essential to so many and such varied industries and businesses that the aggregate demand for these products shows comparatively little falling off, even though conditions in many individual industries are distinctly unfavorable.

These statements are substantiated by a comparison recently made of the earnings of 112 utility companies for the twelve months ended Oct. 31, 1921 (a period of acute industrial depression), which shows an increase of 8 per cent in gross and 11 per cent in net over the combined earnings of the same companies during the generally prosperous year ended Oct. 31, 1920.

On the other hand, periods of marked industrial activity and expansion frequently bring problems for the utilities. This was particularly true during the tremendous industrial activity of the war and the years immediately succeeding. As has been pointed out many times, the business of the utility companies is not static. They must increase their service to keep pace with the growth of the communities they serve. This necessarily involves the raising of additional funds. These additional funds must come eventually from the investing public. Investors want the assurance of the ability of the company to charge rates that will produce a reasonable return on the investment. This was the difficulty the utilities were laboring under during the war. Operating for the most part under public supervision, they were unable to raise their rates rapidly enough to keep pace with the increasing costs of providing their services because the various regulatory bodies controlling the rates did not respond immediately to the changed conditions. In the meantime their operating expenses were mounting. Labor and material costs were far above pre-war levels and were still rising. The demand for new capital both for governmental and industrial purposes was so wide and so insistent that money also was commanding "wages" above anything that had been known since the years succeeding the Civil War. Industrial companies met the situation by charging higher prices for their products, but as this solution was not automatically possible for the utilities, the result was inevitable. Unable in many cases to make the extensions and additions necessary to handle the increased demand, the quality of the service declined to a point commensurate with income.

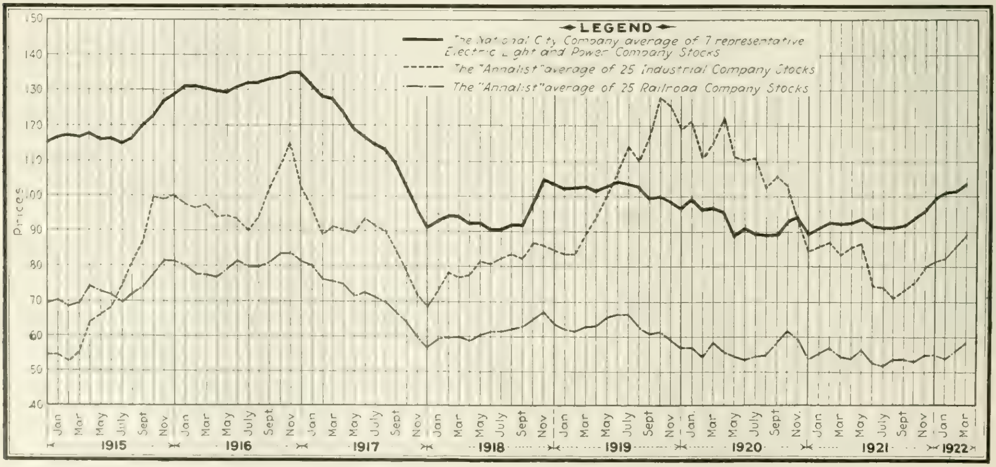
Before long, however, the regulatory authorities recognized the justness of the demands for increased rates and such increases became a general rule, particularly among the electric light and power companies. Allowance was made not only for the increased cost of operating, but also for the increased returns which were the rule on all new capital investments and which the utilities would have to meet if they were to obtain capital in competition with other industries. Wider and wider recognition was given to the principle that companies operating under public supervision should be entitled to earn a fair return on the capital actually invested in their properties.

While the matter of what is a fair return on a public utility property is one that is not susceptible of definite determination to cover all cases, on account of its involving so many variable factors, at the same time it would seem that, generally speaking, under the present conditions an 8 per cent return should be a reasonable one and this belief is corroborated by numerous recent court and commission decisions.

Upward Trend in Price of Light and Power Stocks

Fluctuation of Common Stock for Several Years Past Was Only About One-third That Which Industrial Stocks Exhibited

A STUDY of the stock market brings out the fact that public utility securities form the one group of issues which stands out today in distinct favor. The only possible exceptions to this statement are the state and municipal government issues. The reasons for this upward trend in the popularity of utility stocks with the investing public are not far to seek. One of the essentials of a good security is that its value shall not be materially affected by conditions existing in other industries. Electric light and power corporations were the first to feel the greatly increased industrial activity during the war period, and they were the first to adjust themselves to meet this greatly increased business. The post-war industrial depression found this industry with a materially decreased manufacturing load and the necessity of finding a market for its surplus



MATERIAL INCREASE IN PRICE OF ELECTRIC LIGHT AND POWER STOCKS DURING MARCH electrical energy. The manner in which this was accomplished is clearly shown by the fact that 1,001,700 new residential customers were added to the central-station lines during 1921, and that the gross revenue of the industry as a whole during 1921 was $944,400,000, or $61,650,000 in excess of the former record revenue of 1920.

Through the courtesy of the National City Company we are able to show a diagram of the average prices of the common stock of seven representative electric light and power companies by months for the past seven and one-quarter years. To the diagram have been added curves showing the prices of twenty-five industrial and an equal number of railroad stocks. So far as possible, the electric light and power stocks represented are of companies doing a purely lighting and power business, and, with one exception, companies engaged in more than one utility activity have not been included in the tabulation. In order that the curves may be comparable, the values plotted have been obtained by averaging the high and low sales of each month.

It will be observed that the total fluctuation of the electric light and power stocks based on the percentage of the range to the low during the past seven years has been only about one-third that of the industrials and considerably below that of the seasoned rails. The fact that the electric light and power stocks have not been subject in the past to such sudden and violent fluctuation as industrials—as indicated in the accompanying curve—is a proper basis for believing that there is no cause for alarm in the fact that electric light and power stocks show a less rapid increase in price at this time when compared with prices of industrial stocks.

The prices of electric light and power stocks are now about the same as during the six-month period immediately preceding the close of the war. There is, however, a material intrinsic difference. The trend in the price of these stocks is now essentially upward, as is indicated by an increase of 2.48 points during March, whereas at the opening of 1919 and immediately following that period the price trend was distinctly downward.

The enviable position now occupied by stocks of electric light and power companies is the result of a better understanding of public utilities by the general public. The doctrine of customer ownership, which is being spread by the sale of utility securities in the territory served, is one of the fundamental reasons for this better understanding. The direct result of customer ownership is a more complete understanding by the community at large of the necessity of rates affording adequate compensation to the utilities and a deep-seated influence upon the state utilities commissions for just regulation. The realization of the absolute necessity for a continual supply of electric energy both for lighting and power has brought public attention to the electric light and power industry as never before. This interest of the public not only as customers but as stockholders has created a feeling of mutual confidence which is being reflected in the price of electric light and power securities.

Systematic Inspection Scheme for Preventing Breakdown

By ALEX. E. BAUHAN
Superintendent of Stations, Pennsylvania Water & Power Company, Baltimore, Md.

Involves Specific Written Instructions with Chart Schedules—Makes Inspection Automatic and Reduces Supervision — Provides Visible Record of Condition

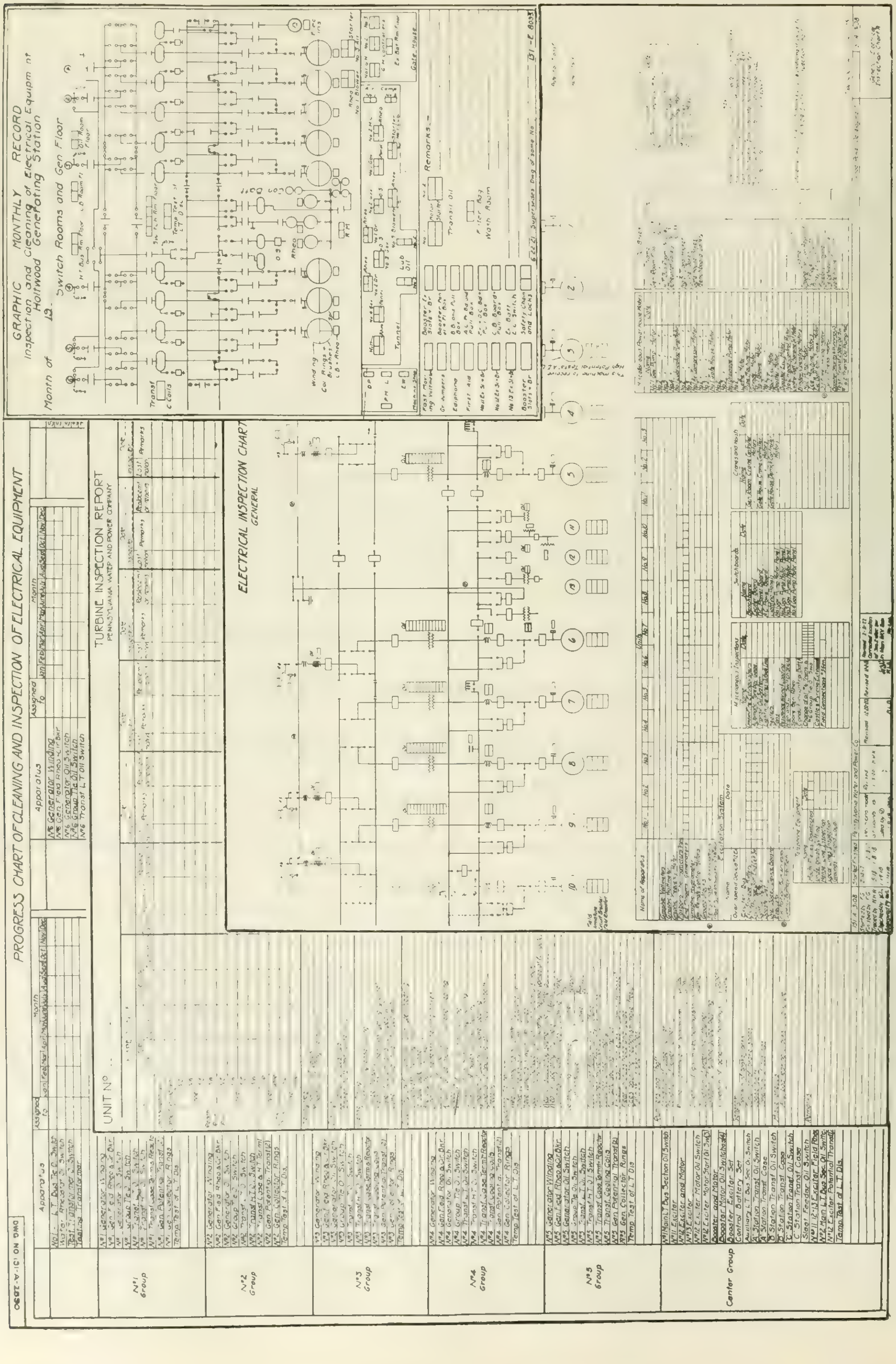
THE desirability of a plan of inspection and correction of minor defects before they develop into breakdowns, causing serious damage to equipment, interruption of service or injury of persons, hardly needs advocacy. Indeed, it can be said that to a certain extent this is the practice in all well-operated plants. However, it is believed that the inspection method here described has some advantages over the procedures more commonly used.

The scheme submitted has been successfully applied in several stations for the past six or seven years and has justified itself not only by a considerable saving in maintenance expense but by a reduction in the number of service interruptions due to apparatus breakdowns to a point far below what might have been expected if the plan had not been in operation. It is a plan which is applicable not only to electrical machinery but also to steam and hydraulic equipment, not only to power stations and substations but also to industrial plants. In fact, it can be applied to the inspection and maintenance of any kind of property. Briefly the plan is:

1. To establish the inspection requirements by written instructions. These instructions tell what inspections are to be made, how they are to be made, enumerate in detail the various tests, observations and measurements required, and specify tolerances of maladjustment or wear.

2. To assign definitely the inspection work to certain persons and to give all of the operating attendants a share in the responsibility for regular inspection.

3. To establish a system of scheduling and progress charts on which every piece of apparatus in the station is listed and which shows the responsibility for each inspection and the periodicity of the inspection. These charts provide space for a record of the inspection having been made and by whom it was made.



PROGRESS CHART OF CLEANING AND INSPECTION OF ELECTRICAL EQUIPMENT

TURBINE INSPECTION REPORT
PENNSYLVANIA WATER AND POWER COMPANY

ELECTRICAL INSPECTION CHART
GENERAL

GRAPHIC MONTHLY RECORD
Inspection and Cleaning of Electrical Equipment at Holtwood Generating Station

FOUR SAMPLES OF RECORDS MAINTAINED BY PENNSYLVANIA WATER & POWER COMPANY IN SCHEDULING INSPECTION

Perhaps the plan can best be elucidated by explaining its operation in a particular application, that of the 83,000-kw. hydro-electric station of the Pennsylvania Water & Power Company at Holtwood, Pa. In the first place, a very complete set of maintenance and inspection instructions has been issued. These instructions will not be referred to further except to say that they tell in detail how the apparatus is to be inspected, what is to be looked for and what precautions are to be observed.

ASSIGNMENT OF INSPECTIONS

The work of making the inspections is assigned partly to the operating attendants and partly to the electrical and mechanical inspectors. The entire equipment of the station is divided among the operating men, each having a certain assignment of apparatus which he is supposed to inspect periodically, keep clean and in proper operating condition. If the apparatus suffers from lack of proper attention, the man who is responsible for this particular piece of apparatus is called to account. If it is kept in exceptionally good condition, it is he who receives the credit. Framed copies of a list of the apparatus and the attendants to whom it is assigned are posted in various parts of the station. In this way the work is equitably divided, and the less industrious attendant is not able to shift his work on the more industrious. The operating men are provided with tools and are permitted and encouraged to take care of the bulk of the minor repairs. Only such work as they cannot take care of is turned over to the regular maintenance men.

While the operating men make the majority of the routine inspections, it is necessary that some of the apparatus shall have a more thorough inspection once a year. These inspections are made by the electrical and mechanical inspectors. The electrical inspector also makes, for instance, monthly transformer-oil breakdown tests, semi-annual relay inspections and calibrations, annual high-potential tests on all station equipment, and inspections on miscellaneous apparatus such as meters, switchboards, signal systems, telephone systems, fire extinguishers, station grounds, cranes and hoists.

In some stations the making of inspections is noted by an entry in the station log book or in a card-index system, or a report of each inspection is made on a printed form which is filed away. Such methods are awkward and lack visibility, accessibility and other advantages which suggest themselves in the following method.

A system of white print charts has been developed on which is provided a place for every item of equipment to be inspected. The charts for recording the operators' inspections are separate from those used for recording the inspectors' work. The charts show clearly to whom the inspection is assigned, indicate whether the inspections are to be made monthly, quarterly, semi-annually or annually, and provide a place for recording the date of the inspection and the initials of the man who made it. These charts are posted on a display fixture readily accessible to the men who are making the inspections so that their progress is continually in view.

Following are features of the principal inspection charts in use, some of which are illustrated in the accompanying figures:

Progress Chart of Cleaning and Inspection of Electrical Equipment.—This chart refers to the periodic inspections made by the operators and covers practically all of the major equipment, including generators, transformers, oil switches, reactors, buses, switchboards, batteries, motors and safety equipment. It is apparent from this chart, for instance, that No. 1 generator potential transformers are inspected quarterly and that No. 1 generator collector rings are inspected monthly. A glance down the sheet at any time shows strikingly whether the inspections are being kept up to date or not and which, if any, has been missed or delayed. Subsidiary to this chart are a number of minor monthly letter-size charts, such as a one-line wiring diagram known as the "Graphic Monthly Record" which the operators use for planning and scheduling the taking out of apparatus and recording the progress of its inspection from day to day during the month. The entries on this chart are transferred to the main chart at the end of the month.

Electrical Inspection Chart "A"—General.—This chart is used by the electrical inspector, and instead of being arranged in a tabular form as in the preceding, it makes use of the station one-line wiring diagram on which the various entries are directly made. This is feasible because most of the inspections made by the inspector are annual. When the inspector completes the inspection on an oil switch the date and his initials are noted in the rectangle representing the oil switch on the diagram. When a bus has received a mechanical inspection a black line is drawn alongside of that bus. When it has had its high potential test a red line is drawn alongside of the bus. This makes it practically impossible for the inspection or test of any part of the equipment to be overlooked. The bottom of this chart provides space for all the miscellaneous inspections covered by the inspector.

Electrical Inspection Chart "B"—Main Relays.—This chart is used by the electrical inspector for the recording of relay inspections and tests. It consists of the lightly drawn one-line diagram of the station on which the relays have been indicated in heavier lines. The relay connections are not shown, but simply the relay itself, and it is identified by its location. Alongside of each relay is a rectangle, divided into as many parts as there are inspections in the year, for noting the date of the inspection and initials of the inspector. Relay settings are not shown on this chart nor is any record made of the setting as found. The normal relay settings are shown on a similar but separate diagram which shows all relay connections and which is one of the permanent records. If the inspector finds the setting correct, no other report is made except the entry on the relay inspection chart. If the relay was found in error, a trouble report is made out and the relay corrected.

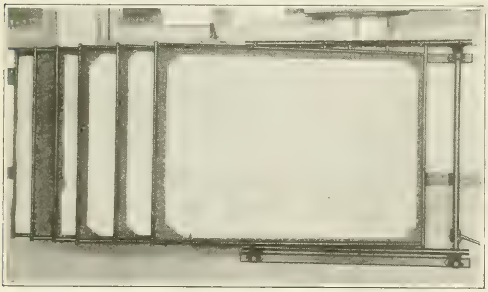
Electrical Inspection Chart "C"—Station Service Relays.—This chart performs exactly the same purpose as the foregoing one except that it applies to the relays on the auxiliary equipment in the station and not to the main power relays.

The foregoing charts take care of the entire electrical end of the station. A similar system of charts has been worked out for the hydraulic end which will not be described at this time. It should be mentioned that none of these charts is of any permanent value. At the beginning of each year a new set of prints is put up, and then of course no further reference is made to the old ones.

All of the foregoing charts have been worked out on the assumption that when a piece of machinery is inspected it is found to be either right or wrong. If it is right, the entry is made on the chart with no explanation whatsoever and no other report is made out. If it is wrong, the letter "T" accompanies the entry and a trouble report is made out. It might be said that none of the equipment is permitted to deviate from its normal condition. If an inspector discovers that deviation has taken place, it is corrected and brought back to normal.

Turbine Inspection Report

However, the situation with regard to the hydraulic turbines is somewhat different. These turbines involve a large number of operating-mechanism parts which are submerged in the corrosive water of the wheel pit and subject to a progressive deterioration or wear and which cannot conveniently and economically be kept in perfect condition. The wear and deterioration must be permitted to progress to that point where it is economical to replace the parts, and yet it must not be permitted to progress so far as to interfere with the output of the unit or to endanger its continued operation. This is a situation which exists not only in hydraulic plants but in steam plants and industrial establishments whenever there are several similar units consisting of a large number of detailed parts requiring inspection and maintenance and where the units are not continuously accessible. In such cases it is difficult to form a comprehensive picture of the condition of all the various details of the units. This is a serious handicap if it is necessary to lay out a maintenance or overhauling program for a year or two in advance or if the time or money available for repairs is limited.



SWINGING FRAMES MAKE INSPECTION CHARTS READILY ACCESSIBLE

The scheme referred to below eliminates these difficulties and makes it possible to decide quickly and accurately on what units and in what parts the time or money available can best be spent, as well as to predict what maintenance attention will be required for several years in advance. And yet it is simple and can be explained in just a few words.

It involves the use of what are known as turbine inspection reports, of which there is one for each turbine. In the left-hand column of the chart is listed each of the seventy-odd turbine parts which it is desired to check up. Note is made of the material of which each part is made. The instructions for turbine inspection call for numerous detailed measurements of lost motion, clearances and wear and for observation of the general condition of each of these parts. The inspections are made semi-annually and are recorded in successive columns on the charts. The enumeration of these various measurements and observations prevents their being forgotten. Instead of conditions being reported in vague general terms, specific measurements are called for. The plan also provides a means for recording the many detailed changes which are made in the equipment, thus showing that a certain bushing in one unit is bronze and in the other unit is steel, or that the diameter of a pin in one unit has been increased from 4 in. to 5 in., or that standard piping was used here and extra-heavy piping there. It records experience where details differ. In short, it provides a convenient, graphic, accurate and comprehensive record of the condition of the various parts of the units in a way that could not possibly be accomplished if dependence was placed on some one's memory or judgment of results.

In order to give a good picture of the comparative condition of the units, each chart, in mounting it on the display fixture, is folded back and overlapped on the next so that only the column recording the last inspection of each turbine is visible. We have then at a glance the relative state of repair of each of the machines and can intelligently make comparison of the behavior with the different designs of details and lay out repair programs far in advance.

These charts have been an important contributing factor in cutting down the labor required in overhauling a turbine from twenty to thirty men for thirty to forty days once every three years to a matter of about fifteen men for twenty or twenty-five days once in six or seven years.

Use of Trouble Reports

Reference has been made to the filling out of a trouble report in case an inspection shows that the apparatus is not in its normal condition. This trouble report becomes authority and instruction for the maintenance force to repair the equipment and restore it to its normal condition. When the job has been completed, record is made on the report of what caused the trouble, how it was corrected, what was done or what should be done to correct similar defects in the future, and any other details about the repair which might be of permanent interest. These reports play an important part in any preventive maintenance scheme for the reason that by them it is possible to keep a watch on the effectiveness of the station inspection and maintenance procedure. When extensions to plant are contemplated, reference to these trouble reports makes it possible to eliminate design defects in the new equipment.

The identical inspection methods outlined in this article cannot, of course, be applied in every case, but the general principle of using definite written instructions with chart schedules is possible of wide application. It makes inspection more a matter of automatic simplified routine and reduces the amount of supervision required to give that assurance that everything is being checked up properly. It provides a readily visible record of maintenance and inspection conditions in a manner which cannot be accomplished by the more generally used card index systems. It gives the men who work by the system a feeling of more businesslike administration which naturally results in carefulness, thoroughness and more businesslike execution of the work laid out. It actually anticipates and prevents expensive breakdowns and the more or less immeasurable consequences of interruptions to service. In short it pays.

A Review of Experience in "Home-Electric" Demonstrations

No Demonstration of This Kind Anywhere Reported as Unsuccessful—The Popularity of the Exhibits Has Been Great in the North, South, East and West

"HOME-ELECTRIC" demonstrations have proved themselves so successful as a medium of publicity and so profitable as an instrument for increasing the sales of house wiring and domestic appliances that the idea has taken strong hold of the industry. The pioneering period has apparently been passed and "home-electrics" are being organized today in many cities East, West, North and South by co-operative organizations representing the local electrical families in cities of all sizes.

The first "home-electric" demonstration was staged so long ago that the records do not show who the father of the idea was. There was one in Brooklyn twelve or fifteen years ago. Boston established one soon after. There have been many in the meantime, and it is impossible to give a list that is complete. In recent years, however, "home-electrics" have been featured to the public in Boston and Lawrence, Mass.; Utica, Long Island City and Brooklyn; Toronto, Hamilton and Montreal; Baltimore; Columbus, Ga.; Nashville; Fort Smith, Ark.; Louisville and Lexington, Ky.; Cleveland, Canton, Lakewood, Toledo and Columbus, Ohio; Chicago and Milwaukee; Denver and Boulder, Col.; Salt Lake City and Ogden, Utah; Spokane; Portland, Astoria and The Dalles, Ore.; San Francisco, Sacramento, Oakland and Los Angeles. At present they are actually getting ready for "home-electric" demonstrations in Pittsburgh, Atlanta, St. Louis, Dayton, Syracuse, Detroit and Seattle. They are planning to hold them in Centralia, Wash.; East St. Louis, Ill.; Omaha, Poughkeepsie, Galveston, Birmingham, Elmira and Buffalo. They have also been reported from Worcester and Cambridge, Mass.; Albany, N. Y.; Charlotte, N. C.; Jacksonville, Fla.; Cincinnati, Akron, Lorain and Sandusky; Indianapolis and Fort Wayne; Bloomington, Ill.; Wichita, Kan.; Minneapolis, Chattanooga, Nashville, Oklahoma City; Kansas City, Mo.; Boise, Idaho; Provo, Utah; Bellingham, Everett, Aberdeen, Walla Walla and Tacoma, Wash.; Chehalis, Corvallis, Medford and Yakima, Ore.; Stockton and Long Branch, Cal.

THE "IDEA" WELL ESTABLISHED

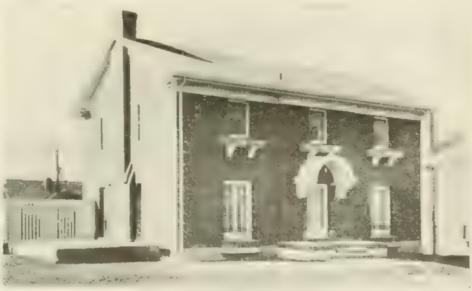
Clearly the idea of the "home-electric" has become established, and the reason is not hard to find. It provides an opportunity not alone to exhibit a complete equipment of electrical household appliances but to show them in a house, surrounded with all the atmosphere that makes a home—furniture, draperies, complete equipment and all comforts ready for living and no diverting duplication of appliances—just a normal home completely electrified. And because it is just a simple home it becomes a matter of neighborhood and community interest and the people come in great numbers. And when they come they can be greeted comfortably and pleasantly in a personal way, conducted through the home in small groups and informed in detail by carefully balanced lectures of all the benefits of modern electric service. Moreover, because these "home-electric" demonstrations are developed by the local dealers and contractors working in co-operation with the central-station companies and local manufacturers and jobbers—all the electrical interests—they become invaluable influences for binding the family more closely together, and, no sales being made in the home itself, the increased local demand for appliances that inevitably results proves profitable to all and makes the enterprise a paying one.

MATERIAL FOR GUIDANCE

It is not the purpose of this article to outline the methods by which a "home-electric" should be organized and operated. A detailed analysis of the experience gained from the three homes conducted in Cleveland in 1921 was published in the ELECTRICAL WORLD for March 11, page 475, with a schedule of recommendations for the guidance of any city. The Society for Electrical Development has also in preparation a handbook on the "home-electric" which will be available soon and covers the subject exhaustively; and on which we have drawn for many of these facts. In planning the activities of the great movement for business development which the convention of the N.E.L.A. will formally launch, however, a picture of the actual experience of the most successful "home-electrics" will perhaps be helpful.

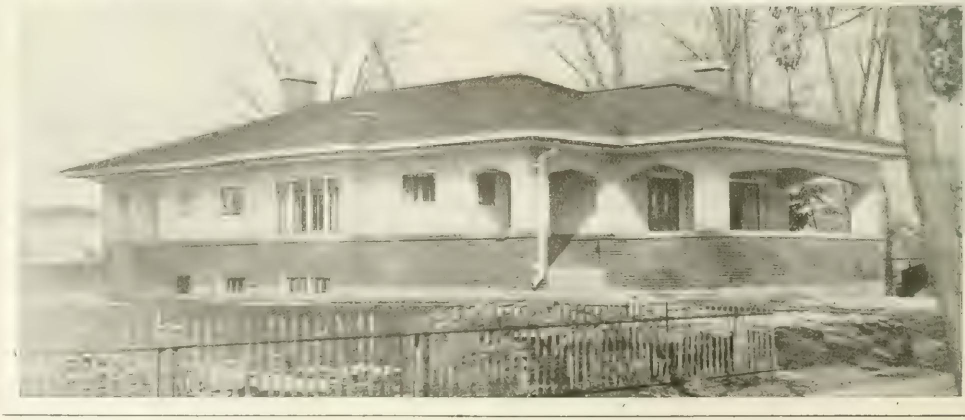
In the first place, there is no "home-electric" demonstration reported so far as unsuccessful. The people have always come. They have always been interested. They have always reacted with a demand for more wiring and more appliances. Results have been directly proportionate to the care and thoroughness with which the project has been planned and executed.

In the majority of the larger cities the enterprise has been sponsored and controlled through either an electric league or club existing in the community or one formed for the purpose. In Denver the general manager was the president of this new league and the local managers of two large manufacturing establishments were vice-presidents. Stock was subscribed to by local electrical interests, including the wiremen's union. The home was designed and built in co-operation with a contractor, some material and services being paid for in stock. In almost all cities a new residence has been used, and in many cases in large towns—Denver, Cleveland and Louisville among them—this residence has been built for the purpose by the league. In many others it has been loaned by the builder. In all but a few cases the house has been sold during the demonstration, and usually at a substantial profit. In virtually every case it has been possible to arrange with a local department store to provide the furniture and draperies,



A Group of Typical "Home-Electrics" from About the Country

FROM Boston to Columbus, Ga., to Utica, to Louisville, to Minneapolis, to Denver, to Sacramento "Home-Electric" demonstrations are meeting with unvarying success. But out of these experiences are developing bits of standard practice which have proven good influences in attracting large crowds and making easier the telling of the story.



though in a few cities the builder has contributed the hangings as a feature of the decoration of the home.

Size of House Used

The size of the house selected has varied with the community and the neighborhood from a small bungalow to a fourteen-room house, as in Utica. But the usual choice has been an eight-room house, as in Denver, Oakland, Louisville and Cleveland. The value has, of course, had the same range. In Sacramento a house valued at $10,000 was used; in Utica the price was $30,000; in Cleveland three homes valued respectively at $48,000, $37,000 and $17,000 were selected; in Los Angeles two priced at $40,000 and $12,500 respectively, in Toronto one at $13,000, and so on. The number of convenience outlets installed is reported as follows: Toronto, 34; Utica, 42; Louisville, 28; Denver, 50; San Francisco, 37; Oakland, 38; Los Angeles, 28 and 37. The number of appliances in use was: Los Angeles, 35 and 50; Oakland, 40; Sacramento, 25; San Francisco, 31; Denver, 50; Louisville, 49; Utica, 40; Toronto, 34.

The money to finance the enterprise has been apportioned between the co-operating firms according to their size, or to the groups, as in Toronto, where the central-station companies subscribed 50 per cent, the manufacturers and jobbers 30 per cent and the contractors and dealers 20 per cent together. They raised in Toronto a fund of $10,000 to finance four "home-electrics." In Denver they sold for cash $6,750 of stock. In Cleveland they raised more than $50,000 to support a big development campaign of which these "home-electrics" were a feature. Here the percentages collected were: Central stations, 33.22; jobbers, 23.91; manufacturers, 22.44; lighting-fixture dealers, 5.82; industrial and commercial contractors, 5.74; appliance dealers, 3.46. In Utica the total expense was $2,200, in San Francisco $1,400, in Sacramento $550, in Oakland $1,100, in Louisville $2,000, in Cleveland $6,700, $5,000 and $2,900, and in Los Angeles $1,150 and $1,800 for the different homes. This is in addition to advertising space contributed by electrical firms, which was estimated for Utica at $100, for San Francisco at $3,600, for Sacramento at $550, for Oakland at $2,200 and for Los Angeles at $3,600. In other cities large amounts of space have also been devoted to the demonstration by co-operating local interests, and small amounts have been contributed in some cases in labor and material. Newspaper space has ever been the largest element of operating expense, with booklets rating second.

The operation of the "home-electric" demonstrations has almost universally been put in the hands of employees of the co-operating firms, under direction of the home committee. In Utica, in Louisville, in Toronto and in Cleveland, however, special employees were engaged to take partial or entire charge of the home.

Hours of Exhibition

The homes have been open to visitors daily and Sunday, but there has been a considerable variety in the schedule. In Los Angeles the hours were 2 p.m. to 10 p.m., in Oakland 10 a.m. to 10 p.m., in Sacramento, 1 p.m. to 10 p.m., in San Francisco 10 a.m. to 5 p.m., in Salt Lake 2 p.m. to 9 p.m., in Louisville 11 a.m. to 9 p.m., in Cleveland 1 p.m. to 10 p.m., and in Utica 2 p.m. to 10 p.m. The usual period of the demonstration has been about two weeks, though in Cleveland each home was open for a month. The relation borne by the length of the period to the total attendance is not clear, but the results have been as follows: Utica, 16 days, 15,124 visitors; Columbus, Ohio, 10 days, 6,000 visitors; Cleveland, 32 days with 34,354 visitors, 29 days with 34,790 visitors and 29 days with 13,965 visitors; Montreal, 25 days, 9,000 visitors; Louisville, 14 days, 89,000 visitors; Lexington, Ky., 10 days, 7,000 visitors; Utica, 16 days, 15,124 visitors; San Francisco, 17 days, 20,000 visitors; Sacramento, 16 days, 10,000 visitors; Oakland, 13 days, 30,000 visitors; Los Angeles, 17 days with 19,000 visitors and 25 days with 15,106 visitors. A surprising number of people can be received in such a "home-electric" in one day. In Los Angeles the record day was 6,966, in Oakland 3,537, in Louisville 3,200, in Cleveland, 3,300.

The net cost of entertaining and informing all these people was found to be 10 cents per person in Louisville and 17 cents in Cleveland.

The Way Open to All

The record is, of course, but fragmentary; yet, incomplete as it is, because detailed statistics are not available from many cities, it serves to point the fact that common experience has found the right way to organize and operate a "home-electric," a way open to all. Many ingenious innovations have been devised in advertising these demonstrations and providing entertainment for the guests. But the basis of it all is the desire on the part of all the people everywhere to learn more about electricity in the home, and the "home-electric" has proved itself a most effective way to demonstrate the comforts of complete electrical household equipment in an interesting and appealing manner, practical and profitable, not alone in the large cities but in towns as small as Boulder, Col., for instance, where, out of a total population of 12,000, more than 2,600 persons visited a unique display in the new residence of the manager of the local central-station company, thrown open for ten days as a "home-electric." The record of Canton, Ohio, is also remarkable, for there 14,000 persons came to see a small demonstration home, being 10 per cent of the population. And in Fort Smith 3,500 people visited the house, which was 12 per cent of the inhabitants.

The Rural Service Opportunity

Initial Problem One of Financing—Fundamental Need for Improving Electric Service to the American Farmer

By G. C. Neff
General Superintendent Wisconsin River Power Company, Madison, Wis.

Except for the difference in the extent of the distribution system necessary to serve the same number of customers, there is little distinction between urban and rural electric service. The electricity supplied in both services is generated in the same way, usually in the same power house, transmitted over the same kind of lines and delivered to similar homes for similar purposes. A mile of urban distribution line may serve from thirty to a hundred customers, while a mile of rural line in many cases will serve only three customers. The new problems introduced by rural service are therefore caused either directly or indirectly by the unusually large amount of distribution system necessary for each customer served.

FINANCING PROBLEM FIRST

The first problem is that of financing the large investment necessary to supply rural service. Under present conditions utilities generally require all the money they can get to keep pace with the growth of their urban business, and they are therefore unwilling and often unable to finance rural lines. Furthermore, rural electric service is still in the period of early development, and many utilities are unwilling to invest a large amount of money in what they consider an uncertain business. Most utilities in the Middle West are willing, however, to supply the necessary capacity in the generating station and to supply the increased capacity in the urban distribution or transmission lines necessary to transmit the energy required to some point in the rural district to be served, if the rural customer will provide the money for the rural distribution system. Under this arrangement both the utility and the customer are intensely interested in the successful development of rural service, since both have contributed to the cost of the equipment necessary to supply this service.

Until rural service has become more stabilized and can furnish a proper ratio of return on the money expended, this seems to be the only fair way to handle the necessary financing. Furthermore, if these conditions are properly explained to the rural customers, they are generally willing to contribute the cost of the rural distribution system, especially since this is generally less than the cost of individual farm-lighting sets, which are of limited capacity and for the most part not so satisfactory as central-station service.

THE RATE PROBLEM

The second problem is to determine a proper rate to be charged for rural service. Urban rates have been developed over a period of years, and it can be fairly assumed that they are approximately equitable. They are designed to give the utility a revenue sufficient in amount to cover certain expenses and to yield it a fair return of the money invested. The expenses meant consist of the actual cost of generating the electrical energy, taxes, depreciation and maintenance on the generating plant and distribution system, losses, liability expense and other operating expenses.

There is more or less uniformity in urban distribution systems as regards the number of customers served from a transformer and the number of customers per mile of distribution line. An examination of twenty-five utilities in Wisconsin shows that in normal times the average cost of the distribution system per urban customer is approximately $50. Urban rates are therefore designed to provide, in addition to other things, all fixed and operating costs on $50 of distribution system per customer. It is not uncommon to find rural lines costing as much as $400 per customer. It is evident that if $400 of distribution system must be maintained and operated per customer, urban rates designed to care for only $50 of distribution will not provide an adequate revenue. Urban rates therefore provide wholly inadequate revenue for average rural service.

The rural customer is fair and does not want this service at less than cost, and if the utility management will take the time and trouble to explain fully and carefully the reason for all charges before any lines are built, there will be no trouble in getting consent to adequate rates. If full explanation is not made and the rates are not thoroughly understood by the rural customer, trouble is sure to follow. Explanations must be made in simple language, and such words as distribution system, transformers and depreciation must be clearly explained.

ALL CUSTOMERS PUT ON SAME BASIS

Many rural customers are now receiving electric service at less than cost. This has established a bad precedent which must be overcome. If a large number of new rural customers can be supplied with electric service on a proper basis, the customers now served can be gradually educated to the fact that they should pay more for their service, and in time all rural customers can thus be put on the same basis. It has been found very unwise to make this change too rapidly in the case of old customers, especially before full explanation has been made. The question of discrimination is here raised, but the plan can be justified. There is no reason why the utility should take on additional rural customers at a loss simply because a wrong method was adopted in the past. Neither should the rates to old customers, who in many cases have contributed money to the cost of the lines, be raised until these old customers learn why they should pay more and have had a chance to see that their neighbors are actually paying a higher rate but not an unreasonable one.

One-fourth of the population of the United States live on farms. This large number of people want and are entitled to electric service. The farmer has come to realize that electric service on the farm is a necessity and not a luxury. He can afford it and is willing to pay for it. The farmer's wife is demanding electric light, an electric washer, an electric iron, an electric vacuum cleaner and an electric pump for running water, and she is going to get them all. The farmer's children are no longer content with the old farm home, with its kerosene lights and oil stove, and are asking for the many comforts which electric service has brought to the city home. The farmhands want improved working conditions and know that electric service will lighten their work and make it more pleasant. Everybody on the farm wants electric service!

NEED OF IMMEDIATE ACTION

Are the utility managers going to turn a deaf ear to these demands and compel the farmers to develop their own means of obtaining this service? This would be likely to result in a rural electric system development similar to the development of rural telephone systems, and a menace would be created that no electric light and power company could afford to incur. It is far better for utilities to face the situation frankly and develop a fair and practical plan for supplying rural electric service. The problem should be approached on the basis of pure business and carefully analyzed to bring out all of the factors entering into the situation. There is need of immediate action. Wisely handled, the situation is in the hands of the central-station industry to direct in a manner that will be of benefit to the industry and of infinitely greater benefit to the consumers.

Hydro-Electric Developments Involve an Expenditure of $150,000,000

Construction in Progress Under Licenses Granted by Federal Power Commission Involves Almost 1,750,000 Hp.—Big Creek Project Largest for Which License Has Been Granted

HYDRO-ELECTRIC projects which are now being constructed under licenses issued by the Federal Power Commission involve an expenditure of almost $150,000,000. To April 15 twenty-six licenses had been granted by the commission, of which five cover projects already constructed. The remaining projects, including three which had units completed and in operation when license was issued, are now under actual construction.

The installed hydraulic equipment included in these developments will total one and three-quarter million horsepower if the ultimate development of the Big Creek Project of the Southern California Edison Company and the Kings River Project of the San Joaquin Light & Power Corporation are included. Several of these projects will be developed by stages depending upon the increase in demand for power in the territory served.

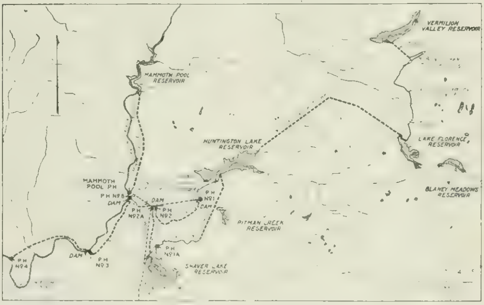
As indicated in the accompanying map, practically every section of the country is represented in these licenses, but California predominates with almost one-third of the total number. The largest of the developments is also in California, namely, the Big Creek project of the Southern California Edison Company, which represents an ultimate development of 545,000 hp. under the license issued by the Federal Power Commission, and of 753,000 hp. if the development is authorized under final permit from the Department of Agriculture.

Detailed data relative to these projects will be found in the accompanying table. Especially interesting are the estimated costs of the various projects as made by the companies themselves or by the engineers of the Federal Power Commission. The total cost of the twenty-five developments is estimated at $149,470,000, of which almost one-half is involved in the Big Creek project of the Southern California Edison Company. The average cost of the projects in the aggregate is $102 per installed horsepower, if the Kings River project of the San Joaquin Light & Power Corporation is not included. However, if the development of the Niagara Falls Power Company is also deducted, the average cost per installed horsepower is $118. The lowest cost is that of the Niagara Falls Power Company, which is estimated at $41 per installed horsepower, and the highest is that of the Home Colony in Wyoming, which is $500 per installed horsepower.

BIG CREEK PROJECT LARGEST DEVELOPMENT

By far the largest new development* for which the Federal Power Commission has granted a license is that of the Big Creek project of the Southern California Edison Company. Under this license the total completed project will involve a hydraulic installation of 545,000 hp., and the total cost of the project is estimated by the Federal Power Commission engineers at $61,152,000. The total electrical equipment is estimated at 407,000 kva., to cost $9,300,000. The estimated cost of the entire project will average $112 per installed horsepower.

The project consists of one earth dam, four concrete dams and two concrete weirs. Almost 129,000 ft. of pressure tunnels will be constructed, three power houses will be constructed or extended, and one three-wire, 150,000-volt transmission line, 8,119 ft. in length, will connect the system to the main transmission line leading to Los Angeles.



THE BIG CREEK DEVELOPMENT OF THE SOUTHERN CALIFORNIA EDISON COMPANY INVOLVES EXTENSIVE SYSTEM OF RESERVOIRS AND TUNNELS

Stations No. 1 and No. 2 have been in operation for about eight years, transmitting power at 150,000 volts to Los Angeles, a distance of 240 miles over a two-circuit transmission line. Station No. 8 was completed in August, 1921. This station was built for 220,000-volt operation, but will be temporarily operated at 150,000 volts pending the construction of additional stations in the Big Creek project.

Following is the construction schedule of the Big Creek project as indicated in the license:

April 1, 1923.
  Portion of Shaver Lake conduit from Pitman Creek reservoir to Huntington Lake reservoir.
June 1, 1925.
  (a) Florence Lake tunnel.
  (b) Portion of tunnel of Shaver Lake conduit extending from Pitman Creek reservoir toward Shaver Lake reservoir.
  (c) Big Creek Power House No. 2-A tunnel to full size.
  (d) Big Creek Power House No. 2-A to a capacity of 50,000 kw., together with necessary penstocks.

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*A license has recently been issued for project No. 175 of the San Joaquin Light & Power Corporation. This completed project will cost $50,970,000. Details will be found in the accompanying table. A license has also been issued for completed project No. 149 of the Wyoming Power Company on Big Horn River, Wyo.

Hydro-Electric Projects Being Constructed Under Licenses Issued by the Federal Power Commission

No. of License	Name of Company	Location	Name of Stream	Dam Data				Power House, Total Cost	Hydraulic Equipment,		Electrical Equipment		Project as a Whole		Reservoir Storage, Acre-Feet	Remarks
				Type of Construction	Height, Ft.	Length, Ft.	Total Cost		Hp.	Total Cost	Kva.	Total Cost	Total Cost	Cost per Installed Hp.		
13	Henry Ford & Son, Inc.	Dearborn, Mich.	Greene Is., Hudson River					800,000	8,100	*$680,000			$2,225,000	$275		
16	Niagara Falls Power Co.	Niagara Falls, N. Y.	Niagara River					683,700	210,000	952,500	157,500	1,324,000	8,700,000	41		Extension to plant No. 3 only.
58	Luther Hill	Independence, Cal.	Sam Mill Creek, Cal.						250				27,000	180		
63	Alaska Endicott Mining and Milling Co.	Juneau, Alaska	Wm. Henry Bay, Alaska						350	47,000			70,000	200		
67	Southern California Edison Co.	Los Angeles, Cal.	Big Creek, Cal.						545,000	2,620,000	407,000	7,740,000	61,152,000	113	307,790	
				Concrete (Dam No. 5)	58	210	$ 104,000									
				Earth	138	4,390	2,000,000									
				Concrete	183	1,005	2,650,000									
				Concrete	128	2,970	2,260,000									
				Multiple-arch, Concrete	180	2,300	4,310,000									
70	Rock Creek Power Co.	Missoula, Mont.	Rock Creek, Mont.						2,000	46,000	1,875	27,000	200,000	100		
77	Snow Mt. Water & Power Co.	San Francisco, Cal.	Eel River, Cal.	Concrete	185	485							2,110,000		215,000	
78	Western States Gas & Elec. Co.	Stockton, Cal.	So. Fork, Am. River, Cal.						6,100							Constructed
82	Alabama Power Company	Birmingham, Ala.	Duncan's Riffle, Coosa River, Ala.	Concrete	95	1,200	1,838,800	1,104,000	110,000	998,000	80,000	1,384,000	11,001,000	100		
94	Alaskan Amer. Paper Corp.	New York City	Orchard Lake, Alaska						5,200		1,200		746,000	144		3,600 hp. in turbines direct-connected to paper machinery.
96	San Joaquin Lt. & Power Corp.	Fresno, Cal.	San Joaquin River, Cal.				750,000	370,000	45,000	400,000	33,750	627,000	5,700,000	127		
104	Home Colony	Cody, Wyo.	Kitty Creek, Wyo.						10	1,300	8	1,800	5,000	500		
108	Wisconsin-Minnesota Light & Power Co.	Grand Rapids, Mich.	Chippewa River, Wis.	Earth, Concrete Core	45	995	282,600						282,600		275,000	Dam only
126	John R. Love and G. A. Von Brecht	Colorado Springs, Col.	Salmon River, Idaho						505				100,000	198		Constructed
130	Grace S. Eyre	Buena Vista, Col.	Chalk Creek, Col.						800	6,000	600	6,000	70,000	88		
148	C. S. Benefiel	Paisley, Ore.							60				9,500	159		
166	McConnelsville Malta Elec. Co.	McConnelsville, Ohio	Muskingum River, Ohio					3,000	500	10,000			34,000	68		Constructed—includes 200 hp. gas engine stand-by.
175	San Joaquin Light & Power Corp.	Fresno, Cal.	Kings River, Cal.										50,970,000			
	Wishon Dam			Concrete	250	6,475	10,000,000	320,000			6,600				128,323	
	Haas Diversion Dam			Concrete	50	240	200,000	3,220,000			87,500					
	Balch Diversion Dam No. 1			Concrete	70	220	130,000	4,820,000			133,000					
	Balch Diversion Dam No. 2			Concrete	60	330	120,000									
	Bear Diversion Dam			Concrete	20	150	20,000									
	Peart Dam			Concrete	325	1,385	4,700,000	190,000			3,500					
	Farnham Diversion Dam No. 2			Concrete	65	330	140,000	910,000			27,200					
	Farnham Diversion Dam No. 1			Concrete	75	210	170,000									
	Meyer Dam			Concrete	180	1,667	1,440,000	230,000			5,200				21,000	
	Kings River Diversion Dam			Concrete	85	550	400,000	660,000			21,600					
184	El Dorado Power Co.	San Francisco, Cal.	South Fork American River, Cal.	Intake Reservoirs masonry	55	385	884,000	191,000	21,500	175,000	15,000	530,000	4,750,000	220	16,000	Initial development only
				Two Twin Lakes dams—earth	85 70	1,250 535										
185	Southern Sierras Power Co.	San Francisco, Cal.	Vivian High and Willow Creeks, Cal.						3,350	27,000	3,000	83,000	630,000	188		
206	George Inlet Packing Co.	Portland, Ore.	Beaver Falls Creek, Alaska						90							Constructed
213	J. H. Cann	Juneau, Alaska	Cann Creek, Alaska						75							
236	Blue Mountain Irrigation Co.	Monticello, Utah	Pole Canyon, Utah						36							
241	Freshwater Bay Lumber Co.	Douglas, Alaska	Parloff Harbor, Alaska						100							
253	Henry Weber	Buena Vista, Col.	Denny Creek, Col.						100							

* Includes hydraulic and electrical equipment.

June 1, 1927.
(a) Vermilion Valley conduit with temporary diversion works across Mono and Bear Creeks.
(b) Remaining portion of Shaver Lake conduit.
(c) Big Creek Power House No. 1-A to a capacity of 50,000 kw., together with necessary penstocks.
January 1, 1928.
(a) Florence Lake reservoir.
January 1, 1930.
(a) Vermilion Valley reservoir.
(b) Rest of Bear Creek diversion works.
(c) Blaney Meadows reservoir.
(d) Shaver Lake reservoir.
(e) Rest of Big Creek Power House No. 1-A, together with necessary conduits.
(f) Rest of Big Creek Power House No. 2-A, together with necessary conduits.
(g) Rest of Big Creek Power House No. 8, together with necessary penstocks.

Niagara Falls Development Will Add 213,130 Hp.

The second largest new development for which a license has been granted by the Federal Power Commission is that of the Niagara Falls Power Company. In addition to the existing installed capacity of 383,600 hp., of which 115,500 hp. will be used as a reserve after the ultimate development is completed, the license provided for new construction with a hydraulic installation of 187,500 hp., consisting of five 37,500-hp. turbines to be added to Station No. 3 and 3,130 hp. to be added to Station No. 2. A new design has since been submitted for the new construction substituting three 70,000-hp. turbines for the five smaller units, or a total new development of 213,130 hp. This added development of 22,500 hp. is obtained at an increased cost of only about $80,000. The total cost of the river improvement at the inlet to the tunnel, the tunnel, forebay and penstocks and extension to Station No. 3 is estimated at $8,700,000 (exclusive of the transmission line and substation equipment), of which $683,700, or 7.9 per cent, is for powerhouse construction; $952,500, or 10.9 per cent, is for hydraulic equipment, and $1,324,000, or 15.2 per cent, is for electrical equipment. The generator installation will be rated at 195,000 kva.

On account of the total absence of dam construction and the comparatively small amount of canal and tunnel construction necessary, the cost of the project per installed horsepower will be only about $41, which is probably the lowest unit figure ever recorded for a large hydro-electric development. A transmission line has been constructed leading to the Echota substation and to Buffalo. The latter is known as the Grand Island Transmission Line and consists of a land section of 8 miles with two three-phase circuits and a river section of 1 mile having four circuits. This will cost $392,000.

Development at Mitchell Dam, Coosa River

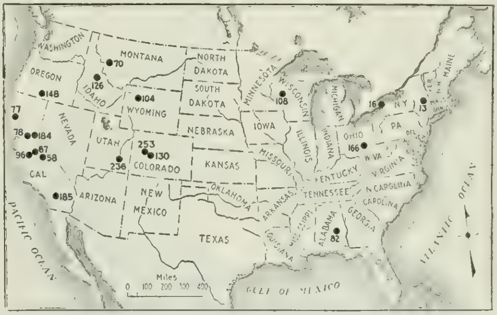
Third in the list of projects now under construction is the Coosa River development of the Alabama Power Company at Duncan's Riffle, designated as the Mitchell Dam Project. The project consists of a dam, a power house and a transmission line connecting this plant with the existing primary transmission system of the Alabama Power Company. The dam will be constructed of concrete and will have a height of 95 ft. and a length of 1,200 ft. The cost of this portion of the project will be $1,838,800. The power house is to be an integral part of the dam, having provision for an ultimate installation of five units. The initial installation will be two units, each having a capacity of 22,000 hp. This hydraulic equipment will be installed under a patented scheme whereby several feet of additional head is gained because of the effect of the tailwater.

The initial cost of the hydraulic installation of 44,000 hp. is estimated at $399,000, and the completed hydraulic equipment of 110,000 hp. will cost about $998,000. The initial electrical equipment of 32,000 kva. will cost $553,600, and the ultimate electrical equipment of 80,000 kva. will cost about $1,384,000. The transmission line will have a length of 12.2 miles, extending to the company's present plant at Lock No. 12 on the Coosa River, and will cost $250,000.

The estimated cost of the ultimate project is $11,001,000, or $100 per installed horsepower. Actual construction of the dam was begun on Aug. 8, 1921.

El Dorado Power Company Project on American River

The project of the El Dorado Power Company on the south fork and headwaters of the American River in California involves a hydro-electric power plant of 107,500 hp. ultimate installed capacity. The initial development will consist of two 10,750-hp. impulse waterwheels, operating under a net head of 1,750 ft. The cost of these turbines installed is estimated at $175,000. Later installations will consist of four 21,500-hp. units of similar type, making a total of 107,500 hp. Each wheel in the initial installation will be directly connected to a 6,600-volt, three-phase, 60-cycle generator rated at 7,500 kva., and for the larger units 15,000-kva. generators will be used, making the ultimate rating of the electrical equipment 75,000 kva.



WIDE DISTRIBUTION OF HYDRO-ELECTRIC PROJECTS BEING CONSTRUCTED UNDER LICENSES FROM FEDERAL POWER COMMISSION

The project includes five storage reservoirs on the headwaters of the American River, a diversion dam, and a diversion canal about 25 miles in length. The cost of an initial storage of 16,000 acre-feet is estimated at $576,000, the cost of the power house at $191,000, and the hydraulic and electrical installation of 15,000 kva. at $530,000. A steel-tower, double-circuit transmission line, designed for 120,000 volts but to be initially operated at 60,000 volts, approximately 6 miles long, will connect the power house with the primary transmission system of the Western States Gas & Electric Company at Camino.

The cost of the initial project is estimated at $4,750,000, or $220 per installed horsepower. The unit cost of the ultimate installation will, of course, be much less by reason of the total cost of the diversion works and power house being included under the cost of the initial project.

Maintaining Joint-Pole Lines on "Fifty-fifty" Basis

Second and Succeeding Occupants Pay Flat Rate per Pole and Share Maintenance Expense—Joint Pole Yard of Questionable Value

By Fred H. Smith
Assistant General Manager Worcester (Mass.) Electric Light Company

MANY advantages accrue to public utilities and to the municipalities which they serve through the use of joint pole lines in districts supplied from overhead circuits. Reduced investment, lower maintenance outlay and decreased obstruction to the use of thoroughfares are worth a good deal of money to all concerned; but these depend largely upon satisfactory intercompany relations for successful attainment and maintenance. Simple agreements, fair to the two or more companies involved in every joint pole line, are the foundation of good relations and efficient co-operation.

AN EXAMPLE OF JOINT POLE USAGE IN MASSACHUSETTS

The question has been asked: "Upon what basis should a central-station 'trade' with a telephone company or other utility for a reciprocal pole interest?" The answer, in my opinion, is that each company shall agree upon a flat-rate cost and to the maintenance of joint poles in proportion to the number of companies using such lines. That is, where two companies use a common pole the second occupant may fairly pay a flat rate per pole if the pole is jointly occupied within a stated period after its erection. Furthermore, over the total area served two companies, such as a central-station and a telephone organization, may fairly divide on a "fifty-fifty" basis the work or the expense of joint pole maintenance, including guying.

An arrangement based on the above scheme has the great advantage of simplicity as compared with the practice of charging for pole occupancy on the basis of the number of "hitches" made. Developments in safety engineering during the last decade or two have established well-defined locations for wires of different voltages and service usefulness. The work of the committee on overhead-lines construction of the National Electric Light Association has been most helpful in this field. The tendency, at all events, is for the assignment of services to become standardized in any particular company and probably over wide areas of the country. This means that a simple agreement involving no complex valuations or computations can generally be arranged in a given community if the utilities concerned are desirous of going ahead on a fair give-and-take basis.

Application for pole rights on the public streets or alleys is generally made to the municipality by the utility first expecting to enter a given district. If it is known at the time when a telephone company applies for pole location rights that the local central-station company will very soon wish to occupy space on the pole or poles a joint application may be framed to save inconvenience. In some cases the telephone company may, by agreement, file all the applications required by the municipal government for joint-pole locations in the public streets or alleys. This may be a great convenience to the telephone company by permitting it to use standardized forms and data sheets over an area perhaps many times greater than that served by a single central station, involving a multiplicity of circuits and a well-settled procedure. Duplication of effort by the central-station company is correspondingly diminished.

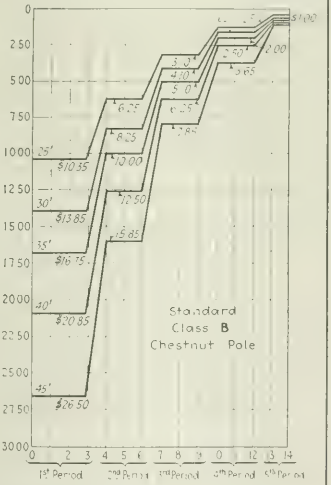
Companies Must Keep in Touch

In cities and towns where so-called back-yard services are used each utility will naturally erect its own poles as needed, but two or more companies maintaining good co-operation will keep sufficiently in touch to plan for joint use as far ahead as possible. Permits from property owners and not from the municipality are required here. A second company making use of a back-yard pole line under joint-use agreement will pay on the basis of a pole value upon an agreed basis, which, as I have indicated, seems to work out well if fixed in proportion to the number of utilities concerned.

By agreement a central station may maintain all poles on public thoroughfares for joint use and bill the other utility occupants for pole cost in place in proportion to the number of companies sharing the use. This is a logical arrangement in view of the street-lighting construction frequently required; but, of course, an agreement whereby the telephone company would maintain all joint street poles and bill the central-station company its proportional cost might be preferred in some towns. The vital point is to get a fair sharing in costs. Each utility will properly limit itself to doing construction work only upon its own lines except in emergencies, and under this plan its standards of construction may be easily and economically maintained.

It is helpful to establish and maintain an agreement as to the value of poles and different periods during their life, so that one company becoming an occupant of a pole sometimes after erection may be required to pay only its fair share of the worth of the pole from then on. In the accompanying diagram a set of pole-value curves based on a life of fourteen years is shown. According to these curves, for example, a chestnut pole 30 ft. (9 m.) long is valued at $13.85, and this value is assumed to hold for the first three years of its life. If one company should install a run of poles on its own account and afterward, up to three years, if a second company should seek joint occupancy, the second company, on the "fifty-fifty" basis, would then pay the first one $6.93, or one-half of $13.85 as its share of the current value per pole. If, however, the second company should enter into joint occupancy from four to six years after pole erection, the value of the pole would have decreased to $10 for the second period, and only $5 per pole would be paid for the privilege of joint ownership. Thus, by three-year periods, the value of the poles declines, until by agreement all poles attain a nominal value of $1 at the end of their service life of fourteen years. Diagrams of this kind, which may easily be put in tabular form if desired, are convenient among companies wishing to take account of pole depreciation in joint-use agreements.

The desirability of a common pole yard for utilities in the same territory is open to question, in view of the space requirements, haulage costs and differences in storehouse and yard locations among companies. It seems best for each company to maintain its own yards, particularly in view of the substantial number of separate poles required for individual company service and the great area, relatively speaking, covered in many cases by a telephone company as compared with a central station. Unless a really vast number of poles is handled annually, a joint pole-treating plant also appears in most cases too expensive to be warranted. An agreement on standard methods of pole treating, however, is most desirable between companies using poles jointly.



SAMPLE CHART OF POLE VALUES

A point which sometimes causes trouble in inter-company relations is that of service attachment locations from joint-pole lines. In general, a central-station service to a building is carried above the telephone lead, following the widely accepted plan of running telephone wires below central-station primary and secondary wires on pole lines. A little care in maintaining these relative heights in making building attachments will save expense later, and this should be borne in mind by each company, regardless of which makes the first entrance. In some places the telephone company tries to enter the south side of a building to insure maximum dryness, while the central station enters on the north side. Knowledge of local practice between companies, combined with co-operation between line superintendents and foremen, goes a long way toward maintaining smooth relations and keeping costs down where they belong.

Joint-pole maintenance may be conveniently handled in more than one way, but the plan used at Worcester is simple and effective. Here we have arbitrarily divided the city into two substantially equal geographical parts, and, generally speaking, the telephone company maintains all joint poles on private property in one of these districts and the central-station company maintains those of the other district. All joint poles on public thoroughfares, no matter in which district, are maintained by the central station, half the cost being paid by each company. Each company does all its own work, with minor exceptions, upon the overhead circuits belonging to it. It is desirable that the line forces of each company be active in pole maintenance, and this arrangement has given good satisfaction and, we believe, has brought since its adoption a fair distribution of the expense of joint pole maintenance among the companies. A certain independence of operation is very desirable in the handling of line maintenance forces among different utilities, and if these are well-proportioned to normal requirements, when emergencies arise one can be used to supplement the other with great advantage to the utilities and the public.

In case of joint-pole relocations a prorating of expense among companies may be convenient on the basis of their mutual interest in the change, and in case of exceptionally heavy pole construction, guying, etc., due to unusual requirements of one company (such as installing a run of 13,200-volt three-conductor cable), a settlement of cost on the basis of a separate adjustment through conference seems fair. Too much emphasis cannot be laid upon friendly co-operation between line-maintenance executives and subordinates as a final factor in the success of joint-pole-line agreements.

Maintaining Marketability on Customer-Owned Securities

A Few Statements of Individual Experience and Opinion from a Number of Central-Station Executives

"THE SECRET, the very fundamental, of success in selling central-station junior securities to the company's customers lies in the maintaining of the market, and the maintaining of the market is the simplest and easiest detail of a stock campaign. For a utility stock certificate is just like a banknote. A banknote is valueless in itself, but the fact that the Federal Reserve bank or Uncle Sam has printed on the face of it the pledge that he 'will pay to the bearer on demand' makes it good money. And a similar pledge by the utility that it will buy back the stock certificate or will sell it to some one else at any time the owner wishes to dispose of it makes the stock good money in the same way. That is about all there is to it."

NEED ONLY LET THEM KNOW

This statement by a central-station executive who has been particularly active and successful in the development of customer ownership is typical of the experience of many companies which have recognized the importance of maintaining marketability. For another company says:

> We have never had occasion to maintain a market for our securities. Our newspaper advertisements have made no reference to marketability, and we have not been asked so

far to buy any stock back for our customers. But, in case a purchaser asks a salesman what he shall do if he later wants to sell his stock, the salesman tells him that the company at any time will be glad to assist him in finding a purchaser. This is all the purchasers want to know.

It does not seem to make much difference to the customers whether the company has formally established a resale department or not, so long as they know that there will be a way to sell. In one city in New York State the company does not maintain a resale department. And it "does not buy back stock for the customer, but it does make a strong effort to resell and has done so in several cases." In a neighboring city, however, though the company's advertising carries no reference to reselling shares, it says:

> The salesmen are instructed to advise the customers, in case the point is raised, that we maintain a permanent investment department and will resell their shares for them in case they wish to dispose of them, or if cash is needed immediately, we arrange with them at a bank so that a loan can be made with the shares as collateral, and before the note is due we shall have sold these shares. We have placed approximately 5,500 shares with a few more than 600 customers in a period of approximately five months. We have had no shares turned in for resale and only a few time payments have not been kept up.

THIS MAP SHOWS STOCKHOLDERS OF THE COMMONWEALTH EDISON COMPANY

This huge map in a window of the Commonwealth Edison Company's Electric Shop in Chicago marks with large black pins the density and location of the local stockholders. Little red lights mark the position of the eight generating stations and green lights indicate the sixty substations. One of the interesting features is the fact that the greatest number of stockholders per square mile is shown to be in the "North Shore" residential district. There are 24,000 stockholders in Chicago with a very general distribution. This map will be on exhibition at the N.E.L.A. convention in Atlantic City next week.

This from another manager:

> Every man who has no money in the bank wishes that he could save. Every man with a bank account has some money which he can invest. Therefore practically every household is a "prospect" for the sale of utility stocks on the installment basis, provided that a way is made for the purchaser to sell should he need to. The more frankly and freely this resale protection is represented to the customer the easier is his mind and the more willingly he buys.

Reasoning similarly, a Pennsylvania company says:

> We maintain an investment department where customers do all their trading. We buy back from them any stock they have subscribed for on partial payments by returning to them all they have paid plus 6 per cent interest. However, there is little trading of this kind, as the customer is reluctant to dispose of his subscription owing to the fact that the market on our securities has advanced from the selling price of $42 per share to $50 per share. It has not been necessary to advertise that we conduct an investment department. Our customers all understand that they can trade at our office.

The attitude of the local banks, of course, has a direct influence on marketability. An Ohio company makes this statement out of its experience on this point:

> The banks generally seem to be "sort of on the fence" when it comes to our stock. We have heard in one or two cases that they recommend it, and we know of a number of cases where they have directly opposed its purchase. We feel that as a rule they sort of damn it with faint praise, saying it is probably all right, but there are other things better. We believe that most of the banks are convinced that the company and the stock are sound. In one case, however, a bank bought some traction bonds eighteen or nineteen years ago on which later on default was made. The bank has since been bitterly opposed to public utilities of any kind. One of the leading banks caused us quite a bit of trouble until we told it we were maintaining a permanent securities department, when it right-about-faced, and we believe it is now helping us.

Another Pennsylvania central-station company says:

> The various bankers in the four counties in which we operate accept our securities as collateral and recommend their purchase to customers who inquire, but have not sold any of our securities except where an occasional customer of theirs has called and asked them to purchase for him. When we first offered securities to our customers we heard indirectly of two bankers who were not enthusiastic in recommending them to their customers. The balance sheet of our financial statement was presented to the bankers, and they were readily convinced.

Inexperience of the Purchaser

It must be remembered that the average purchaser of these shares is inexperienced in security holding and therefore needs and obtains advice, and it is most important that the advice which he receives be based on knowledge and sympathy. Of this the manager of the investment department of another light and power company says:

> We find that 95 per cent of our customers do not have any knowledge whatever of stock exchange trading. This is evidenced by the number of stockholders who call at the investment department explaining that through adversity they are compelled to sell. Naturally they come to the place where they bought and inquire if they can sell their holdings for what they paid for them. If we do not have a buyer and the customer wants his money, we give him a check on sight at the market price, and he goes out happy. He is sure to spread this news among his friends, and thereby the company benefits in good will and favorable advertising for another issue.
>
> We consider our investment department as a very necessary adjunct to our business. We have approximately 2,100 shareholders in our territory, all of whom depend more or less on our company for advice.

"In a word," says another executive in appropriate conclusion, "the man who under this plan buys the securities of a central-station company is not only the purchaser of stock; he is an old acquaintance, a friend, an established customer, and he must be treated as such. He loans the company his money because he believes in the company as well as because he wants a good investment. And if anything happens which makes it necessary for him to get that money back, it must be made easily possible, for this old friend must be taken care of cheerfully and without delay."

Some Economic Engineering Problems to Think About

By **LOUIS R. LEE**
Chief Engineer E. W. Clark & Company Management Corporation, Columbus, Ohio

Location of Plants, Lines, Substations as They Are Affected by Market, Labor, Fuel, Water and Transportation—Feasibility of Future Changes and Extensions - Efficient Use of Equipment and Arrangement Thereof

THE development of every electric service company, virtually without exception, has been a compromise—a compromise between what is desired and what the circumstances permit. When emergencies and possibilities arise it is the duty of the engineer to present to his executives all of the reasonable and feasible alternatives. He should be able to weigh good engineering in with what some may think concerns only expediency and should present the true measure of the value of the different alternatives. If the engineer finds that by building a permanent dam and installing good equipment, but minimizing the cost of the superstructure and other features of what would be styled a well-rounded development, he can reduce his cost so that the development may be started in time, he is exemplifying good economics.

There is little chance for the engineer to be criticised if he installs a minimum of good equipment, incorporating in his plans such ideas as will permit of extensions or additions or further elaboration as time goes on, but getting for his initial investment a maximum of reliable capacity. If, in contrast with this plan, he builds an elaborate plant complete to the last detail, getting a unit cost possibly not extremely high, but spending considerably more money in all than he might have spent by a more simple plan, his economics are out of balance.

The engineer should have a trained idea of the general fitness of things. It is certainly well to consider the general appearance of the buildings and their appurtenances when plants are to be built in thickly settled districts; but of what advantage is ornamental appearance to a building situated miles from the thickly settled districts or where probably it never will be surrounded by any built-up district? There is, of course, little excuse for flimsy buildings that will involve high maintenance cost. It is usually a fact that substantial, plain buildings of the very simplest nature can be built for rather low figures. Moreover, the advantage lies not so much in the saving in these buildings themselves as in the idea which goes along with simple construction, for it is generally true that plans calling for tiled walls and mosaic floors conduce to the same trend toward expense in the more essential features.

In presenting his alternatives the engineer must be sure that he does not offer schemes which if followed will lead to trouble due to inadequate plans. On the other hand, he may properly present alternatives which limit the things they make possible so long as these limitations are carefully enumerated at the outset. Every plan must have in it some features to take care of future needs. These features of most plans have cost a great deal and probably in most cases have been worthwhile investments, but a great many exceptional instances have shown that too much consideration can be given to the future. Usually provisions for future consideration are rather cheap as they may obviate making investments which would be poor ones and may point to other possibilities which can be realized on. However, it is well to weigh carefully and point out to those who authorize the expenditures just what things are being put in and paid for with the sole idea that some time later they may be required. It sometimes is true that with an eye to the future a feature here and there can be provided along with the initial work at a very slight cost, considering that the labor involved is about the same in either case and the material required only slightly more. However, this argument can easily be overworked and may sometimes even hamper the plan for the things that are to be done right away. One of the great dangers in making the provisions for future possibilities is that, because of the changes in the design of equipment from year to year, there is no certainty at all that five or ten years from now, or even next year, the engineer will want to install additional equipment like that he is installing today. Therefore, in making his plans about the best he can do is to leave space and to show in his drawings what equipment similar to that of today may be required in the way of extensions to the present plant.

ULTIMATE COST MUST BE CONSIDERED

In branching out to new territory a company must always consider not only the initial unit cost of extensions to its plant or buildings, but also the ultimate cost. Usually, present plants, if designed and laid out with some foresight, can be added to at a relatively small cost, so that the unit cost of the extension should be rather low. Moreover, where a number of water-power developments are being built upon a stream, especially if there is any storage in the development, it is of great advantage to build one plant after another up the same stream, because water stored in the plants furthest up the stream will be used over and over by the plants further down. It is also usually found that the cost of transmission lines serving a number of plants in this way is rather low. However, there is advantage in having water power on different streams in widely separated territory because difference in weather conditions may prevent a prevalence of low water or flood water in one section from being experienced in another.

In hydro-electric enterprises it is necessary to consider what the stream may produce in power if developed to a maximum; that is, if all the natural fall is used to best advantage. A stream may present several sites some of which can be developed more cheaply than others. There may also be alternatives as to the number of sites that may be developed while still utilizing the total fall of the stream. However, such a plan might cause the unit cost of the developments to be excessive and render the proposal commercially unattractive. Is it not better to develop the stream so that it will be a good business proposition even though something less than 100 per cent of the fall is developed? A similar consideration enhanced in degree is forced by the impracticability of developing any part of some streams because of their wide range in stream flow. While it may seem the right economic course to develop as much water power as possible in order to conserve coal, yet investors are certainly not ready to spend money for its development unless the expenditure promises to be a good business venture.

From the point of view of conservation steam plants should burn the lowest grade of coal, yet that is often quite impracticable from a business standpoint. In the same fashion, the company seeking steam power has some choice as to the cost of the plant it may build. The cost will increase with higher efficiency. There is a point where the higher efficiency will not make a proper return on the additional investment required to obtain it. Therefore the company having mixed water and steam power has an even greater problem in determining, first, the general characteristics of steam generation. The first essential of the standby steam plant, of course, is reliability. But a plant may be built to be more or less efficient without changing its reliability. Here again the most valuable plan for the steam plant will be one which will allow it to be started with moderate efficiency with provisions for additions which will increase the efficiency. A flexible plan of this kind is extremely valuable as it allows the company to try out its ideas by experience, and when it finds that new expenditure will be justified by additional efficiency it can secure this efficiency when it is most needed.

Best Way Not Always Most Costly

The best way to do a thing is not necessarily the most expensive way, neither is it the way that costs least, but it may approach one or the other extreme according to a combination of many factors.

The location of standby steam plants must also be made with reference to load centers and existing or prospective water-power sites, but it also must be affected by the freight rate on coal and the availability of cheap fuel, the cost of the coal being determined by the kilowatt-hours that will be produced by each dollar expended in its purchase.

In the consideration of transmission lines for new territory there are many factors. Some of this territory may require long, high-voltage lines, while in other parts only extensions to lower-voltage lines may be necessitated. It is usually rather easy to go into a new territory and get some load immediately, but it is much harder to close contracts for a large percentage of the available load on existing lines. There are always some small plants that have use for exhaust steam or that have a quantity of waste product which may be used as fuel. Such considerations make the generation of power somewhat of a by-product. There are, therefore, sometimes good reasons why an individual plant must, from an economic standpoint, continue to exist rather than be superseded because of the purchase of power from central stations, although eventually, as these plants wear out and as their by-product becomes relatively a smaller item in their total expense, they will be glad to transfer the burden of power generation to some one else and devote their entire energies to their main manufactured product.

The characteristics of prospective loads should always be known because a power company always has before it the opportunity of improving its load factor by diversity of demand or by actually high load-factor use. Night load is very hard to get, and certainly extra effort would be in order if thereby a large block of night load or twenty-four-hour load could be secured. The engineer should have pretty definite knowledge concerning load factor, power factor, load balance and momentary and sustained peaks. He should also know what damage the customer will suffer if service is interrupted momentarily or for various extended periods. It will be much more satisfactory to discuss probable interruptions than to review actual outages. If the engineer lays claim to any anatomical possession more important than a wishbone, he must feel reponsible for reliable service. Such service cannot be given with inadequate facilities, and adequate facilities cannot result from plans sketched out on the back of an old letter.

Customer Financing an Impetus to Load

Sometimes it is practicable for the prospective new customer or customers to supply the necessary capital or even to build the line extension. Such a method usually serves as an impetus to the community to obtain as much load for the power company as possible because it reduces the proportional capital charge to each indvidual customer. In many cases this is a very good way for the power company to secure a large percentage of the available load. However, in building any line extension it is necessary for the power company to consider continuity of service, and therefore a substantial line must be built. In addition to continuity of service the maintenance of the line must be considered. This brings up the question of the type of line—whether steel towers, black or galvanized iron, wood poles, plain poles or treated poles, and so on. Any of these materials can be used to build a good and substantial line, but if the line is to be an especially heavy one traversing a right-of-way which is rather hard to get at, in a rough country where the spans may be very long, it may be found that the best steel tower is the cheapest structure. If, on the other hand, the line is to run along or near a public highway, where it can be reached quickly and easily and where the spans may be of any reasonable length, then possibly the treated wood pole will, besides being low in first cost, permit of maintainance at a reasonable charge. The insulator item may be an important one, especially for the higher voltages.

In building transmission lines the larger conductor can be strung at virtually the same cost as the smaller one. If at the time of building conductors are low in cost, the larger conductor may be a good investment. However, there will probably be many things that will determine its advisability. The demand for the transmission of electrical energy over a given line may decrease in the years to come. Many other factors may influence the importance or the need of a certain transmission line. Although it is true that a considerable percentage of the cost of transmission lines is invested in movable property, yet it would not be generally considered a good plan to build lines with the idea that they are going to be taken down and moved from one point to another. As things go, they are about as permanent an investment as the power company is likely to have.

Costs may be greatly increased by providing too much for emergencies. It would be hard to determine the amount of expense which is involved in plans for special cases. For example, practically all power transformers are purchased with, at least, taps for various voltages, while many transformers are purchased with various winding combinations. If all power transformers were to be provided with taps and combination windings, there would eventually be provided a certain amount of transformer capacity which would never be used. It has been found, however, that in the development stage of light and power companies a great deal of flexibility in equipment is a real advantage, because such companies usually are forced to develop rapidly and are required to meet numerous emergencies and serve new customers on short notice. Flexibility of equipment and many possibilities of transformer arrangement made possible by means of taps and winding connections help the operating force to meet these emergencies satisfactorily. The engineer must study this phase of the question and see, as the development of the company proceeds, what provisions might have been made to better advantage and what the general trend of the company's progress is. It has been found in some cases advantageous for companies to spend large amounts to simplify generating and transmission characteristics. Systems have been built up of a number of smaller companies, thus bringing together different voltages, frequencies and phase characteristics which have complicated the whole scheme of things. Movements like the superpower surveys will help a great deal in bringing the country together on reasonable voltage and frequency standards.

It is really a question of economics whether old equipment should be remodeled and brought up to date. There are many who believe in using a piece of equipment as the manufacturer designed and made it, and then when it ceases to be entirely adequate to junk it and start anew. Quite often, perhaps even in the majority of cases, that is the safest course to follow. However, much profit may sometimes be reaped by bringing equipment up to date, and surely the engineer is remiss in his duty if he does not investigate all such possibilities.

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Local Interdependence of All Electrical Men

Central-Station Companies Must Co-operate with the Local Electrical Trade in the Rendition of Service to the Community

BY WILLIAM H. ATKINS
General Superintendent Edison Electric Illuminating Company of Boston

IN ONE very important particular at least all of the branches of the electrical industry share a common aim—that of rendering service to the public. Unless the manufacturer, the jobber, the contractor-dealer and the central-station company function as public necessities in the scheme of civilized life, they must pass from the world of affairs. It is easy for one or another branch of our industry to become so absorbed in its own immediate problems that those of other branches are overlooked, along with the relations of each branch to that final source of revenue, the ultimate consumer. If we stop and think of these things, we soon realize that the industry is highly interdependent and that successful development cannot be had by disregarding the interests of any other branch of the electrical industry.

I am very glad as a central-station executive to testify in these columns to my conviction that unity of purpose is nearer realization today in the relations of the central-station company and the local electrical trade than ever before. There have been many discouraging experiences in our industry among those who have tried to bring mutual understanding to bear upon trade development. Each branch of the industry has had its troubles and then some. The failure to get the other fellow's point of view has handicapped progress, and lack of initiative, poor business methods and lukewarm confidence have held back development at times when every shoulder ought to have been at the wheel. To deny that discouraging experiences still arise would be outside the truth, but today a better degree of co-operation is evident among all who are willing to play the game fairly and squarely, recognizing one another's viewpoints and putting into practice joint efforts to develop electrical service in every field.

PROSPERITY IS MUTUAL

It ought to be clear that in the long run the prosperity of one branch of the industry spells profits to the others. Some people still appear to think that the central station regards itself as sufficient unto its needs, indifferent to the success of the wiring and appliance retailer. Capital is concentrated into one organization in the central station while it is distributed among competing retailers. This means that uniformity of policies and practices is easier for the central station to attain, but it does not mean that the central station can get along well without the co-operation of the local trade.

For many years the Boston Edison company has been developing its system to the mutual profit of the local electrical trade and itself. We have maintained a vigorous sales organization and have placed our credit at the disposal of house-wiring concerns that have done installation work and have secured new business by this means all over our territory. We have sold electrical appliances in competition with the local trade and are still selling them. We believe in selling at list, but that does not in our opinion preclude our moving shopworn or obsolete stock at reduced prices, and we see no injustice in the special sales we have conducted, usually after full advance notification of the local trade.

Our fundamental reason for existence is to supply electrical energy, and we have already begun to lean more and more upon the local trade interests where those interests have shown themselves prepared and willing to merchandise electrical conveniences as they should be marketed.

The central-station company might abandon itself to supplying existing customers and to meeting the needs of those automatically coming upon the system or solicited by company employees, but if it did this, it would fail to render its full service to the community. We cannot accurately tell just the amount of new business that comes to us year by year as the result of "missionary work" by contractor-dealers, but unquestionably these men are constructively helping the central station to attain larger usefulness. The more progressive wiring contractors and dealers—those who co-operate most willingly with us and who have the vision to see that every new installation well made helps the entire industry to prosper—are in a sense partners in our work and true sharers in its rewards. It is not a matter of size, for we recognize that the very small contractor who does a good job adds desirable outlets to our system, and he receives the same fair treatment from the central station that is accorded his larger competitor. We do no inside wiring, and it is a satisfaction to see the increasing mutual confidence apparent, even if there is still room for improvement.

The Boston Edison company serves over 600 square miles of metropolitan and suburban territory and about twoscore cities and towns. To insure a constantly better understanding between ourselves and the local trade, we assigned about a year ago to this contract work an assistant to the general superintendent, who devotes his entire time to questions of inter-trade relations. Thus we are endeavoring to give a personal touch to the company's attitude toward the local trade and are trying, successfully I believe, to build up a warmer friendship among electrical men concerned with the extension of electrical service into all these communities. What cannot be accomplished if the spirit of inter-trade co-operation continues to develop, as I believe it must, in the coming years of our industry?

Open the Central-Station Doors Wider to New Business

The Time for Extreme Conservatism Is Past—The Public Demands Extensions of Electric Service and This Demand Must Be Met

By William Gould
Commercial Manager Massachusetts Lighting Companies, Boston, Mass.

IT IS time for the central-station company which has not reached the point of voluntarily suspended growth, not to say coma, to adopt a bigger and broader commercial policy than is evident in altogether too many companies. There was some reason for putting strict limitations on development during the war, when the demand for money and materials was imperative to the winning of the conflict. I am afraid that some managers are still holding back expansion through inability to realize that war-time restrictions long since disappeared in the background of central-station history, and that the public is waking up very rapidly to a perception of what sort of electric service it is entitled to and must demand.

The question has been raised of how the market for central-station service should be analyzed by the commercial departments of such organizations. Frankly, I see little reason for extended analyses of this kind by those whose business it is to market electrical conveniences and to increase the demand for electric service. To put the case in a nutshell, I believe that it is time the central-station industry threw open its doors for business on existing lines, without spending so much time and effort in proving that new business should be taken on circumspectly and in the fear of its effect on existing plant and line capacities.

The people in almost every section of this developing country are thoroughly aroused to the necessities, comforts and conveniences of electric service. In our electric properties (eleven in number) on the Massachusetts Lighting Companies group the number of electric meters in service has risen from 7,110 in 1914 to 20,459 in 1922. We are trying to make it easy, not hard, for the public to obtain our service, and the rate of increase is now so rapid that it is absolutely clear that the public intends to have the service which it wants and which we are doing our best to furnish.

Opportunity to Take on Diversified Business

Our companies, like many others of moderate or smaller size, purchase energy at wholesale rates and distribute it over local areas. Only one of our own properties operates its own generating plant. For some time to come there should be little question of such companies' concentrating on this or that type of load. If spare capacity in lines is available, let us make every effort to cram these lines with service, welcoming business of all sorts and going to work to provide additional facilities as the growth of business dictates.

This is no time to adopt a "pussyfooting" policy regarding new business. The public will have service in the long run, and if we do not provide it, who will? Shall we leave matters to develop through agitation until municipal plants are established? I take it that the vote is unanimously in the negative. But, you may say, would it not be well to concentrate on securing off-peak business or long-hour loads, rather than try to encourage additional consumption of energy from virtually all sources? Again the answer seems to me clear. Let us take on loads of every variety and cut our engineering cloth to fit the coat.

Favorable Cost of Extensions

Contracts for service need not be final until accepted by the higher executives of a company, and this provision goes a long way to protect an organization against entering into a distinctly unprofitable service. In this connection reasonable provisions must, of course, be established in regard to line extensions of any considerable length; but the present cost of copper wire and relatively low expense of running short overhead services justifies a pretty liberal attitude on the part of the central-station company. Even where a group of would-be customers at some distance from our lines desire service, it is for us to meet them on a reasonable basis, and if it is possible to make a fair agreement and get back the cost of construction in say four or five years, the word should be "go ahead."

Instead of wearing out slide rules in the sales department trying to analyze prospective new business to death, the industry will do better to play the game with enthusiasm and challenge the engineers to keep ahead of the growth of business if they want to hold their jobs. Customer ownership and the present lower cost of money offer no little aid to financing, provided the public feels that the local company is doing its utmost to provide service at fair rates and is making it just as easy as is humanly possible for the public to obtain such service. Instead of spending excessive time and exhausting brain cells in picking and choosing business, let the central-station commercial department cultivate the friendship of the contractor-dealer, "play square" with these potential "boosters" for additional loads and co-operate for more business. The saturation point is still too far from sight to justify a "stand-pat" policy.

Economical Increase of Distribution System Rating

How the West Penn Power Company Planned and Carried Out a Change-Over from 2,300-Volt Two-Phase to 4,000-Volt Three-Phase with Maximum Use of Old Equipment and Least Interruption of Service

THE central-station company with an overloaded distribution system usually has one of two remedies to apply. The first and perhaps the most natural is to add circuits or increase the size of copper in existing circuits. The second is to raise the voltage. A possible third remedy that applies only in larger communities is the construction of additional substations and splitting the system into smaller units. In the average small city this plan is usually too costly to consider. A typical case of the small-city problem is that of Connellsville, Pa., which is served by the West Penn Power Company. The city has a population of approximately 20,000 and is situated to the southeast of Pittsburgh. It is tied into the transmission system of the company through 25-kv. lines. One of the system generating plants is at Connellsville, the substation being at this plant. It is about 2 miles from this substation to the center of distribution in town, a rather long run for 2,300-volt circuits if a considerable amount of power is to be carried.

Originally the distribution system had been 2,300-volt, four-wire, two-phase. Some years ago changes were made so that three-phase power could be supplied, and some progress had been made in changing the system to full three-phase when a badly overloaded condition developed in the summer of 1921. Nearly 3,500 kw. in transformer capacity was installed, it being about equally divided between two-phase and three-phase service. One hundred and eleven power customers and 3,200 lighting customers served by 215 transformers were affected.

After a survey of the situation it was decided that the addition of circuits at the same voltage would not only involve a heavy cost but would soon produce a congestion in the streets that would be both undesirable and eventually impracticable. Additional substations were also impracticable, and a change to 4,000-volt, three-phase, Y-connected circuits was decided on as it would clean up the existing condition of poor regulation and leave the way clear for future expansion at the cost of only a few new circuits as the load should grow.

Not only was it necessary to make the change with

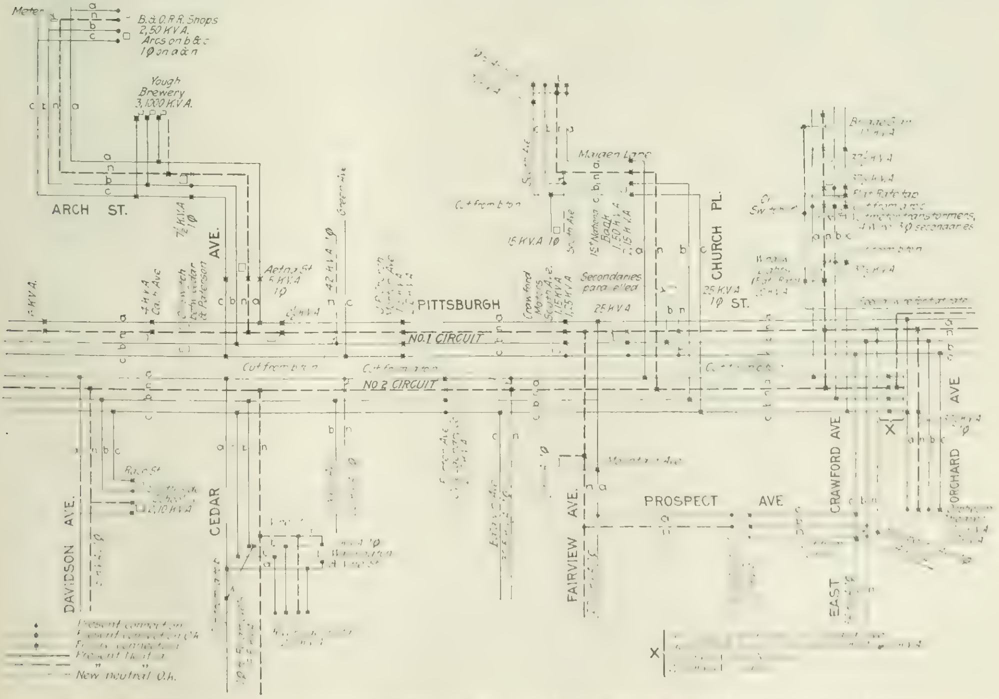
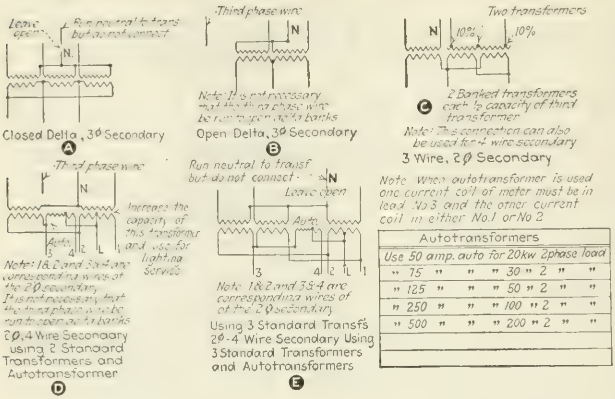


FIG. 1—SECTION OF THE CONTROLLING DRAWING USED IN THE CHANGE-OVER OF THE CONNELLSVILLE SYSTEM


Leave open
Run neutral to trans but do not connect
N.
Closed Delta, 3φ Secondary
A
Third phase wire
N
Note: It is not necessary that the third phase wire be run to open delta banks
Open Delta, 3φ Secondary
B
Two transformers
N
10%
10%
2 Banked transformers each ½ capacity of third transformer
C
Note: This connection can also be used for 4 wire secondary
3 Wire, 2φ Secondary
Third phase wire
N
Increase the capacity of this transformer and use for lighting service
Auto
3
4
2
L
1
Note: 1 & 2 and 3 & 4 are corresponding wires of the 2φ secondary
It is not necessary that the third phase wire be run to open delta banks
2φ, 4 Wire Secondary using 2 Standard Transformers and Autotransformer
D
Run neutral to transf but do not connect
N
Leave open
Auto
3
4
2
L
1
Note 1 & 2 and 3 & 4 are corresponding wires of of the 2φ secondary
Using 3 Standard Transfs 2φ-4 Wire Secondary Using 3 Standard Transformers and Autotransformers
E
Note When autotransformer is used one current coil of meter must be in lead No 3 and the other current coil in either No. 1 or No 2

Autotransformers
Use 50 amp. auto for 20kw 2phase load
" 75 " " " 30 " 2 " "
" 125 " " " 50 " 2 " "
" 250 " " " 100 " 2 " "
" 500 " " " 200 " 2 " "

FIG. 2—VARIOUS TYPES OF TRANSFORMER CONNECTIONS WERE NEEDED TO HANDLE THE MIXED TWO-PHASE AND THREE-PHASE LOADS

A and B are for closed and open delta service. D and E handle two-phase, four-wire service. C is e connection required for the interconnected two-phase motors found on the system.

the least possible disturbance to service, but under the plans it was necessary to wipe out the existing arrangement of primary circuits whereby either two-phase or three-phase service could be given and make these circuits four-wire, three-phase, with some method of handling the two-phase service from these new circuits to be worked out. This was done through the use of auto-transformers, as will be described later.

The system consisted of two main four-wire circuits from the substation. Either two-phase or three-phase service could be given, one of the wires being used as a teaser for the two-phase service. The teaser wire was utilized as the neutral for the new arrangement. Under the old arrangement the conductors had been placed haphazardly on the cross-arms, and it was decided that they should be rearranged so that the same cross-arm positions would be occupied by each conductor throughout the system. The neutral was placed so that it is on the left-hand pole pin when the observer stands with his back to the source of power. In order that there should be no mistakes, the entire system was laid out at the beginning of the study in map form, a section of this map being reproduced here (Fig. 1). It was corrected day by day as the study proceeded and plans to care for the various changes were decided on. The system of legends showing the existing connections, the changes to be made and the connections as they were to be finally is indicated.

While the individual arrangements for the service of all the consumers were shown on the map, this was not judged sufficient. Several types of transformer connections were needed to care for all conditions. These are shown in Fig. 2. A and B are for closed-delta and open-delta, three-phase service respectively, while D and E are for the four-wire, two-phase service. Certain motors on the system were found to have interconnected phases for which the transformer connection in C for three wire, two-phase service was required. In D and E auto-transformers with capacities as shown in the table were used to secure the necessary phase relations, while in the cases involved in C the transformers used were supplied with 10 per cent taps that could be used to give the proper relations, though there is a slight unbalance. This has not shown any practical effect that warrants avoiding its use. The same result could be obtained with transformers not having these taps, but at the expense of using another set of transformers as boosters.

Each consumer's installation was taken and small drawings were made up showing the connections of the transformer bank both as they existed and as they were to be when the work was complete. Samples of these sheets are shown in Fig. 3. Even these were not deemed sufficient for the linemen to work from in making the changes necessary at the cut-over period. Hence shipping tags were cut to the shapes shown in Fig. 4 and tied to the conductors between which connections were to be made as indicated. As a result the linemen had only to follow the tags to make the necessary connections either at transformer installations or other points. One point that was overlooked in marking the conductors was the fact that some few conductors were to be cut entirely. While no trouble resulted, it seems advisable in future cases to provide a tag marking for all conductors so that no possible confusion can result.

In handling other situations where two-phase service must be cared for, an alternative method has been developed that seems to offer some advantages. It involves a standard phase-changing transformer in which the connections are changed from that shown in A, Fig. 5, to that in B, so that the service can be carried to the customer's premises as three-phase and metered as such. Phase changers can be used to handle the older installation, and as new motors are added or old ones displaced they can be changed to three-phase, thus providing for a gradual and natural change to complete three-phase. The same thing might be possible with the Connellsville installation, though at the expense of considerable complication in wiring and a possibility of some mix-up in meter connections if care be not taken. This scheme is being tried as an alternative or for joint use with the one at Connellsville, the decision depending on the experience that is had with both methods.

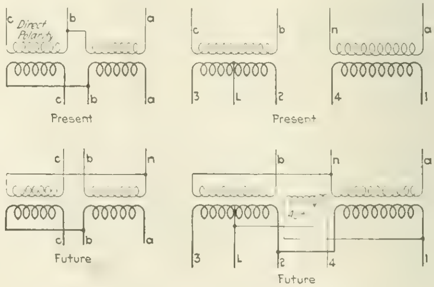


FIG. 3—MANNER IN WHICH "CUT-OVER" OF TWO POWER CONSUMERS WAS WORKED OUT

One drawing was made for each bank of transformers affected. Shipping tags cut to the forms shown in Fig. 4 were used to mark the connections to be made on the lines. One of the proper shape was placed on each wire to be changed, showing the men just what to do.

The system was supplied from the 25-kv. system by two 2,500-volt T-connected transformers. A third was added, and the three were connected for 4,000-volt Y, four-wire service. One of the essentials in the change-over was that no power consumers' motors should be reversed. To see that no reversal occurred in the changes at the substation a small motor was used as a check for phase rotation. This, combined with the method of laying out the work to be done and marking the connections to be made by means of the specially cut shipping tags, brought the result desired. This temporary motor used as a check on phase rotation was made more necessary because at the cut-over period some revamping of the substation interior work was undertaken. A temporary bank of transformers was used for a few hours to give Sunday service.

The entire job was planned and executed in a very short period of time. Study on the plan began on Nov. 1, 1921, and the final cut-over was made on Dec. 11 following. Seven gangs with a maximum of three men per gang were formed to handle the eighty-eight distinct jobs that had to be done during the cut-over. Each gang had from five to sixteen pieces of work to handle. These were so scheduled that each gang completed its work in a given district and reported back to a central point before the work in another district was commenced. In this way the cut-over was completed, district by district, and service restored. The longest period that any district was out was eight hours. The work was started at midnight, and at 8:35 a.m. three-fourths of the service was back. Part of the work was held back during the morning church service hours to avoid interference with religious services. At four o'clock in the afternoon the entire service, including the permanent substation transformers, was restored, leaving only the clean-up work to be done at leisure.

In carrying out the work not only was the field work as laid out carefully and repeatedly checked against the drawings, but the gangs responsible for the cut-over work had each their schedules and were required to go over the work on the day preceding the cut-over and satisfy themselves that all preparations had been correctly made and that all needed material was on hand, thus preventing delays. Among other things that it was necessary to do in preparing for the cut-over was to check the polarity of all transformers supplying two-phase service. This was done with a potential transformer with marked leads and a voltmeter.

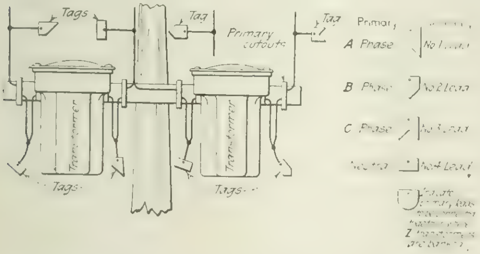


FIG. 4—SPECIALLY CUT TAGS USED TO INDICATE CHANGES IN TRANSFORMER CONNECTIONS NECESSARY IN "CUT-OVER"

The work of cutting over was done almost altogether in the dark. Each gang had with it an automobile that was equipped with a spotlight and an extra storage battery to furnish light for the work. While the arrangement worked to fair satisfaction, an electric lantern supplied by two dry cells will be used on future work to avoid difficulty due to the sharp shadows cast by a spotlight. These lanterns are light and can be easily handled by the men on the pole. The spotlights used could have been taken from the cars and brought closer to the work, but no advantage was found in so doing. During the cut-over job the opportunity was taken to do considerable clean-up work on the system. This prolonged the shut-down, which otherwise could have ended before 8 o'clock in the morning.

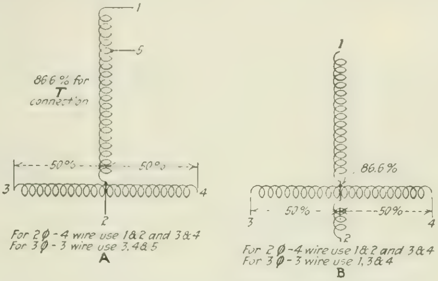


FIG. 5—STANDARD PHASE-CHANGING TRANSFORMER FACILITATED CHANGE-OVER

Arrangement for use on three-phase, two-phase lines is shown in A. By connecting as in B service may be carried into the consumer's premises and metered as three-phase. The phase changer is placed on the two-phase circuits. Either three-phase or two-phase service is available, and three-phase can be substituted as changes in equipment are made.

The big advantage of the 4,000-volt Y system in a case of this kind is the possibility of using all the old equipment. Insulation is adequate, and the only changes in transformers and other equipment are those needed to care for load conditions. The change brings a theoretical increase in capacity of the circuits that is three times the original capacity, though, owing to practical conditions, the actual increase is probably slightly less than this figure. In the present case the circuits in a badly overloaded distribution system were made adequate to carry the existing load, and future increases can be cared for by the addition of one circuit at a time as the demands warrant. The entire change was made at an expense between one-third and one-half what would have been required if the lower voltage had been maintained and the capacity of the system built up to handle the load by adding copper to the existing circuits or installing new ones, and either of the alternatives would have involved considerable expenditure and some problems in supporting structures. The change as made has probably involved a minimum of operation difficulties on the system, because the men can handle the lines exactly as before. In this case, after several months of operation, none of the difficulties which, because of the complication imposed by the combination of two kinds of service, might have been looked for has arisen.

In concluding, it is well to remember that a considerable part of the complication of the work was due to the fact that the entire system is in a transition period from the older two-phase system to three-phase. The two-phase service is in process of elimination as old equipment wears out and is replaced. A change from an ordinary three-wire, delta-connected, three-phase system to a four-wire, Y-connected system could be handled by exactly the same method, with less possibility of troubles to be encountered. The story of the work points the way to make an economical change in any distribution system before it becomes necessary to consider the higher distribution voltages that will naturally involve a shift in all service equipment.

Letters from Our Readers

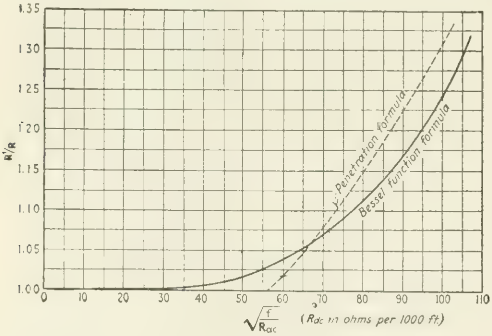
This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Bessel Function for Calculating Skin Effect

To the Editors of the Electrical World:

In the editorial of March 11 on skin effect in cables it is stated that "One of the theoretical formulas referred to above indicates that a close approximation to the skin effect may be had by assuming that all of the current carried is limited to a surface layer of definite thickness, depending on the frequency. This applies to solid circular conductors."

Since a definite comparison of the results of the penetration formula with those of the Bessel function formula has not, to my knowledge, appeared in any recent publication, perhaps readers of the Electrical World may be interested in the accompanying curve, giving this comparison up to 30 per cent increase of resistance, which is the range required for large 60-cycle cables. It can be seen that the penetration formula gives 36 per cent increase in resistance where it should give 30 per cent. It gives 26 per cent where it should give 20 per cent, and it gives zero per cent where it should give 3 per cent.



SKIN EFFECT IN SOLID ROUND WIRE

Such large discrepancies show that the penetration formula does not give a "close approximation" for the range considered. If a calculation is to be of use in deciding questions of design of large cables, it should not give errors as large as 6 per cent in a quantity which amounts to not more than 30 per cent. The same statement applies to test results having discrepancies between duplicate readings amounting to several per cent. The penetration formula was originally published by physicists who were discussing skin effect at high frequencies with increases in resistance of several hundred per cent. Under such conditions, the error due to the penetration formula is quite small.

Canadian Westinghouse Company, H. B. Dwight.
Hamilton, Canada.

Italy's Hydro-Electric Troubles Are Over

To the Editors of the Electrical World:

Referring to an article in your issue of March 25 (page 579) concerning the power shortage said to threaten the industrial zone in north Italy, may I inform you that the danger reported to the Department of Commerce and the pessimistic deductions drawn are now things of the past? The reports were, no doubt, correct at the time they were made, if they referred to the situation existing in the last months of 1921, but by the time they reached you through the official channels they were already superseded.

You give April 1 as the peak of an unprecedented power shortage. As a matter of fact, that was precisely the date when the last restriction on the use of light and power was repealed and electrical transportation, illumination and industrial exploitation were again back to "normalcy." A few weeks ago the Genoa-Modane electric railroad was inaugurated and immediately opened to traffic. This would seem an eloquent contradiction of your information that electric traction was to be supplanted by steam locomotives.

We faced an indeed unprecedented power shortage during 1921, but by December we had already overcome all difficulties and commenced to increase our output gradually and constantly, so that by March, 1922, the production was once more normal. This result we attained by means of interprovincial connections, of new lines thrown across the mountains in record-breaking time, and of a rational distribution of power when it was scarce. G. G. Ponti,
Società Idroelettrica Piemonte, Managing Director.
Turin, Italy.

Importance of Familiarity with Apparatus

To the Editors of the Electrical World:

Frank H. Broome in his article on "Preparation Necessary for Tests on Steam Equipment" in the Electrical World of Feb. 4 has left out what I believe to be an important preparation for making any test. This is to familiarize one's self with the apparatus that is to be tested.

It is absolutely necessary to get some kind of a drawing or blueprint of the boiler or turbine or other apparatus to be tested, showing the dimensions that will affect the quantities to be measured in the test, the arrangement of the piping, and the proper points for inserting or connecting the measuring instruments. It is also very desirable for the person who will superintend the test to look over the apparatus, because he can see more clearly just where he can best set up his measuring instruments, scales, etc., what readings can be taken by the same man, what pipe connections must be blanked, and so forth.

By familiarizing himself beforehand with the installation he can get the test under way more promptly, after his observers are at their stations and conditions are right for starting the test, and with less chance of having it spoiled by the neglect of some precaution.

When a test is started during daylight and is to be continued after dark, portable lights should be rigged up where the readings are to be taken, or else the observers must be provided with good flashlamps. It is well to place a table under a good light to make it possible to record data. J. J. Storrow, Jr.,
Mechanical Technical Engineer Generating Department.
Edison Electric Illuminating Company of Boston.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

New Pole-Type Transformers.—E. Lapp.—A description of the most important features of a new series of oil-cooled three-phase transformers rated at from 5 kva. to 150 kva. In spite of their relatively small size, the machines are equipped with oil conservators, a circumstance no doubt due to the rather high price of transformer oil in Europe. A tap-changing switch or ratio adjuster permits changing the voltage taps without removing the cover of the machine. All sizes are placed in corrugated steel tanks with cast-iron base and band. —*Brown-Boveri Mitteilungen*, March, 1922.

Theory of the Single-Phase Generator.—G. Shimidzu and K. Ito.—On the assumption that the field poles are non-salient, that the entire iron core is finely laminated, and that the flux in the armature and in the field windings fluctuates in a pure sine wave form, the instantaneous maximum and effective values of steady short-circuit current are calculated. In the latter part of the paper the author fully explains the phenomena caused by short circuits taking place between two line terminals in one, two or three-phase generators.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1922.

Generation, Transmission and Distribution

Pilot Circuits.—Allain Launay.—Description of the way in which pilot circuits have been developed by means of experiments at the Central Laboratory of Electricity so that by their use any number of lamps or appliances energized by an urban network may be controlled simultaneously. Street lamps, transformer stations, meters for variable rates where time registration is effected, motors and heating appliances are among the apparatus to which the pilot circuits have been successfully adapted.—*Bulletin de la Société Française des Electriciens*, Vol. 1, No. 10.

Buitreras Hydro-Electric Power Station on the River Guadiaro.—An elaborate description of this hydro-electric development in south Spain, profusely illustrated with line drawings and photographs. The plant has a capacity of 6,000 kva. and generates power at 5,000 volts and 50 cycles. The alternators, transformers and switching layout are described in detail.—*Brown-Boveri Review*, January, 1922.

Lamps and Lighting

Motion-Picture Projection with "Mazda" Lamps.—H. H. Magdsick and C. E. Egeler.—The use of "Mazda" lamps for the projection of motion pictures in theaters is attended by numerous advantages both in the results obtained on the screen and in the projection room. Maximum satisfaction is realized when each element in the projection system is designed and adjusted for this light source. The bulletin discusses (1) the optical principles involved in the projection of motion pictures by "Mazda" lamps, (2) the properties of the component optical elements, (3) "Mazda" lamps and their correct application, and (4) the complete operating equipment. Under the first general head are considered the image formation, objective lenses, relation of light on screen to light through film, requirements for uniform screen illumination and the purposes of the condensing lens and spherical mirror. The second part explains each element of the projection equipment and gives the purposes of each. The third considers the sizes of lamps available, with their operating characteristics. Under "complete operating equipment" are discussed the requirements and installation of the equipment and also the adjustment of the light source and mirrored reflector.—*Bulletin 33-A of National Lamp Works of General Electric Company.*

Traction

Electrification of Main-Line Railroads.—S. T. Dodd.—The author gives several examples of the electrification of steam railroads to illustrate the extent to which interest has been excited throughout the world by this very important engineering development. Among the partly electrified railroads in this country that he instances are the New York Central, the Norfolk & Western and the Chicago, Milwaukee & St. Paul, and he also describes the electrification of the Great Northern Railway where it passes through the Cascade tunnel. He gives a list of companies now seriously considering a change from steam to electric operation.—*News Letter of the Princeton Engineering Association*, March, 1922.

Installations, Systems and Appliances

Electric Drop Hammer Operating on Induction-Motor Principle.—P. Trombetta.—In this article an electric hammer of the induction-motor type is described. Instead of the usual arrangement of concentric armature and field, the slots are punched on long strips of iron in a straight line, which makes the field and armature parallel. The rotating fields of an induction motor are here replaced by magnetic fields moving in a straight line. The author claims that this hammer is more flexible, handier, cheaper to operate and cheaper in first cost than the board hammer with the flywheel. —*Journal of the A. I. E. E.*, April, 1922.

Operation of a Drum-Type, Elevator-Machine Alternating-Current Motor Controller—William Zepernick. —The functions of the different parts and circuits of an elevator controller operating a single-speed, slip-ring type of alternating-current motor are described. This type of motor compares favorably in compactness and durability with the single-speed direct-current motor. One of the features described is the means for preventing the operator from running the elevator on any other than high speed, this being insured by the car switch having but one running position for each direction.—*Power*, Feb. 21, 1922.

Passenger and Freight Transfer in Piers and Warehouses.—L. S. Gatter.—This marks the beginning of a series of articles dealing with material handling.

Other articles will cover factories, office buildings, hotels, apartment houses, etc. The series refer in particular to the elevator equipment problem, which has long been one of the most difficult for architects and engineers. The purpose for which buildings are to be used determines the equipment required to accommodate the passenger and freight movement. Transfer equipment in the modern pier and warehouse includes the machinery used in loading and unloading ships, freight cars and motor trucks, as well as the equipment used in vertical movement, such as automatic operatorless elevators. The author discusses in this article the pier dimensions necessary for transportation of freight from or to the ship, loading and unloading freight cars, cranes, hand and motor trucks, and exterior and interior elevators.—*News Letter of Princeton Engineering Association*, March, 1922.

Wires, Wiring and Conduits

Maximum Rating of High-Voltage Cables.—M. Höchstädter.—In a paper by Clark and Shanklin (*Proceedings A. I. E. E.*, 1919) these authors maintained that no dependable high-voltage cable can be built for more than 1,950 volts per millimeter of insulation between the conductor and the lead sheath. At this point a so-called ionization point was said to be reached beyond which it would be unsafe to go. The present author has carefully tested a number of existing cables in use in Holland and Germany, and he takes strong exception to the above figure. There have been cables in successful use for several years, operating under a stress of from 3,000 volts to 13,300 volts for each millimeter insulation, which is six and eight-tenths times that permissible according to Clark and Shanklin. For modern cable manufacture values between 3,000 volts and 4,000 volts per millimeter are very conservative, the value depending upon local ionization and upon the chemical stability of the dielectric under prolonged static stress and high temperature. Improved manufacturing methods and the choice of dependable and stable insulating materials will no doubt permit this critical voltage to be further increased. Careful measurements showed also that the dielectric loss in a high-tension cable diminishes with rising temperature, reaches a minimum at about 50 deg. and then rises again.—*Elektrotechnische Zeitschrift*, Feb. 16, 1922.

Electrophysics and Magnetism

Length-Voltage-Current-Pressure Characteristics of Normal Arcs for Different Electrode Materials.—W. N. Eddy.—The results of the investigation carried on by Dr. Steinmetz and Messrs. Ayrton, Duddell and Childs are combined and given in a usable form in this article, together with curves and illustrations.—*General Electric Review*, March, 1922.

Ionization by Cumulative Action.—K. T. Compton.—Prof. F. Horton and Miss A. C. Davies have proved the importance of radiation in the production of ionization in certain cases in which ionization by direct impact is impossible or at least improbable. These cases include the formation of arcs in metallic vapors and in helium at voltages less than their minimum ionizing potentials. Experiments conducted at Princeton University to test the possibility of the production of similar low-voltage arcs in multi-atomic gases have indicated that it is impossible to strike arcs in such gases at less than their minimum ionizing potentials. —*Philosphical Magazine (London)*, March, 1922.

Units, Measurements and Instruments

Electrical Porcelain Research.—M. H. Hunt.—Research work in this subject usually includes the following considerations: (1) Properties of the various ingredients that enter into the porcelain body; (2) properties of the body as a whole in the plastic state, including shrinkage, cracking and strength; (3) burning behavior, including cracking, vitrification, shrinkage, specific-gravity changes, color, etc.; (4) properties of the fired porcelain, such as impact resistance, tension, compression and shear, thermal expansion, etc. The means for carrying on these various tests are described. —*Electric Journal*, March, 1922.

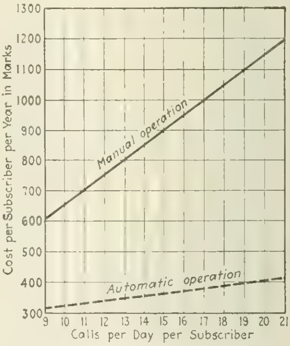
Electrochemistry and Batteries

Oxide-of-Copper Battery That Can Be Regenerated.—M. Leblanc fils.—The oxide-of-copper battery, although known for many years, has never received the industrial applications that it merits because of its robustness, its qualities of conservation and, above all, the fact that it maintains its maximum voltage during almost all the time it is discharging. The reason for its not being employed more extensively has been its cost, which has not permitted competition with the manganese-dioxide type. The author describes an oxide-of-copper battery which can be regenerated and will, he believes, replace the manganese-dioxide battery for many uses.—*Bulletin de la Société Française des Electriciens*, Vol. 1, No. 10.

Telegraphy, Telephony and Signals

The Economy of Small Automatic Telephone Exchanges.—M. Langer.—The author shows the great economic advantages of the automatic telephone system over hand switching. Assuming a life of twenty years for both systems and a return of 5 per cent on the invested capital, the accompanying table, applying to present German conditions, will be of interest.—*Siemens Zeitschrift*, March, 1922.

COST OF TELEPHONE SERVICE FOR 60,000 SUBSCRIBERS



	Manual	Automatic
Cost of repair parts per one year, per cent of investment	9	1.6
Cost of energy per year per subscriber, marks	3.00	9.00
Total cost of operation of an exchange with 400 subscribers, per year per subscriber, marks........	450.00	270.00

Amplification of Weak Alternating Current.—H. Barkhausen.—The author discusses in this portion of a continued article on wireless transmission the grid circuit and input transformer. He explains how the input transformer and the capacity between the grid and the anode affect the power supplied to the grid circuit.—*Radio Review*, February, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Chamber of Commerce to Bring Coal Producer and Consumer Together

A DRIVE is being made by the Chamber of Commerce of the United States to bring together on Tuesday next, May 16, representative groups of producers and consumers of coal. During all next week the chamber will hold its annual convention in Washington. It was recently pointed out in official quarters that there is no restraint of trade if producers and consumers sit down around the table together. On that suggestion the chamber has acted.

An address on the subject "The Coal Industry and Government Regulations" will be delivered by Senator Howard Sutherland of West Virginia. The remainder of the meeting will be devoted to a discussion of three pertinent phases of the coal business—distribution, transportation and labor.

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McClellan Urges that Engineering Board Consider Muscle Shoals

ACTING on the invitation extended to the presidents of all the national engineering societies by the Senate committee on agriculture to appear before it and give their views on the Muscle Shoals project, Dr. William McClellan, president of the American Institute of Electrical Engineers and a member of the executive board of the Federated American Engineering Societies, visited Washington for this purpose last Tuesday, May 9. Dr. McClellan, who was the first of the technical association executives to act upon the invitation, made in the course of his testimony two main recommendations —that the existing construction and equipment at Muscle Shoals be protected to prevent its deterioration, and that an engineering board of review be appointed to report to Congress a general plan of procedure.

Dr. McClellan bound himself to place at the disposal of Congress a committee of engineers with commercial experience who would recommend a general plan for the handling of the project from a business standpoint. He said he would arrange, through the American Institute of Electrical Engineers or through the Federated American Engineering Societies, for the services of such a committee which would be composed of disinterested men of thoroughly established reputation. He told the committee that the government should not act except on the basis of unbiased and competent professional and business advice. "It is perhaps not unfair to say," he asserted, "that all those engineers and business men who have made detailed studies of the project have done so for some reason of their own and did not look at it from the government's standpoint. The disposal of Muscle Shoals is not a technical engineering proposition. It is a commercial matter. The only way for the government to get an impartial review of the commercial and engineering features of the situation is for the committee of the Senate and the committee of the House jointly to request a group of not less than five engineers who have had adequate commercial experience in large projects to take all of the data, statements and reports which have been submitted and report to the committees what the government should do.

"The government under no circumstances," continued Dr. McClellan, "should alienate its nitrate plants until an adequate plan is agreed upon for the completion of these plants or the construction of nitrate plants at some more favorable points, should such places be found. During the period of investigation the works at Muscle Shoals can be adequately protected against deterioration. Such protection of interrupted construction work is very common among commercial companies."

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Savings Banks Association Considering Public Utility Investments

ENACTMENT of new state laws or the amendment of existing laws throughout the country so that savings banks may have the legal right to invest in sound public utilities securities was urged at the closing session of the third annual conference of the National Association of Mutual Savings Banks at Atlantic City last week. At present, it was asserted at the conference, the laws in a majority of states prohibit investment in such securities of moneys held by savings banks, trust companies or trustees. This was declared to prevent local money being invested in local utility undertakings, thus sending into other fields the money that might be invested at home.

"The investment bankers of the country recognize that the expansion of utilities and the extension of their services are essential to the continued commercial prosperity of the country," said H. M. Addinsell, of Harris, Forbes & Company of New York City. "Therefore we naturally are looking for a wider distribution of these securities which will make that possible, and the help of the savings banks is greatly to be desired as a stimulus to the raising of the tremendous amount of money necessary to develop the country."

Asserting that "every dollar invested in sound public utilities securities is reflected in increased property value, increased business, increased prosperity and general well being," Martin J. Insull, vice-president of the Middle West Utilities Company of Chicago, who represented the National Electric Light Association before the bankers, said that the public utilities of the country represent an investment of $16,000,000,000, and that the electric light and power industry alone must raise and invest annually $750,000,000 for the next several years to keep pace with demands for service. Thus far in 1922, he stated, this one utility industry has started development projects and extensions which will require more than $200,000,000 to complete and which are giving employment to thousands of men.

"The electric light and power industry represents an investment of $5,000,000,000, these securities being owned by more than 1,500,000 Americans, and the gross income of the industry a billion dollars a year," said Mr. Insull. "There is every reason why the public's savings should be invested in these utilities," he continued. "They supply service which the public requires and uses in its business and social life. The whole economic structure of the country depends upon the successful operation of the utilities. The operators are merely the trustees of the money of these nearly two millions of investors and are quasi-public servants. The public, through its regulatory bodies, says what the standards of this service shall be, what rates shall be charged for the service and what securities the utilities may issue in order to supply the equipment which will give the service demanded."

The investor's phase of the question was presented by J. M. Wilcox, vice-president of the Philadelphia Saving Fund Society of Philadelphia, who related in detail the investigation which should be made to determine, before purchasing, the stability of the properties back of the securities offered.

Other representatives of the N. E. L. A. present at the conference were its president, Milan R. Bump of Henry L. Doherty & Company; its vice-president, Frank W. Smith of the United Electric Light & Power Company, and its executive manager, M. H. Aylesworth.

Announcement was made at the meeting that a conference committee representing both associations is now studying the question.

Senate Committee Against Accepting Private Muscle Shoals Offers

EVENTS in Washington during the past week continued to point to the prospect of a deadlock on Muscle Shoals legislation. At the hearings before the Senate committee on agriculture and in a statement made public by him separately, Senator Norris, chairman of that committee, made it plain that the committee will not recommend the acceptance of any of the private offers for the development, lease or sale of the nitrate and power projects of the government. Instead, he announced, he will press, with the support of the majority of his committee, for an appropriation rider for $7,500,000 for at least one year's more work toward the completion of Wilson Dam by the government. Against this there was balanced again this week the reiterated opposition of Chairman Kahn of the House military affairs committee to the expenditure of any more government money at Muscle Shoals without first ascertaining what is to become of the government's present $107,000,000 investment there. In this Mr. Kahn is supported by a majority of his committee. While the Senate continued to hold public hearings, the House committee remained in executive session framing requirements which, it is expected, will throw out all private bidders.

There have been a number of test votes in the executive sessions of the House committee, one of the most important having been a division of eleven to ten on the acceptance of Mr. Ford's most recent modification to his offer, under which he would agree to take over the Gorgas plant at the Warrior River station of the Alabama Power Company under the provision reported in the ELECTRICAL WORLD last week.

It is understood that there is to be a reconsideration of this vote at the request of several members who voted by proxy, as the effect of the vote would place the committee in favor of reporting out a lawsuit, a position which it is most unlikely its members could support in general debate on the floor of the House.

Further attention to this feature of the fight in regard to the Ford offer was brought about in a hearing which was granted Wednesday by the Attorney-General to the representatives of the Alabama Power Company, Chairman Kahn of the military committee and the Judge Advocate General of the army. An opinion was expressed by the latter official that the contract of the power company to purchase the government interest in the Gorgas plant was null and void, and even the supporters of the Ford proposal on the military committee felt that there should be no vote in committee of a definite character until this hearing had been held and a decision by the Attorney-General rendered. Such an opinion is now expected momentarily.

As this is telegraphed from Washington the question of what kind of a guarantee to manufacture fertilizer at Muscle Shoals must be exacted in connection with the Ford offer is engaging the attention of the committee. It is felt in many quarters close to the military committee that the policy adopted by the committee in this respect will be one of rigid protection to the farmers.

On the Senate side, Chairman Norris is frankly denouncing the Ford offer, a position in which he has the support of more than a majority on the committee. Characterizing the offer as "unconscionable," he announced that "no corporation will get Muscle Shoals" with his consent.

Six Groups of Papers Make Up A. I. E. E. Convention Program

PLANS for the annual convention of the American Institute of Electrical Engineers, to be held at Niagara Falls, Ontario, June 26-30, will probably be completed within the next two weeks. The annual business meeting of the Institute will be held in New York on Friday of the coming week.

Five main groups and one miscellaneous group make up the convention technical program. As yet they have not been assigned to sessions. The groups and the papers are as follows:

A. "The New Queenston Plant of the Ontario Hydro-Electric Power Commission":

1. "The Queenston Plant," by F. A. Gaby.
2. "Queenston Generators—45,000 Kva.," description of the Canadian General Electric Company's generator—187½ r.p.m., vertical, 25-cycle, 12,000-volt, three-phase, by B. L. Barns.
3. "Queenston Generators," by R. A. McCarty.
4. "Design Features of Main Power-House Transformers in Queenston Station," by M. E. Skinner.

B. "Standards of Rating of Generator Insulation":

1. "Questions Relating to Standards of Rating, with Particular Reference to Large Machines Using Class B Insulation," by F. D. Newbury.
2. "Probable Values of Conventional Allowance for Alternating-Current Generator Stator Windings," by F. D. Newbury.
3. "Temperature Limits in Large Machines," by P. Torchio.

C. "The Baltimore Oil Circuit-Breaker Tests" (the highest power tests ever made):

1. "Baltimore Oil-Circuit-Breaker Tests," by H. C. Louis and A. F. Bang.

2. "Interrupting Capacity, Tests of General Electric Oil Circuit-Breakers at Baltimore," by J. D. Hilliard.

3. "Tests on Westinghouse Oil Circuit-Breakers at Baltimore," by J. B. MacNeill.

D. "Symposium on Education from Employer's Standpoint":

1. "Suggestions Concerning the College Education of an Engineer," by Carl Hering.

2. "Training for Character," by A. M. Dudley.

3. "Some Suggestions for Possible Improvement in Methods of Engineering Education," by B. G. Lamme.

4. "What May Be Done by Engineering Schools Better to Prepare Students for Railway Work, with Special Reference to the Telegraph and Telephone Department," by I. C. Forshee.

5. "Education," by S. E. Doane.

6. "Principles of Engineering Education," by P. Torchio.

E. "Electric Cables":

1. "Dielectric Losses and Stresses in Relation to Cable Failures," by D. W. Roper.

2. "On the Minimum-Stress Theory of Cable Breakdowns," by D. M. Simons.

3. "Determination of Temperature of Electrical Apparatus and Cables in Service," by E. J. Rutan.

4. "Effect of the Composite Structure of Impregnated Paper Insulation on the Electric Properties," by W. A. Del Mar and C. F. Hanson.

F. "Miscellaneous Group":

1. "Higher Steam Pressures or Pulverized Coal?" by F. A. Scheffler.

2. "The Economics of Direct-Current Railway Distribution, with Particular Reference to the Automatic Substation," by L. P. Crecelius and V. P. Phillips.

3. "The Two-Stage Current Transformer," by H. B. Brooks and F. C. Holtz.

4. "Two Thousand Tests on the Dielectric Strength of Liquid Insulation," by J. L. R. Hayden and W. N. Eddy.

5. "A General Law of Electromagnetic Forces," by Carl Hering.

Study of Economics Urged in Engineering Colleges

AT THE close of the second conference on commercial engineering held at Pittsburgh on May 2 under the auspices of the committee on commercial engineering of the United States Bureau of Education a statement was adopted embodying principles expressive of the proper aims and purposes of educational institutions and industrial organizations. Stated briefly, faculties were urged to give their students an adequate conception of production, distribution and finance. Commercial and business schools on the other hand are urged to give their students an introduction to the elements of engineering. Research to eliminate waste in material and human resources was recommended.

The conference recommended further that colleges of engineering and of business adopt the following procedure in developing students:

1. Secure the co-operation of industry in defining standard terminology and specifications of the requirements of industry.

2. Analyze the specifications of the requirements of industry to determine what are the fundamentals that must be taught, and organize the instruction accordingly.

3. Study and experiment with ways and means of discovering native bent and of measuring proficiency, that every student may be guided into a career of maximum achievement.

Large and Enthusiastic Convention Foreseen by President Bump

FROM all indications the Atlantic City convention of the National Electric Light Association next week, President Milan R. Bump said to a representative of the ELECTRICAL WORLD on Wednesday, will be the largest and most enthusiastic meeting ever held by the association. Already the advance reservations are taxing the hotel accommodations. Some of the principal Eastern companies are taking the opportunity to send large delegations for a day or two. In addition, Mr. Bump pointed out, the general business tone is better this year. This is especially apparent, he said, in the investment situation.

MILAN R. BUMP
President N. E. L. A.

"It has been possible," Mr. Bump said, "for electric light and power companies to secure money since the first of the year on a favorable basis and a much lower interest yield. This means that the utilities can now go ahead with their plans for extension of service.

"From all that I can learn I am convinced that there is more new work under way and definitely planned than at any previous time in the history of the electrical industry. Furthermore, I see several years of very rapid growth in the electric light and power field. Why, at the present time the total power consumption is only about 10 per cent of existing possibilities."

The biggest thing on the program, Mr. Bump said, is the business development campaign, to the discussion of which one whole session will be devoted.

"This is a permanent co-operative movement," declared Mr. Bump, "carried on by all branches of the industry. Its backbone is the local organization. One of its aims is to get the local electric light and power company to take the lead in each community in the formation of local electrical development leagues. It becomes in that way a systematic means for promoting electricity in all its ramifications."

Mr. Bump mentioned the important progress that had been made by the co-operative committee with the American Telephone & Telegraph Company in inductive interference. There is now complete agreement, he said, as to principle and practice, and there only remains the work necessary to adopt working specifications. In working out this joint agreement, Mr. Bump said, the co-operation of the telephone officials was remarkable.

One of the things the association has done this year which Mr. Bump expects will be of considerable interest is the co-operative work with the National Association of Mutual Savings Banks. An effort is being made to have state laws changed so that prime utility securities may become legal investments for savings banks and trust funds.

Attention was also called by Mr. Bump to the exhibits, the first since 1919. These are of an educational nature and are arranged in such a way as to bring out their greatest value.

State Department Revives German Patent Convention

AFTER an extended study of all the ramifications of the proposal that the patent convention of 1909 with Germany be allowed to lapse, the State Department decided to revive the convention, and notice to that effect was transmitted to the German authorities prior to May 11, which was the time limit for such notification. The revival of this convention gives the holders of American patents registered in Germany immunity from the working clause in the German patent law.

Manufacturers of machinery in the United States were among those who were most strongly in favor of reinstating the convention with Germany. It was asserted that it would cost machinery manufacturers millions of dollars to undertake the manufacture of their patents in Germany. The electrical industry especially, it was stated, would have been affected adversely had the convention not been continued.

Strong pressure was brought by the War Department and the chemical industry against the revival of the convention. The War Department is anxious to secure the enactment of a working clause to apply to all patents registered in the United States. Germany has a large number of patents registered in this country which are not being worked.

Yale University's Meter Course Has Public Policy "Slant"

PUBLIC relations as they concern electric metermen, in addition to his technical problems, were dealt with in a successful short course in metering which closed on April 22 at the Dunham Laboratory of the Sheffield Scientific School, Yale University, New Haven, Conn. Forty-nine men from New England, New York and New Jersey attended. The technical program covered principles of alternating current and machinery, principles of metering, laboratory tests and field work. Among the speakers were Profs. Scott, Morrow, Wilson and Warner of the Yale staff, assisted by Messrs. Wittig, Haugh and Ralph.

The following technical papers or addresses also formed part of the excellent program: "Graphic Metering," by Manfred L. Johnson, the Bristol Company, Waterbury, Conn.; "Timing in Watt-hour Meter Calibration," by F. L. Pavey, Duncan Electric Manufacturing Company, Fort Wayne, Ind.; "Instrument Jewels and Pivots," by B. W. St. Clair, General Electric Company, Lynn, Mass.; "Reactive Metering," two papers, by J. M. Joy, test engineer Connecticut Light & Power Company, Waterbury, Conn., and Henry J. Blakeslee, treasurer States Company, Hartford, Conn.; "Organization and Management of a Meter Department," by R. D. Webster, Manchester (Conn.) Electric Company, and "Installation and Maintenance of Relays for Line Protection," by Frank C. Whiting, superintendent Connecticut Power Company, Canaan, Conn.

The value of courtesy as an attribute of metermen in view of their close contact with the consuming public was emphasized in an address by Samuel Ferguson, vice-president Hartford Electric Light Company, and this, with the importance of greater familiarity with rate schedules, was stressed in a talk by C. L. Campbell, treasurer Connecticut Light & Power Company, Waterbury. During the week of the course those in attendance were welcomed at a meeting of the Yale branch of the American Institute of Electrical Engineers, at which M. H. Aylesworth, executive manager National Electric Light Association, gave an inspiring talk upon "Customer Ownership." The course was directed by Prof. A. E. Knowlton of the Sheffield Scientific School, who is also electrical engineer of the Connecticut Public Utilities Commission.

Information Committee Formed at Southwestern Convention

THE Southwestern Electrical and Gas Association and the Southwestern Geographic Division of the National Electric Light Association held a joint convention in San Antonio, Tex., on May 3, 4, 5 and 6. Both conventions were well attended.

At the concluding business session of the Southwestern Electrical and Gas Association on Saturday R. J. Irvine of the Jacksonville (Tex.) Electric & Ice Company was elected president, succeeding C. E. Calder of the Dallas Power & Light Company. Other officers elected are: J. H. Gill, Dallas Power & Light Company, first vice-president and chairman of the power and light section; Alves Dixon, El Paso Electric Railway, second vice-president and chairman of the railway section; P. E. Nichols, Galveston Electric Company, third vice-president and chairman of the gas section; E. N. Willis, Dallas, re-elected secretary; F. G. Ganno, Fort Worth, treasurer.

Officers elected by the Southwestern Geographic Division of the National Electric Light Association are: R. J. Irvine, Jacksonville Electric & Ice Company, president, succeeding A. Hardgrave of Dallas; John W. Carpenter, Texas Power & Light Company, Dallas, vice-president for Texas; J. W. Owens, Oklahoma Gas & Electric Company, Oklahoma City, vice-president for Oklahoma; S. E. Dillon of the Citizens Electric Company, Hot Springs, Ark., vice-president for Arkansas; W. E. Clements, New Orleans Railway & Light Company, vice-president for Louisiana; E. S. Meyers, Vicksburg (Miss.) Light & Traction Company, vice-president for Mississippi.

One of the most important steps taken during the convention of the Southwestern Division was the creation of the Public Utility Information Bureau for Texas, which will be established in Dallas. George McQuaid, veteran newspaper man of Texas and Oklahoma, will be in charge of the bureau.

Massachusetts Issues Tentative Lighting Code for Industries

A TENTATIVE industrial lighting code has been issued by the Department of Labor and Industries of Massachusetts, with the object of permitting its experimental application by employers before a mandatory code is adopted. A public hearing on the code will be held at the State House in Boston on May 16, after which its definitive form will be determined.

The code in its tentative form contains nine rules, ranging from those of general requirements to classifications. A table giving the minimum amount of illumination to be maintained is published. The proper illumination for the various parts of a plant and various kinds of work is prescribed; methods of reducing glare are explained, and rules for the distribution of light to avoid sharp contrasts of intensity are given. Entrance and exit illumination, care of switches, maintenance of lighting fixtures and the use of shades or diffusive glass are other points covered.

San Francisco Awards Contracts for Hetch Hetchy Power Units

THE San Francisco Board of Public Works on April 28 awarded contracts for the equipment to be used in the Moccasin Creek power plant of the Hetch Hetchy water-supply project. It is the present intention to sell power from this plant to one of the large power companies. Deliveries on the units for which contracts have just been awarded are limited by agreement to the period between April 15, 1923, and Aug. 1, 1923.

Contracts awarded were as follows: Pelton Water Wheel Company, four 25,000-hp. double-overhung impulse units, $248,000; General Electric Company, four 20,000-kva. generators with exciters and one spare exciter set, $260,285; Coffin Valve Company, eight 36-in. valves, $37,586. The electrical units involve a departure from standard practice in that they have direct-connected overhung exciters.

Pacific Coast Jobbers Discuss Proposed California Power Act

EFFECTIVE means for defeating the passage of the proposed California water and power act, whereby the water and electric utilities would be subject to state ownership, was the topic for discussion at the spring meeting at Del Monte, Cal., of the Pacific Coast Division of the Electric Supply Jobbers' Association. S. M. Kennedy, vice-president of the Southern California Edison Company, in analyzing the act, predicted some of the results which would follow should a supergovernment of five men be set up in California and receive unlimited authority in the spending of the $500,000,000 which the act would place at their disposal.

Mr. Kennedy characterized the act as the most vicious piece of legislation that had ever been placed on a ballot in this country. He pointed out that the addition of this amount of bonds to the bonded indebtedness of the state would make the total equal to 45 per cent of the total indebtedness of all the states. As the proposed act is claimed to have been modeled after the Ontario plan, Mr. Kennedy visited Ontario to study the conditions there and reported that, after ten years' trial, the Ontario plan was now far from successful. He laid stress on the reported statements of high government officials of Ontario casting doubt upon the financial conditions under which the Ontario Hydro-Electric Power Commission is operating.

A general feeling was voiced at the association's meeting that the electrical market on the Pacific Coast is in a very healthy condition and that the continued expansion of all industries and the great activity in general building will result in a large volume of business during the year.

Industrial Lighting Code Proposed in State of Washington

AN INDUSTRIAL lighting code for the State of Washington is now being drafted by a committee of electrical workers, electrical contractors and the safety division of the State Department of Labor and Industries. When perfected the code will be submitted to the Department of Safety and a public hearing will be held. At present the inspectors can only recommend the installation of proper lighting equipment. The plan is not to add expense by forcing employers to install new lighting fixtures, but rather to provide a standard for future installations. The code will embrace not only yard and factory lighting but also the proper arrangement of skylights and windows. Day Morgan, electrical engineer, who has had experience in drafting lighting codes in other states, has been engaged to gather data and draft the code with the assistance of Mr. Meechem, electrical contractor of Seattle; F. G. Heller of the electrical workers and J. H. Lewis, electrical inspector for the Department of Labor and Industries.

Dr. Aston Tells of Advances in Atomic Structure Study

THROUGH the discovery of isotopes much new light is shed on the structure of the atoms. A series of lectures on this phase of pure electrical and chemical science has just been completed under the auspices of the Franklin Institute by Dr. Francis Aston before various universities and engineering bodies. Dr. Aston is a member of the Cavendish Physical Laboratory, Cambridge, England, which, under the direction of Prof. J. J. Thompson, has long been the leader in research in this field which lies at the foundation of engineering.

Isotopes, as disclosed by Dr. Aston, are substances having identical chemical properties but different atomic weights. They occur in pairs, threes or even larger groups. For a long time the atomic weights of some of the elements as determined by different methods or observers have shown variations in value. Lead is a well-known example. The differences are usually approximately one, two or three times the unit of the scale of atomic weights, *i.e.*, the weight of the hydrogen atom. It appears that the chemical properties of the elements are associated with the number and arrangement of the electrons within the atom. The positive nucleus about which the electrons are supposed to revolve has always been shrouded in considerable mystery, as compared with knowledge of the electron. The behavior of the cathode rays, or streams of electrons, is very definite and has been largely instrumental in leading to present knowledge of the negative product of gaseous ionization and the negative particles from hot metals, the two being identical. On the other hand, the canal rays or streams of positive particles which pass through openings in the cathode have appeared to have a wide range of values of mass and charge, when subjected to the same class of tests as those used in the study of the cathode rays.

Recognizing that the particles probably have differences of both mass and charge, by an ingenious combination of powerful electric and magnetic fields the canal rays have now been shown to be susceptible of division into definite groups, each group corresponding to particles all having the same mass. Moreover, the differences in mass are simple multiples of the mass of the hydrogen atom. The results of the experiments have led to the strong suggestion that the atoms of all elements are made up of outer systems of electrons, as now long recognized, and of positive central nuclei consisting of different numbers of the positive parts of hydrogen atoms or "protons." Isotopes have the same number of outer electrons, corresponding to identical chemical properties, but slightly different numbers of protons in their nuclei, thus accounting for the differences in atomic weights. Electrical balance is maintained by the presence of electrons also in the nucleus.

Education of Rural Customer in Rate Base Topic at Nebraska Convention

EDUCATION of the rural customer so that he will understand why rates for service to outlying districts must exceed those charged in urban sections occupied the most important place on the program of the recent convention of the Nebraska Section of the National Electric Light Association. This is the second time that the section has held its annual convention in conjunction with the State University at Lincoln. Such close harmony was considered by Chancellor Avery in his address of welcome as a good sign.

The report of the rural service committee, F. H. Brooks chairman, considered the condition now existing in the agricultural states where an unreasonable outlay of capital was required without good prospects for a fair return on the investment. In addition to the excessive initial capital expenditure, the report pointed out that the reason for another charge besides the primary rate of urban consumers was the higher per capita costs of maintenance, the extra transformer and line losses and higher taxes. Mr. Brooks considered it very important to inform the consumer what the entire charge would amount to before building the lines. In this way litigation could be reduced to a minimum. The Nebraska operators are agreed that a development of rural lines will hasten the day when the Railway Commission will control all the utilities.

President W. B. Roberts drew attention to the changing attitude of the public toward utilities. He showed that thirty municipal plants in Nebraska in the year 1921 junked their generating equipment and contracted for transmission-line service from large power companies.

At the annual dinner J. E. Davidson argued for wide-open publicity, a broad public relations policy and friendly co-operation between central-station operators and manufacturers. He urged the university students to learn more than the mere technical phases alone of engineering if they hoped to become successful utility managers.

Walter S. Byrne of Omaha gave a practical talk on "Placing the Dollar Mark in the Engineering Course." Professor Condra presented slides showing water-power development in the state and maintained that the ultimate use of the Nebraska River should not be considered from a political but from an engineering standpoint.

In a discussion on inductive interference the necessary steps by power and signal companies to organize a joint committee whose duty it should be to settle controversies if possible without submitting them to the railway commissions or carrying the matter into the courts were debated.

J. E. Harsh, Lincoln Gas & Electric Light Company, was elected president and T. H. Fritts, Central Power Company, Grand Island, vice-president of the section.

Philadelphia to Have Big Electrical Show

WHAT is expected to be the largest electrical show ever held in Philadelphia is scheduled to take place in the Commercial Museum, the largest covered space in the city, during October next under the auspices of the Electric Club of Philadelphia. The available floor space for exhibition purposes will run to about 75,000 sq.ft. The Electric Club plans to set aside about 10,000 sq.ft. of floor space for an educational exhibit, which will include a "home electric," properly lighted, showing the necessary outlets, appliances and fixtures; a correctly illuminated office and show window, and an industrial plant.

Ohio Electric Light Association Adopts Program for Cedar Point

FOR the annual convention of the Ohio Electric Light Association, to be held at Cedar Point, Ohio, on July 11-14, this program was formulated at a recent meeting of the executive committee:

Tuesday, July 11

Afternoon.— Reports of officers; report of transmission and distribution committee, A. M. Wilson.

Wednesday, July 12

Morning.— Report of new-business co-operations committee on rural service, including report of special committee on underground construction for farm service and report of executive committee on policies governing such extensions.

Afternoon.— Report of meter committee, S. C. Henton; address (not determined).

Thursday, July 13

(Joint session with Ohio Electrical Contractor-Dealers' Association)

Subject: "More and Better Business." Addresses from National Jobbers' Association and National Contractor-Dealers' Association.

Afternoon.—Addresses by A. K. Baylor, General Electric Company, and W. L. Goodwin, Society for Electrical Development.

Friday, July 14

Morning.—Address (not determined); report of station-operating committee, William Long.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Controlling Interest in Wilmington (N. C.) Company Bought by Northern Capitalists.—A. E. Fitkin & Company, bankers with offices in New York, Chicago and other cities, have purchased a controlling interest in the Tidewater Power Company of Wilmington, N. C., offering besides to purchase the outstanding holdings. The company, which reported for 1921 a net income of $333,000, will be operated by the General Engineering & Management Corporation.

C., M. & St. P. Is Giving Country-Wide Lectures on Its Electrification.—Lectures on the electrification of the mountain divisions of the Chicago, Milwaukee & St. Paul Railway are now being given by members of the mechanical department staff before engineering clubs and at colleges in cities as far east as Maine and Virginia. Twenty-six cities and eighteen states are represented in the schedule, which went into effect on March 16 at Sioux City, Iowa, and will end on May 24 at Lexington, Ky.

Texas A. & M. to Hold Electric Meterman Course.—The five-day course for electric metermen to be held at the Agricultural and Mechanical College of Texas, College Station, Tex., from June 12 to June 16, will be divided into two groups, one covering the fundamental principles, operation and mantenance of direct-current and single-phase alternating-current meters, the other polyphase and maximum-demand meters. The courses are primarily for men having meter experience who wish a better understanding of the theory involved. The college has co-operated with the Southwestern Electrical and Gas Association in arranging this course.

Induction Motors for United States Superdreadnoughts. — The Westinghouse Electric & Manufacturing Company has built for the Navy Department a number of electric motors to propel the superdreadnoughts of the navy. Four motors are required to propel one battleship, one motor being directly coupled to each of the four shafts. Each motor is rated at 16,500 hp. and makes 227 revolutions per minute. They are almost identical in characteristics and appearance with the 22,500-hp. motors, said to be the largest ever built. The motors are designed for the most economical operation at two ship speeds, the battle speed of 23 knots and the cruising speed of 15 knots. This result is obtained by the use of two entirely separate stator and rotor windings in each motor. At the battle speed one set of windings is used, and at the cruising speed the other set is operative. Sixty thousand cubic feet of air per minute is required to conduct away the heat losses developed in operation. This amount of ventilation air for a period of fifty minutes is equal to the weight of the motor.

New York State Merger.—The New York State Gas & Electric Corporation of Ithaca, N. Y., has purchased the stock of the Tompkins County Power Company, the Onid Electric Company and the Standard Light & Power Corporation and will merge these interests with its own.

Carnegie Foundation Building at Washington Soon to Be Begun.—Erection of the building which is to house the National Academy of Sciences and the National Research Council at Washington is, according to a statement by Dr. C. L. Walcott, president of the National Academy, soon to begin, and it is thought that by a year from next fall the structure will be finished. This building, which is to be the gift of the Carnegie Foundation of New York, will face the Lincoln Memorial in Potomac Park. It will be of simple classical style, three stories in height, rising from a broad terrace and having a frontage of 260 ft. The cost will be $1,300,000.

Mayor Shank Out for Municipal Ownership.—Mayor Lew Shank of Indianapolis has come out as an advocate of the municipal purchase of the principal utility companies' properties in that city, naming specifically the Indianapolis Street Railway Company, the Indianapolis Light & Heat and Merchants' Heat & Light companies and the Citizens' Gas Company. He has announced that he will take personal charge of a fight before the next session of the Legislature for the enactment of a constitutional amendment that will permit the city's bonded indebtedness limit to be increased from 2 per cent of the tax valuation to 10 per cent for the specific purpose of bringing about municipal ownership and operation of the utility companies' plants.

Hydro-Electricity and Navigation on the Rhine. — Much interest is being taken by the countries bordering on the Rhine in the question whether the French proposal to erect several power stations and twenty-four locks or dams across that river will interfere with its navigability. The Versailles treaty gives France, or rather Alsace-Lorraine, the right to take water from the Rhine below Basle, Switzerland, for the generation of electricity, to convey it by canals through the Alsatian plains and return it to the river above Strasbourg. Switzerland, which insists on the right of all nations to unrestricted navigation of the Rhine under the Paris treaty of 1814, wishes also to export electrical energy to Alsace and advocates that the river be "regularized" for navigation and not exploited at enormous expense for the production of electricity. Germany, the third party in interest, favors canalization between Basle and Strasbourg.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Coming Conventions.—Among annual conventions of technical associations soon to be held and not previously announced in this column are those of the Pacific Coast Section of the A. I. E. E., at Vancouver, B. C., on Aug. 8-11; the American Association of Engineers, at Salt Lake City on June 5-7; the American Association for the Advancement of Science, at Salt Lake City on June 22-24; the American Society of Civil Engineers, at Portsmouth, N. H., on June 21-22, and the Society for the Promotion of Engineering Education, at the University of Illinois, Urbana, on June 20-23.

Approaching Section Meetings, A. I. E. E.—These Institute section meetings are announced for the coming weeks: Cleveland, May 16, annual dinner meeting; Erie, May 16, "Twelve Months of Electrical Development," by H. Hansen; Fort Wayne, May 18, annual business meeting; Baltimore, May 19, "Application of Electricity to the Steel Industry," by R. B. Gerhardt, Bethlehem Steel Corporation; Atlanta, May 25, "Industrial and Commercial Lighting," by H. R. Spaulding, Cleveland; Utah (Salt Lake City), May 26, "Mine Signaling," by Abner R. Wilson, Utah Apex Mining Company; Vancouver, B. C., June 2, "Electric Power for Irrigation," by C. R. Yuill. The annual meeting of the association is scheduled for May 19 in New York.

Coming Meetings of Electrical and Other Technical Societies

Florida Engineering Society—Daytona, Fla., May 15-16.
N. E. L. A. Annual Convention—Atlantic City, May 15-19. (For program see issue of April 22, page 797.)
National Electrical Credit Association—Detroit, May 18-19.
Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.
N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.
Electric Power Club—Hot Springs, Va., June 5-7.
Canadian Electrical Association—Ottawa, Ont., June 15-17.
Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.
American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.
Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., Juno 22-24.
A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30.
American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.
National Council of Lighting Fixture Manufacturers—Cleveland, June 28-29.
Ohio Electric Light Association—Cedar Point, Ohio, July 11-14.
International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Discontinuance of Service for Refusal to Pay Bills Sustained.—The Court of Civil Appeals of Texas, in Withers vs. Fort Worth Gas Company, sustained the right of the company to cut off service because of refusal to pay bills, in the absence of any proof of an overcharge and despite the acceptance by the company of payment for a certain month subsequent to the period for which the bills were in dispute. (238 S.W. 324.)*

City Must Provide Light on Bridge Built by Railroad but Maintained by Municipality.—That a city is liable for failure to provide sufficient light on a bridge opened and maintained by it was the finding of the Missouri Supreme Court in Boyd vs. City of Kansas City. The action was brought because of injuries received when an automobile collided with a girder in the center of the roadway of a bridge erected by a railroad company under plans prepared by the city. The court held that the city was liable because it had invited the public to use the bridge for travel without providing sufficient light to make the obstruction visible. (237 S. W. 1,001.)

Reciprocal Rights in Maintenance of Dam Denied.—Failure of an old dam and the decision of the owner not to rebuild it have brought from the Supreme Court of Michigan, in Goodrich vs. Pollock, the dictum that one acquiring a prescriptive right to overflow lands by means of a dam is under no obligation to maintain the dam, and persons holding under independent titles, and building cottages and other improvements with reference to the artificial level of the water, acquired no reciprocal right or easement to have the dam maintained and such lands overflowed, as against the owner of the dam and the owners of the overflowed lands. (187 N. W. 368.)

United States Supreme Court on Including Federal Income Tax in Operating Expenses.—In the course of its decision sustaining the district court's findings in Galveston Electric Company vs. City of Galveston (see Electrical World, April 29, page 852) and declaring that confiscation had not been established, the United States Supreme Court thus dealt with the federal income tax in its relation to operating expenses: "The remaining item as to which the master and the court differed relates to the income tax. The company assigns as error that the master allowed, but the court disallowed, as a part of the operating expenses for the year ended June 30, 1920, the sum of $16,254 paid by the company during that year for federal income taxes. . . . In calculating whether the 5-cent fare will yield a proper return it is necessary to deduct from gross revenue the expenses and charges, and all taxes which would be payable if a fair return were earned are appropriate deductions. There is no difference in this respect between state and federal taxes or between income taxes and others. But the fact that it is the federal corporate income tax for which deduction is made must be taken into consideration in determining what rate of return shall be deemed fair. For under Section 216 the stockholder does not include in the income on which the normal federal tax is payable dividends received from the corporation. This tax exemption is therefore, in effect, part of the return on the investment."

Good Will and Earning Power Often Worth More than Tangible Property.—From the decision of the United States Supreme Court in Galveston Electric Company vs. City of Galveston (see Electrical World, April 29, page 852) the following further extract is made: "Nor is there evidence in the record to justify the master's finding that a business brought to successful operation 'should have a going-concern value at least equal to one-third of its physical properties.' Past losses obviously do not tend to prove present values. The fact that a sometime losing business becomes profitable eventually through growth of the community or more efficient management tends to prove merely that the adventure was not wholly misconceived. It is doubtless true, as the master indicated, that a prospective purchaser of the Galveston system would be willing to pay more for it with a record of annual losses overcome than he would if the losses had continued. But would not the property be at least as valuable if the past had presented a record of continuous successes? And shall the base value be deemed less in law if there was no development cost because success was instant and continuous? Or, if the success had been so great that, besides paying an annual return at the rate of 8 per cent, a large surplus had been accumulated, could the city insist that the base value be reduced by the amount of the surplus? In determining the value of a business as between buyer and seller, the good will and earning power due to effective organization are often more important elements than tangible property. Where the public acquires the business compensation must be made for these, at least under some circumstances, and they, like past losses, should be considered in determining whether a rate charged by a public utility is reasonable. . . . Going concern value and development cost, in the sense in which the master used these terms, are not to be included in the base value for the purpose of determining whether a rate is confiscatory."

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* The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Permission for Construction of Municipal Power Line Refused.—The Nebraska State Railway Commission refused to the village boards of Maxwell and Brady permission to construct a 13,200-volt electric transmission line paralleling a railway with heavy leads of telegraph, telephone and signal wires for a distance of about 22 miles, it appearing that the proposed line would be about 60 ft. distant from the telegraph and telephone wires of the railway for a distance of 9 miles and 128 ft. from its signal wires for a distance of about 12 miles. The judgment of the commission was that these distances were not great enough to insure safety at all times in the operation of the railway's wires and that inductive interference would result.

Stock Dividends Allowed at Portland, Me.—Seven quarterly dividends aggregating about $250,000 in arrears are to be paid to the extent of $230,000 in preferred stock by the Cumberland County Power & Light Company, Portland, Me., in accordance with a decision handed down recently by the Maine Public Utilities Commission. The commission pointed out that it has reasonable ground for belief that the company's net revenue will be sufficient to guarantee the payment of the dividend on the stock to be issued. In its finding the board stated that money earned by a corporation remains the property of the corporation and does not become the property of the stockholders until it is distributed among them by the company, and that the corporation may treat such money either as profits or as an addition to its capital.

Eight per Cent Return Held Sufficient.—Rate increases instituted by the Mount Victory Electric Light & Power Company in November, 1921, have been declared to be excessive and unreasonable by the Ohio Public Utilities Commission. The company was instructed to file a new schedule providing a return of 8 per cent on the valuation of its property, as fixed by the utilities commission, and to refund to its patrons the difference between the new and the old schedules for all payments since Nov. 1, 1921. The company has been charging 13 cents for the first 100 kw.-hr. and 12 cents for all over 100 kw.-hr., subject to a discount of 1 cent per kilowatt-hour if the bill was paid before the tenth of each month. The rates ordered by the commission provide 11 cents for the first 50 kw.-hr. and 7 cents for each additional kilowatt-hour. The Mount Victory company purchases energy from the Hardin-Wyandot Lighting Company of Kenton.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

E. A. Robert has recently been elected president of the Quebec Railway Light, Heat & Power Company, in addition to his other numerous executive activities. Mr. Robert first attracted public attention about sixteen years ago when he undertook to enter the power field in Montreal by developing the water power of the Beauharnois Canal and distributing energy in the territory of Montreal. Mr. Robert was born in 1865 at Beauharnois, Quebec. About ten years ago he became interested in the tramway and power situation of Halifax, N. S., and in 1917 formed the Nova Scotia Tramways & Power Company, Ltd., operating the tramway, light, power and gas services in Halifax and the adjoining city of Dartmouth. He resigned from the presidency of this company in 1919 in order to devote his entire time and attention to the more important tramway and power situation in Montreal and throughout the Province of Quebec. Mr. Robert is also president of the Montreal Tramways & Power Company, Montreal Tramways Company, Canadian Light & Power Company, Montreal Public Service Corporation, Beauharnois Light, Heat & Power Company, Imperial Trust Company, and Quebec Railway Light & Power Company. He is a member of the leading clubs in Montreal and Quebec and sat for two parliaments in the Provincial Legislature.

E. A. ROBERT

Iner Carlson has been appointed commercial manager of the Houghton County Electric Light Company, Houghton, Mich. Mr. Carlson was formerly commercial manager of the Keokuk Electric Company, another Stone & Webster property.

Louis A. Keen, manager of the Middletown division of the Connecticut Power Company, has been transferred to the Ponce (Porto Rico) Electric Company.

R. W. Shoemaker has been appointed electrical engineer for the Turlock Irrigation District and will make his headquarters at Turlock, Cal. Mr. Shoemaker was born in Germantown, Pa., in 1881 and was graduated from the California Institute of Technology in 1903. Upon graduation he became connected with the Federal Lead Company of Flat River, Mo., as electrical and mechanical engineer. In 1911 he built the first trackless trolley in America, at which time he was electrical engineer for the Lone Pine Utilities Company. From 1915 to 1920 he was connected with the Great Western Power Company, first as superintendent of the meter department and later as engineer of distribution. During the war he served as lieutenant in the navy and was assigned as instructor in electrical and steam engineering at the San Pedro training camp and engineer officer of the U. S. S. Gwin. Following the war Mr. Shoemaker spent two years in China and Manchuria on investigations for electrical developments in those countries. As electrical engineer for the Turlock Irrigation District he will have supervision of the development of plants with a total rating of approximately 50,000 kw.

Frederick Krug has been appointed superintendent of the La Plaza Hidroelectric plant of the Porto Rico Railway, Light & Power Company and expects to sail from New York about April 1 to take up the duties of the position. Mr. Krug was born in 1894. He was graduated from Cooper Union, New York, in electrical engineering in 1915 and subsequently attended the New Mexico State School of Mines. Upon graduation he was employed by the Watson-Flagg Engineering Company and later as a rotor and stator winder by the Crocker-Wheeler Company. In 1917 he was appointed assistant superintendent of the electrical department of the New York & Honduras Rosario Mining Company in Honduras, Central America, resigning in 1918 to become an instructor in electrical engineering in the Carnegie Institute of Technology. In December, 1918, he became sales service engineer for the Crocker-Wheeler Company in charge of all repair work handled by the factory through the sales department, from which position he was promoted to be superintendent of the electrical department of that company in July, 1919. Mr. Krug was appointed assistant superintendent of the electrical department of the New York & Honduras Rosario Mining Company in March, 1920, and resigned this position to take up his present work with the Porto Rico Railway, Light & Power Company. Mr. Krug has written numerous articles for the technical press.

William C. Sterne, who was elected chairman of the Rocky Mountain Committee on Public Utility Information to succeed T. O. Kennedy, has had a varied industrial career along with his activities in the operation of public utilities. After graduation from Harvard University in 1891 he spent some time in Europe in the interest of a fertilizer company. Later he moved to Colorado, where he engaged in the drug and chemical manufacturing business. In 1905 he started a central-station company which is now known as the Summit County Power Company. Later, under the firm name of the Municipal Properties Investing Company, he assumed control of the Arvada Electric Company, the Arapahoe County Electric Light & Power Company, the McCook Electric Company and the Fort Lupton Light & Power Company. In addition to these interests he is president of the Littleton Lumber Company and is a director of the Hamilton National Bank of Denver.

W. C. STERNE

E. G. Allen, formerly engineer of the Westinghouse Electric & Manufacturing Company at South Philadelphia, has joined the engineering department of the Philadelphia Electric Company.

W. H. Garrett has been appointed general manager of the Terrell plant of the Texas Power & Light Company to fill the vacancy caused by the resignation of Kenneth E. Mason.

John R. Proctor, a consulting engineer of Bayonne, N. J., has been awarded the contract for the electric work at the Claremont freight terminal of the Lehigh Valley Railroad, Jersey City, N. J.

J. J. Gibson, who has been manager of the supply sales department of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of assistant to Vice-president H. D. Schute. Mr. Gibson was born in York, Pa., and was graduated from Lehigh University in 1895 with the degree of electrical engineer. He then entered the employ of the Westinghouse company at its old Garrison Alley plant, Pittsburgh, where he remained until the following year, when he left to join the American Telephone & Telegraph Company, with which he remained until 1900. In 1900 he re-entered the employ of the Westinghouse company in its Chicago office, where he remained until 1905, being then transferred to Philadelphia. He was appointed district manager of the Philadelphia district in 1906, and in 1914 he was promoted to the managership of the supply department.

J. J. GIBSON

D. B. Rushmore, who has been engineer, power and mining department, General Electric Company, at Schenectady, has just been appointed a consulting engineer for the company in order that he may give his time more completely to the general engineering problems in which he is interested.

K. A. Pauly has been appointed engineer, power and mining department, General Electric Company, with headquarters at Schenectady, to succeed D. B. Rushmore, now one of the company's consulting engineers.

E. W. Knight, assistant manager of the fan-motor section, supply department, Westinghouse Electric & Manufacturing Company, has been appointed acting manager of that section, to succeed W. J. Jockers, who resigned recently to go with the St. Paul Electric Company.

Richard Waller has been placed in charge of the Paris office of the American Insulating Machinery Company, Philadelphia, and will handle all Continental European business with the exception of that of Scandinavia.

Daniel D. Gibson, Jr., has recently become connected with the Sanderson & Porter Corporation as electrical designer on extensions to the Windsor Power Station, Power, W. Va. Previous to going to Power Mr. Gibson was connected with the New York Edison Company.

N. Harwood Lasher of Gloversville, N. Y., has recently been appointed manager of the statistical department of the General Electric Company at Schenectady.

E. P. Parker, formerly manager of the Eureka Vacuum Cleaner Company's Springfield (Mass.) office, has been appointed manager of the company's office at Hartford, Conn.

W. J. Jockers has resigned as manager of the fan-motor section, supply department, Westinghouse Electric & Manufacturing Company, in order to accept the position of sales manager of the St. Paul Electric Company, St. Paul, Minn.

Frank P. Cox, who was recently appointed manager of the West Lynn (Mass.) Works of the General Electric Company, is widely known in the field of meter and instrument engineering as a technically trained executive of long experience. Mr. Cox is a native of Terre Haute, Ind., and was graduated in 1887 in electrical engineering from the Rose Polytechnic Institute. He took a post-graduate course of one year at Johns Hopkins University, Baltimore, Md., and soon afterward entered the employ of the Kester Motor Company at Terre Haute. About 1890 he went to Lynn to enter the service of the Thomson Electric Welding Company and shortly afterward took up the work of meter manufacture in the Thomson-Houston plant in West Lynn. For thirty-two years Mr. Cox has been closely associated with the development of meter production and for the last two years he has been manager of the company's Federal Street works in Lynn. He has maintained close contact with employees for many years and is highly regarded in his relations with subordinates besides having a high reputation as an expert outside the confines of his own company.

F. P. COX

George H. Southard has been appointed president of the J. & B. Manufacturing Company, manufacturer of electrical and ignition specialties, Pittsfield, Mass., to succeed Edward B. Jacobson, who resigned recently. Mr. Southard has been treasurer of the company for the last six years. He was born at Newburgh, N. Y., in 1871 and secured his technical education at the Brooklyn Polytechnic Institute and Sheffield Scientific School of Yale University, being graduated from the latter institution in 1895. Prior to becoming connected with the J. & B. Manufacturing Company he was in charge of the New York office of the Franklin Trust Company, now the Bank of America. In addition to holding the position of treasurer Mr. Southard has acted as general manager of the organization, and under his guidance the business has grown from a comparatively small beginning to the point where it employs several hundred people. He is a member of the Society of Automotive Engineers.

G. H. SOUTHARD

Obituary

Clifton Wharton, one of the firm of Wharton Brothers, which originally owned the plant that has become the National Works of the National Tube Company, died at his home in Plainfield, N. J., on April 15.

Thomas Flanagan, for twenty years connected with the Western Electric Company, died recently from pneumonia at his home in New York City at the age of fifty-nine years.

Irving J. Bent, superintendent of motive power, electrical department, Illinois Steel Company, South Chicago, Ill., died recently after a short illness. Mr. Bent was born in Needham, Mass., in 1867. He was connected with the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company before joining the Illinois Steel Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Mills Report Second Quarter Production of Electric Sheet Already Booked

INQUIRIES for electric sheet, according to several producers, are meeting with refusals to book the orders for second-quarter delivery, and as the books for the third quarter will not be open for a short time these inquiries are going begging. This condition is due to the fact that producers have had their entire tonnage of sheet for the second quarter booked for the last two weeks. It is true, however, that the mills are not operating at rated capacity by any means, an estimate placing operations at between 70 per cent and 80 per cent. It must be remembered also that black and galvanized sheet, and auto body sheet especially, have been very active and have engaged the capacity of the mills to a large extent. Discounting both of these considerations, producers declare their orders for electric sheet to have been heavier in the last two months than at any time in the last twelve. This is an important sign of activity in the motor, transformer and generator field and backs up the brighter reports coming from manufacturers of this apparatus.

Electric sheet quotations have not followed those on black and galvanized sheets, which were advanced $3 per ton recently, while electric sheet remained firm but did not increase. The base is $4.25 on the United States Steel electric sheets and $3.75 on the armature sheets.

Inquiries at present are not heavy, consumers being fairly well supplied for second-quarter requirements and not wishing to strengthen the market any further by coming in before the books for the third quarter are opened. One large producer stated to the ELECTRICAL WORLD that when third-quarter bookings were available it was highly possible that his sales force would still have to do quite a bit of selling.

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Producers Raise Pole Prices for Second Time in Three Months

PRODUCERS of Western red-cedar poles on May 3 advanced the prices of all sizes of their poles, the advances ranging from 50 cents to $1.75 per pole. The new prices per pole in l.c.l. lots, f.o.b. New York, are as follows: 25-ft., 6-in.-top. $5.17; 30-ft., 6-in.-top. $7.05; 35-ft., 6-in.-top, $10.90; 40-ft., 7-in.-top, $15.10; 40-ft., 8-in.-top, $16.45; 45-ft., 8-in.-top, $19.70; 50-ft., 8-in.-top, $22.40. These prices are advances of 50 cents on the 25-ft. pole, 75 cents on the 30-ft., $1.50 on the 35-ft., $1 on the 40-ft., $1.50 on the 45-ft., and $1.75 on the 50-ft. The percentage of increase averages around 10.

This is the second time in a little less than three months that producers have shown their confidence in the market by jacking up prices. The first time was about the middle of March and was confined to only a few sizes. In view of later developments it would seem that the first increase was in the nature of an attempt to feel out the market on the question of a general raise. Previous to March prices had been descending for over a year. This current increase, it is pointed out, is a definite sign that the market is again on the up grade and that the producers, as opposed to the small broker or selling agency, are once more in control of the situation.

Demand in practically all sections of the country is good, with some parts, such as the Southwest, particularly active. Stocks are good, though not too heavy, and producers are not having any trouble in making shipments.

An increase is also announced on Northern white-cedar poles, the 30-ft., 7-in. top pole now selling at $9.40 f.o.b. Chicago.

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Building Contracts Let During April Break All Previous Records

THE month of April broke all previous records for the amount of construction started, according to figures supplied by the F. W. Dodge Company. Contracts awarded in the twenty-seven Northeastern states of the country amounted to $353,192,000. The previous high record was for the month of July, 1919, the total for that month having been $317,698,000. April's figures represented an increase of 20 per cent over the previous month and of 60 per cent over April, 1921. The first four months of this year have rolled up a total figure that is just under a billion dollars and is 65 per cent greater than the total for the first four months of last year.

There was an increase in every important class of construction project during the month, even in industrial plants, the last group to show signs of activity. Residential building continues in the lead, amounting in April to $132,478,000, or 37 per cent of the total; public works and utilities amounted to $75,251,000, or 21 per cent; business building to $58,711,000, or 17 per cent, this being a notable increase over last month; educational buildings to $36,718,000, or 10 per cent, and industrial buildings to $24,312,000, or 7 per cent. Contemplated new work reported during the month amounted to $490,926,000.

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Metal Market Situation

THE reverse of the usual order of things has taken place in the copper market in the last week, outside selling agencies having taken the initiative in advancing prices while the producers trailed behind. The advance amounted to ⅛ cent, bringing the quotation on electrolytic to 13⅛ cents per pound for May, June and July delivery. Most of the producers have come up to this price, though at the beginning of this week especially attractive orders could be placed at 13 cents with a few producers. The Copper Export Association also has advanced its prices to 13⅛ cents c.i.f. European ports. Shipments abroad have been very heavy recently. Domestic buying continues fair, mainly for shipment this month and next.

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NEW YORK METAL MARKET PRICES

Copper:	May 2, 1922	May 9, 1921
London, standard spot	£ s d 60 2 6	£ s d 60 5 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00	13.00-13.25
Electrolytic	12.87½	13.00
Casting	12.50	12.62½
Wire base	14.12½-14.37½	14.62-14.87½
Lead, Am. S. & R. price	5.25	5.25
Antimony	5.37½	5.37½-5.50
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.35	5.40
Tin, straits	31.25	30.62½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.00 -11.12½	11.00 -11.25
Brass, heavy	5.25 - 5.50	5.25 - 5.50
Brass, light	4.87½ - 5.12½	4.87½ - 5.12½
Lead, heavy	4.50 - 4.62½	4.50 - 4.62½
Zinc, old scrap	2.50 - 3.00	2.75 - 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A DEFINITE improvement is to be noted in the electrical industry since the middle of April. Before that time the demand for wiring materials and radio was carrying the burden of trade on its shoulders, whereas now there is a healthy demand for line material, generating equipment, appliances and several other items, while the trend throughout the whole line is upward. Jobbers are well satisfied with their volume, which exceeds anything in the last year. An order calling for twenty-five carloads of rigid conduit was placed with a New York jobber last week and, although not an average order, it shows how building construction is stimulating jobbing trade. Production of large apparatus in the New England centers is reported to be increasing rapidly, though it still is below normal. Continued improvement is seen in Southeastern jobbers' business, and prices are stiffening there. The same chain of occurrences is found to be taking place in Chicago and St. Louis. Good range business is being reported by all sections of the Pacific Coast, the wide sales campaigns on a time-payment basis bearing fruit at last.

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NEW YORK

Improvement of conditions in the electrical trade has been going ahead steadily for the past two months, and it now appears that better times are here to stay. The best indication that business is on the up grade is the actual increase in volume of sales. One jobber reports that his April sales were the largest in any month during the past two years. This business is not confined to any particular class of material, but is well distributed over the entire line. A large potential market is developing with the increased building activity, and the effects of this are already being felt in the number of inquiries that are being received. During the past week an order for twenty-five carloads of conduit to be used on one job was placed by a contractor. This is probably the largest single sale of wiring material made in this section since 1920.

Generally there is a better tone to the whole market, and while there is little indication of immediately increasing prices, those now in effect are much steadier. Jobbers' stocks are fair to good and no shortages are reported. However, it is believed that most contractors' and dealers' stocks are pretty low because of the hand-to-mouth buying of the last year. All of these factors point to very satisfactory conditions in the electrical trade for the rest of the year.

Conduit.—Sales have been very good for the past week as it seems that present quotations have been very attractive to contractors and dealers. Jobbers who had fair stocks on hand or ordered before the last advance have given their customers the benefit of the old price. It is doubtful, however, if conduit can be bought at the former price by the end of this week. Quotations ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Demand is fairly active and prices show no change. In 5,000-ft. lots No. 14, rubber-covered, sells for $6.25 per 1,000 ft. In lots of 10,000 ft. and over quotations have been made around $6.15 per 1,000 ft.

Flexible Armored Conductor.—Sales are steady and demand holds up well. No. 14, two-wire, single-strip, sells for $43 to $45 per 1,000 ft., and double-strip is quoted at $45 to $47 per 1,000 ft. Most sales are being made at the lower figure. Stocks are only fair.

Lock Nuts and Bushings.—Quotations on lock nuts and bushings have been advanced about 10 per cent. These items, which formerly were quoted at 70 and 10 per cent off list, are now quoted at 70 per cent off.

B-X Connectors.—Prices have dropped about 7½ per cent through an increase in the discount from 35 per cent to 40 per cent.

Sockets.—Demand is good and prices have remained unchanged. Pull sockets in standard-package lots of 250 are quoted at $33 per 100. Key sockets in standard-package lots of 500 sell for $18.15 per 100, and keyless in the same quantity are quoted at $16.50 per 100.

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CHICAGO

Several price changes occurred this week along with the sustained and improving demand for wiring materials. Jobbers are beginning to feel the result of the several thousand building permits issued during March and April. Flexible armored conductor increased in price about 5 per cent, and dealers attribute it to the uncertainty caused by the coal strike. An increase of $1 was announced on several standard-sized red and white cedar poles. Pole-line hardware also was increased about 10 to 15 per cent. The motor industry is returning to normal and the small-motor field is improving.

Building permits for April virtually equaled the number issued in March. Permits for 1,315 buildings call for an expenditure of $17,076,560 with a frontage of 38,077 ft. The gain over the same period last year is 782 buildings with 22,250 more feet of frontage, but with an increased valuation of only $1,977,660.

Flexible Armored Conductor.—An increase in price was noted this week. In 5,000-ft. lots the No. 14 double-wire, single-strip varies from $44 to $45 per 1,000 ft. Dealers tell of a very active demand for this material. Stocks are ample.

Conduit.—A healthy movement in pipe was reported by most dealers. Prices range from $42 to $43 per 1,000 ft. for the ½-in. black pipe in 5,000-ft. lots. Stocks are good.

Wire.—The activity in the building line is carrying this material along so that the demand on most dealers is good. However, keen price competition still exists, and prices vary from $6 to $6.25 per 1,000 ft. for the rubber-covered No. 14 in 5,000-ft. lots. Most dealers' stocks are good. The movement of bare and weatherproof wire has been steady.

Motors.—Nearly all manufacturers report improvement in the demand. Conditions in the small-motor market are gradually becoming easier. One manufacturer reports a much better call for both large and fractional-horsepower motors, but says that these are fairly well distributed instead of being grouped entirely within one industry.

Transformers.—The spring expansion and replacement work of utility companies has resulted in a better call for distribution transformers, but, according to manufacturers, the volume consists of a number of small orders rather than a few large ones.

Fans.—A few dealers report that the movement of fans has started, but the cool weather during April has delayed sales. However, jobbers are shipping stocks to dealers on regular schedule.

Poles.—An increase in price on both the Northern white cedar and the Western red cedar was announced this week. This makes the 7-in. top, 30-ft. Northern white-cedar pole sell for $9.40 f.o.b. Chicago. An increase of $1 was also made on the 5½-in. to 8-in. top, 30 ft. size. The Western red cedar in the 7-in. top, 30-ft. size is quoted at $8.30 f.o.b. Chicago, an increase of $1. The call for poles is very active.

BOSTON

A stronger tone is apparent in trade, with improved movement of wiring supplies and a slightly better demand for motors. General business in New England is gaining, despite the protracted strike in the cotton textile industry. Woolen mills are busy, paper manufacturers are active, and makers of rubber goods and automobile accessories are busier than awhile back. Building operations are growing rapidly into totals that are affecting the electrical trade, and house-wiring campaigns are meeting with notable success. While residential building predominates, some important mercantile structures are under way, and it was announced last week that financing has been arranged for a new five-million-dollar building for the Boston Chamber of Commerce to be erected in the financial district. So far the coal strike has had little noticeable effect on business in this territory. Central-station outputs are gaining in many quarters, and the electrical demands of the Boston Edison territory are picking up gradually. New life has begun to show itself in Boston marine circles, through use of facilities for shipments to the Pacific Coast via the Panama Canal. The production of larger units of electrical apparatus, especially for Asiatic trade, is increasing.

Radio Apparatus.—No let-up in demand is evident. Ninety exhibitors kept open house at last week's radio show in Boston, the attendance being 30,000, notwithstanding three rainy days. Shortages in vacuum tubes and telephone receivers continue. Scheduled production in one establishment making tubes has increased from 75,000 in February to 150,000 in May, and another company's New England factory is producing 500 complete receiving sets daily with plans to double this output by midsummer. Deliveries are improving on aërial insulators, these being obtainable on a two weeks' basis at present. Magnet-wire deliveries for radio work are uneven.

Motors.—Slow but steady recovery in demand is evident. Motors under 10-hp. rating are in chief request. One distributer reports a decided gain in sales last week, and on the whole conditions look better than for some time.

Ranges.—Inquiries are in better volume in retail circles, and the outlook continues good for a healthy season. Competition is sharp for the business offered.

Transformers.—The demand for large units is much improved, especially for Far Eastern trade. Hydro-electric development in Japan is increasing, and this is reflected in New England transformer production. Distribution types are also moving somewhat faster. Prices are firm.

Meters.—Trade is fairly good, owing to new building operations. Excellent deliveries and steady prices rule.

Refrigerating Equipment.—Popular interest in electrical ice making is increasing, and one retailer has sold about ten installations within the fortnight. Prices are favorably regarded by the consumer, it is reported.

Wire.—Competition is sharp for existing trade in rubber-covered and weatherproof wire. The former, No. 14, sells from $6 to $6.25 per 1,000 ft. in 5,000-ft. lots, the market being wide open above this. The large number of interior wiring jobs is creating fairly good business in rubber-covered wire.

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ATLANTA

"Unmistakable evidence of continued improvement in business conditions" is the opening line of the business review by the Sixth Federal Reserve Bank for April. While inclement weather is interfering materially with agricultural activities, an increase in the price of nearly all farm products has resulted in a considerably improved outlook among the farmers, with a consequent reflection of better business in the small towns. Preliminary reports on the prospective cotton crop, together with a stronger demand for the staple, have sent cotton prices back to an attractive figure, Atlanta spots being quoted at 18.35 cents. Cotton held in the district but which will now be released will serve to liquidate quite a large amount of outstanding accounts.

Reports in general indicate a decrease in the number of unemployed, due to increased building activities, muni improvements and the employment of labor on fa. Building permits for Atlanta in the month of April reache a total of $1,297,000, an increase of more than half a million dollars over April, 1921. The number of permits amounted to 503, as against 324 for April, 1921.

Electrical jobbers report a general improvement in their lines. There is some tendency toward price advancing which seems to be stimulating purchases by the small contractors. A number of the larger electrical retailers are preparing to undertake sales campaigns for household appliances, effective this month, and the general opinion is that electrical appliances and heating devices will show greater activity very shortly.

Industrial Motors.—Business is on the up-grade, one of the largest distributers reporting very satisfactory sales, particularly in sizes up to 40 hp. with the three-phase, 220-volt types most in demand.

Panelboards.—Sales are very satisfactory, particularly on the sectional type, the tendency apparently being to make a more liberal use of this specialty than has been the case heretofore. Factory shipmnts are good and prices steady.

Poles.—No marked change in the situation is reported, purchases still being rather slow, with good stocks at all yards. Creosoted poles show a slight reduction in price, but chestnut prices are steady.

Pole-Line Hardware.—A fair movement is reported, particularly in the class of material used for rural telephone extensions. A price advance of 10 per cent seems to have stimulated sales and stocks are reported quite satisfactory.

Portable Drills.—A slight improvement in this line is to be noted, though sales continue rather small owing to the failure of automobile and garage business to get back on a stable basis. Local stocks are good to heavy with prices steady.

Lightning Arresters.—Anticipation of the summer months is causing quite a satisfactory turnover in this line, with the compression type leading in demand. Local jobbers have accumulated very satisfactory stocks for seasonal sales and expect no reduction in price.

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ST. LOUIS

The more extensive scale upon which building operations are being conducted is shown in the April report of building permits for St. Louis, the amount being $2,111,596. as compared with the March figure of $1,799,005 and the April, 1921, value of $1,127,155. The permits issued during the first four months of this year amounted to more than double those for the same period of last year, the respective values being $6,315,866 and $3,149,430. Most of the construction is for residential purposes, and the permits for factories and workshops make a very small portion of the total. The latter amounted in April to only $34,000, and for the first four months of this year to only $124,460. Most of the industrial work has consisted of improvement of equipment in existing buildings, and no indication of such work would be found in the above figures, for they include only the cost of the buildings.

Jobbers were quite enthusiastic about the business done last week, not that it was of extremely large volume, but it was more active than has been experienced for some time and gave indications of further improvement. A large order for high-voltage underground cable was placed, weatherproof wire was active, poles were moving in increased volume. warm weather began to move fans, and orders for radio equipment continued to pile up. Several jobbers report that the April business was better by a substantial margin than has been experienced for many months. Price increases on poles, pole-line hardware and conduit boxes were noted.

Poles.—With substantial improvement in demand, prices have been increased by $1 to $2 per pole. Resultant quotations for Northern white cedar poles with 7-in. tops, in carload lots, f.o.b. St. Louis, are: 30-ft., $9.90; 35-ft., $16.60; 40-ft., $20.30; 45-ft., $23.75. Stocks are said to be in good condition and immediate deliveries can be given. A large portion of the buying is for telephone work, but power companies are buying for distribution work, and there is some purchasing for transmission construction.

Cross-Arms.—Increased sales and good stocks are found. Fir arms, 3¼-in. x 4¼-in.. in lots of 1,000 lineal feet and more, f.o.b. St. Louis, are priced per 100: 3-ft., $45.60; 4-ft., $60.90; 6-ft., $91.35; 8-ft., $121.80; 10-ft., $152.25.

Flexible Armored Conductor.—Volume of sales has shown very little variation since the first of the year, and low stocks are maintained because of the low demand.

Pole-Line Hardware.—Double-arm and cross-arm bolts have increased in price by about 15 per cent and other items by about 10 per cent. Movement has accelerated to some extent in the past ten days, and stocks are reported to be in good condition to meet the increased demand.

Conduit Boxes.—Word is received that prices are increased about 5 per cent, but the new prices on individual items have not been established. The demand is not very active, and stocks are conservatively maintained.

Wire and Cable.—Sales of bare and weatherproof were substantially better last week, and a large order for high-voltage cable was placed, with other large cable orders pending. No. 14 bare stranded is finding a good opening in the radio field and is quoted at 28 cents per pound. The base on weatherproof is 15½ cents per pound, and that on bare from 16 cents to 17 cents per pound. No. 14 rubber-covered continues to move in comparatively good volume at $6.25 to $6.50 per 1,000 ft. in 1,000-ft. lots.

SAN FRANCISCO

California building during April showed an increase. except for a temporary falling off in the extreme Southwest sections. The value of building permits issued during April, 1922, is as follows: Los Angeles, $12,954,288; San Francisco, $3,993,720; Oakland, $1,782,189; San Diego, $1,006,010. Los Angeles has set a new high mark for the Coast in these figures. Elaborate electrical installations for new public schools have resulted in an excellent immediate demand for electrical wiring and apparatus. An increasing number of secondary schools are now being equipped with household appliance departments. When the range campaign is finally inaugurated it will prove a stimulus to retail-store buying, which even now is better.

Conduit.—Fluctuations of price have brought a corresponding activity in purchase orders from dealers, though these have not caused any appreciable shortages except in one or two galvanized types. The present prices for galvanized styles run generally about $6 per 100 ft. for the ½-in., $7.80 per 100 ft. for ¾-in. and $11.25 per 100 ft. for 1-in. in any quantity. Black conduit is being quoted generally at about $5.55 per 100 ft. for ½-in. with other sizes at proportionate prices.

Batteries.—There is an extensive demand for wireless-type batteries, but nevertheless few shortages are reported. A seventy-two-cell battery of great amplification is being sold for $9 in lots of ten and a twenty-seven cell, 18-volt to 43-volt battery for $3.

Radio Supplies.—Foreseeing possible duplications of stocks when Eastern and local factories begin to deliver the orders which have been promised for the latter part of May and for June, local dealers are beginning to be very wary in ordering. A desperate situation of shortage caused quite frenzied buying, but the situation is clearing, and within the next month good stocks should be on hand.

Wire.—Weatherproof in three-braid base sizes is now selling in coil lots for $20.50 per 100 lb. The local stock situation is again normal through the arrival of stocks of sizes 4, 6 and 8. Bare copper wire is being quoted on a basis of $18.70 per 100 lb. with progressive additions of 50 cents per 100 lb. in 100-lb. lots to $10 per 100 lb. in less than 24-lb. lots. Bare wire is now brisk in movement, and these graduated additions providing for unusually small quantities are made necessary by the call for radio antennas.

PORTLAND—SEATTLE

Utah coal mine operators have proposed to reduce the price at the mine $1 a ton and the haulage charge to the Puget Sound region by $1.35 a ton, making a total reduction in the price of coal in Seattle of about $2.35 a ton. Conditions in the lumber industry continue to improve. Production for the week ended April 29 was only 3 per cent below the normal, i.e., the aggregate cutting capacity of the mills reporting for an eight-hour day.

Building continues active. April permits in Portland totaled 1,366, with a valuation of $1,865,970. Residence permits numbered 334, with a valuation of $1,248,285, a 25 per cent increase in valuation over April, 1921. Electrical permits to the number of 1,286, with a valuation of $146,035, were issued during April in Portland. This is an increase in valuation over April, 1921, of 69 per cent and is the largest month's business in the history of the department. During the month of April 973 permits having a valuation of $1,632,175 were issued in Seattle, as compared with 1,091 permits. valued at $1,439,855, reported for April, 1921.

Electrical jobbers of Portland report business materially improved over a week ago, while Seattle jobbers state that business is about the same as for several weeks past. There seems to be an ever-increasing tendency toward buying in standard-package quantities. Copper is very low at the present time and demand is good. It is predicted that there will be a raise in price forthcoming soon in steel, copper and rubber. Contractor-dealers are doing a good business in wiring and particularly in fixtures. Portland dealers report store sales normal, not including the heavy demands for radio material. Ranges are in demand in Portland and appliances are picking up.

Conduit.—Demand for conduit is very good. Recent price advances in Seattle have not affected sales. Quotations are: ½-in. black, $5.74 to $6.25; ¾-in. black, $7.11 to $8.05; ½-in. galvanized, $6.03 to $6.80; ¾-in. galvanized, $7.83 to $8.85. All prices are per 100 ft. in 10,000-ft. lots.

Outlet Boxes.—Sales have been stimulated by the educational campaigns put on by contractor-dealers and jobbers to increase the use of convenience outlets. Quotations are: 3-in. boxes, $8.10 to $9.40, and 4-in. boxes, $10.57 to $11.74, per 100 in standard quantities.

SALT LAKE CITY—DENVER

Building activity for April showed a substantial gain over permits for the same month of 1921. The increase was reflected both in the number of buildings begun and the total amount appropriated for construction. May promises to show an even more decided improvement in building and construction. Extensive road projects are getting under way, furnishing labor for hundreds that have been unemployed during the winter and spring. Labor troubles in the coal fields are subsiding, and production is picking up gradually, nearly every important Utah mine operating either part or full time. Metals are getting in better shape, with the market showing steady improvement. There is a resulting increase in the volume of electrical merchandise sold to the mining companies.

Several steel manufacturers have recently announced their intention to manufacture radio poles. They will build them according to any specification. The first "listening-in" demonstration with their new equipment will be made within a week by the Salt Lake City Commercial Club.

Electric Ranges.—Advertising is now focusing attention on electric ranges, with the result that an increased number of sales are being made. Easy-payment plans are being intensively featured.

Motors.—With the approach of the irrigating season interest in motors for private orchard and farm pumping installations is being shown. This is a constantly expanding market. Some recent rulings of public utility commissions have favored extremely moderate power rates, and this, it is believed, will further encourage the use of motors for pumping water to farms and orchards.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Company Organized to Manufacture "Hot Line" Tools

The W. T. Safety Tool Company, Inc., Taylorville, Ill., has been formed to manufacture and distribute tools and equipment for working on high-voltage transmission lines and equipment without interruption of service. The products of the company, according to the announcement of W. D. Williams, secretary-treasurer, form a complete equipment for this sort of work.

The company was formed shortly after the first of the year and now has production in full swing. A selling organization is now being formed, and it is planned to cover the entire country in the near future with road salesmen. Jobbers of high-tension material are also being interested as distributors, and demonstrations are now being given to leading central-station companies and jobbers. The officers of the company are: C. R. Wood, president; M. T. Tipsord, vice-president; W. D. Williams, secretary-treasurer.

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Lighting Fixture Manufacturers Meet in Cleveland in June

The midsummer convention of the National Council of Lighting Fixture Manufacturers is to be held in Cleveland June 28-29, according to an announcement sent out by headquarters of the organization. A definite program has not been arranged yet, but it is understood that one of the subjects to be taken up is the introduction of a uniform system of cost accounting among member firms.

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Retail Stores May Form Radio Distributing Syndicate

The National Retail Dry Goods Association, it is learned, is obtaining a favorable response from its members in answer to an inquiry on the advisability of forming a syndicate of stores to handle the distribution of radio apparatus. The inquiry was sent out recently, and the report of the retailers' committee appointed to study the radio problem was communicated to the stores at the same time. This report put forward the idea of having the stores pool their purchases and suggested that a company be formed for the purpose which would not be connected directly with the association but tied up to it in some way, possibly in an advisory capacity.

It was found by the committee that the Radio Corporation of America would deal directly with the stores if they pooled their purchases.

The committee explained that the pooling of buying orders would make the manufacturing problem less difficult, thus making possible preferential discounts. The appointment of another committee was suggested to carry out the plan for a company of retailers.

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Westinghouse Forms Merchandising Sales Department

A reorganization of the supply sales department and the establishment of a merchandising sales department by the Westinghouse Electric & Manufacturing Company have been announced by H. D. Shute, vice-president. The changes, which entail the promotion and transfer of a number of officers and are considered to be among the most important actions taken by the Westinghouse company in several years, became effective May 1. At that time the new merchandising sales department began to function.

J. J. Gibson, manager of the supply sales department, becomes assistant to vice-president in the new plan of organization. In his new position Mr. Gibson will have supervision over the activities of both the supply sales and the new merchandising sales department. Other changes are as follows:

A. A. Brown is appointed manager of syndicate operations; J. S. Tritle, manager of the St. Louis office, becomes manager of the merchandising sales department; T. J. Pace, assistant manager of the supply department, becomes manager of the supply sales department; C. E. Allen, manager of the central-station division of the Chicago office, becomes manager of the St. Louis office; George Baily, assistant to the manager of the supply department, becomes supervisor of distributing agents; M. C. Morrow, assistant sales manager of the Westinghouse Electric Products Company, becomes assistant to the manager of the merchandising sales department, and J. J. Dorney, manager of the industrial division, St. Louis office, becomes assistant to the manager of the merchandising sales department.

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Ilg Company Plans Wide Ventilating-Fan Campaign

An extensive campaign to bring to the attention of the public the value of ventilating fans and to increase the sale of its product has been launched by the Ilg Electric Ventilating Company, Chicago. One of the most important objects of the campaign will be to establish a "Good Health Week" from Oct. 23 to 30.

Hurley Machine Company Betters Financial Position

While the annual report of the Hurley Machine Company, Chicago, washing-machine manufacturer, shows less business done in 1921 than in 1920, it also shows an improved financial position for the company at the end of the year. Net income after payment of all charges and preferred dividends was $429,309 for 1921 against $706,663 for 1920.

The surplus for the year was $29,556 as compared with $175,175 in 1920. For 1921 the net sales were $3,708,261 against $8,967,685 for 1920. However, the year closed with cash in banks and United States certificates totaling $1,268,315 and inventories of $904,458, a reduction of $892,932 as compared with Dec. 31, 1920. During the year bank loans of $977,500 were liquidated in full. The present ratio of current assets to current and accrued liabilities is 5.17 to 1, which compares with a ratio of 2.36 to 1 at the close of 1920. Net sales of electric washing and ironing machines were 42 per cent of the 1920 sales. The 1921 net income was 11½ per cent of the net sales, as compared with 8 per cent in 1920.

The prospects for 1922, according to Edward N. Hurley, chairman of the board, are very encouraging, as indicated by the shipments of orders amounting to $962,793 in the first three months of this year. This compares very favorably with the same period in 1921, when the orders amounted to $777,554, particularly in view of reductions in prices amounting in some instances to as much as 28 per cent.

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General Electric Stockholders Authorize New $35,000,000 Issue

Stockholders of the General Electric Company at their annual meeting Tuesday, May 9, at Schenectady, N. Y., voted to increase the authorized capital stock by $35,000,000, consisting of 3,500,000 shares of par value at $10 each. The new shares will be issued without voting or subscription rights, but will be entitled in priority to the common stock to cumulative dividends at the rate of 6 per cent per year.

As explained in a letter sent out previous to the meeting to all stockholders by C. A. Coffin, chairman of the board of directors, these shares will be used to pay 5 per cent annual stock dividends on the common stock, and such payments will take the place of the 2 per cent semi-annual stock dividends heretofore paid in common stock. It is expected that the first of such 5 per cent annual stock dividends will be paid next October.

This dividend plan will eliminate a vast number of fractional shares, as the only fractions will be half shares, the conversion of which into full shares of $10 each can be easily made. Under the proposed plan, stockholders will receive for each two shares of common stock which they own an annual dividend of one ten-dollar share of the new stock.

The stockholders at this meeting also authorized an amendment to the bylaws of the company whereby the number of directors is to be increased from fifteen to nineteen. The following fifteen directors were elected at the meeting on May 9 for the ensuing year: Gordon Abbott, Boston; Oliver Ames, Boston; George F. Baker, Jr., New York; Anson W. Burchard, New York; C. A. Coffin, New York; George P. Gardner, Boston; Francis L. Higginson, Jr., Boston; D. W. Morrow, New York; Marsden J. Perry, Providence, R. I.; Seward Prosser, New York; E. W. Rice, Jr., Schenectady, N. Y.; B. E. Sunny, Chicago; Robert Treat Paine, 2d, Boston; Philip Stockton, Boston, and E. R. Stettinius, New York.

New York Dodge Office Now in Dodge Building

The Dodge Sales & Engineering Company, Mishawaka, Ind., manufacturer of power-transmission appliances and heavy oil engines, has moved its New York City branch from 21 Murray Street to the new Dodge building, located at the corner of Park Place, West Broadway and Murray Streets and known as 53 Park Place.

The new Dodge building is twelve stories high, of steel and concrete construction and is modern in every detail. Four elevators are installed in the building, and special provision has been made for extra heavy floor loads, which permits of ample provision for the storing of emergency trade service stocks as well as the display of power-transmission machinery and heavy oil engines. The Dodge Manufacturing Company has maintained a branch and warehouse in New York for more than twenty-eight years and in moving to its new building, conveniently located as regards shipping and railway facilities, it will be able to handle more efficiently its local and export business.

Western Electric Makes Record Amount of Cable in March

The telephone cable plant of the Western Electric Company at Hawthorne, near Chicago, broke all its records for production in March. During the thirty days ending the first fiscal quarter it made more wire into lead-covered cable than during any other like period in its existence. There were used 1,789,147,000 ft. of copper wire in the process. The previous largest amount produced in one month was 1,419,829,000 conductor feet in September, 1921, 369,318,000 ft. less than in March. The latter month was also marked by a new record for a weekly output. During the last week of the month the conductor-feet figures reached a total of 410,143,000.

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The Hall-Mark Electric Supply Company, jobber of electrical supplies, lighting fixtures and brass goods, has opened an establishment at 625 Broadway, Brooklyn, N. Y.

The Thomaston Manufacturing Company, Thomaston, Conn., has adopted a capacity schedule of operation at its plant, running for the most part on radio sets and parts.

The General Radio Corporation, Philadelphia, is arranging for the operation of a local plant for the manufacture of a full line of wireless equipment. It is proposed to commence work before the close of the month. The company is headed by Walter L. Eckardt, chairman of the retail merchants' committee of the Chamber of Commerce, Twelfth and Walnut Streets.

The Fisher Motor Company, Orillia, Ont., Canada, has started construction work on its new buildings.

The Electric Hoist & Derrick Company, Baltimore, Md., is to handle the sales of the electric hoists and derricks at the Hog Island Shipyard, Philadelphia. William H. Price, Jr., will be in charge of the work at the yard.

The Canada Electric Castings Company, Orillia, Ont., Canada, has started work on its new buildings in that city.

Foreign Trade Notes

FRENCH MACHINERY EXPORTS.—The official French statistics for the year 1921, recently published, show that the exports of electric generators and elecrical apparatus have greatly decreased. Exports of generators in 1919, were valued at 19,873,000 francs; 1920, 41,080,000 francs; 1921, 6,959,000 francs. Exports of electrical apparatus in 1919 were 92,387,000 francs; 1920, 126,263,000 francs; 1921, 27,356,000 francs.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in India (No. 1,721) desires to purchase electrical goods, metals, wire, etc.

The purchase is desired in India (No. 1,754) of a complete electric plant for a farm of about 1,000 acres. Power will be obtained from a hydro-electric station, 5 miles distant from the farm.

A firm of general merchants in India (No. 1,760) desires a manufacturer's sales agency for the sale of electrical goods, electric motors, etc.

An engineering company in India (No. 1,810) desires to represent firms for the sale of induction motors, 50-cycle, single-phase, up to 1½ hp., to operate on 230 volts; three-phase squirrel-cage, from 5 hp. to 15 hp. to operate on 400 volts, with starters; three-phase, slip-ring type, from 15 hp. upward, with necessary control; direct-current motors, shunt or compound, with starters and field resistances, for 110, 230 and 400 volts; small motor-driven, single-stage centrifugal pumping sets, directly connected; electrical supplies and heating appliances for 230-volt service.

A request has been received from a merchant in England (No. 1,812) desiring to purchase or secure an agency for small gasoline engines from 3 hp. to 4 hp., capable of generating electricity for small hotels and country residences.

A municipality in Mexico (No. 1,825) is in the market for electric street lamp standards. Approximately 110 will be required.

A merchant in Switzerland (No. 1858) desires to secure an agency from manufacturers only for the sale of electrical novelties, etc.

ELECTRICAL MACHINERY AND SUPPLIES.—Carr & Haynes, Casilla 2769, Santiago, Chile, electrical contractors and dealers, request manufacturers of electrical machinery, appliances, supplies, fixtures, telephones, etc., to supply them with catalogs, price lists and export discounts.

New Apparatus and Publications

RADIO LIGHTNING PROTECTOR.—Schweitzer & Conrad, 4435 Ravenswood Avenue, Chicago, have issued Bulletin No. 501, describing their new radio lightning protector, consisting of the regular high-voltage S. & C. fuse spark gap and a choke coil. Bulletin No. 501-A describes a radio lightning arrester, a smaller type than the protector, which includes a spark gap and the regular S. & C. use.

BEARINGS.—The Kingsbury Machine Works, Philadelphia, is distributing Catalog "C," describing the "Kingsbury" thrust bearings.

INDEX.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a revised index applying to catalog No. 17, issued in 1921, and bulletins.

GENERATOR FOR RADIO OUTFITS.—A new line of high-voltage, direct-current generators and motor-generator sets for use with wireless telephone outfits has been developed by the Robbins & Meyers Company, Springfield Ohio.

LIGHTING PLANTS.—A small lighting and power plant, rated at 1½ kw., driven by a single-cylinder kerosene engine, has been placed on the market by the S. Wylie Merritt Company, 697 West 133d Street, New York City.

DISHWASHER.—The Bucyrus (Ohio) Copper Kettle Works Company has placed on the market an electric dishwasher, "Murdoch," for use in homes, apartments, diet kitchens and small tea rooms.

BATTERY TESTER.—The J-M-P Manufacturing Company, 172 Seventh Street, Milwaukee, has placed on the market a device for testing batteries at high discharge.

RADIO SET.—A crystal-detector radio receiving set has been placed on the market by the Rex Radios, Inc., 36 Spring Street, Newark, N. J.

TIME-SWITCH CLOCK.—A time-switch clock with an eight-day movement has been developed by the American Time Switch Company, Perkins-Power Block, Frankford, Avenue, Cleveland.

FRACTIONAL-HORSEPOWER MOTORS.—A line of small motors ranging in size from ⅛ hp. to ¾ hp. has been brought out by the Leland Electric Company, Dayton, Ohio.

LIGHTING ATTACHMENT.—An atachment for converting vases into portable lamps has been placed on the market by the De-Lite Lamp Company, 80 Boylston Street, Boston.

SOCKETS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing bulletin No. 17-11, covering its electrolier push-button sockets.

INSULATION.—The Fibroc Insulation Company of Valparaiso, Ind., has issued a six-page bulletin which describes its four grades of "Fibroc" insulation.

New Companies

THE MAQUOKETA (IOWA) HYDRO-ELECTRIC COMPANY has been incorporated by A. A. Hurst, W. L. Keck, J. E. Anderson and others. The company is capitalized at $100,000 and proposes to construct a hydro-electric plant.

THE HASKELL (FLA.) LIGHT & POWER COMPANY has been chartered with a capital stock of $15,000. The officers are: James Harris, president; E. Winton Hall, vice-president, and J. L. Gilliam, secretary, all of Lakeland, Fla.

GRAND SALINE (TEX.) LIGHT & POWER COMPANY has been incorporated by T. S. McGrain C. O. and E. L. Dixon. The company is capitalized at $25,000.

THE ELMHURST (PA.) ELECTRIC COMPANY has been organized to furnish lighting and heating service in Elmhurst. The company proposes to secure electricity from the Moscow (Pa.) Electric Company, recently organized. The incorporators are B. J. and Stewart Biesecker, H. C. Finn and C. L. Frantz, Elmhurst; A. M. Sayre, Dr. J. W. Kneedler and F. J. Doherty, Moscow.

THE NAPANOCK (N. Y.) ELECTRIC COMPANY, Inc., has been granted a charter to generate and distribute electricity in Lackawanna, Honk Hill, Montela and Warwarsing. The incorporators are Morris Sutts, Samuel Moll and Jacob Benson, all of Napanock.

Record of Electrical Patents

Notes on United States Patents

(Issued April 18, 1922)

1,412,941. Reversing Switch; Frank Hoffner, Bessemer, Mich. App. filed June 11, 1921. Automatic control of railway motors.

1,412,959. Specific Gravity Control for Electric Circuits; Edward I. Pearson, Toledo, Ohio. App. filed Nov. 10, 1919. Storage-battery charging set automatically controlled by specific gravity of electrolyte.

1,412,972. Starting Magneto; Wolfgang E. Schwarzmann, Springfield, Mass. App. filed Sept. 27, 1918. Hand-operated.

1,412,982. Casing for Telephone Sets; John S. Timmons, New York, N. Y. App. filed May 3, 1919. Waterproof, for outdoor use.

1,412,986. Preparing Manganese-Containing Bodies; Alfred A. Wells, Montclair, N. J. App. filed Oct. 27, 1917. Purifying of depolarizer from used dry batteries.

1,413,001. Construction of Current-Carrying Resistors; Wallace L. Brooks, Schenectady, N. Y. App. filed Nov. 2, 1920. Loop type for making precision measurements.

1,413,027. Automatic Telephone System; Harry H. Ide, La Grange, Ill. App. filed July 29, 1918. Individual line switches connect calling line to idle trunk.

1,413,049. Visual Telegraph Signal; Arthur H. Matthews, Limoilou, Quebec, Can. App. filed May 4, 1918. Same code as telegraph with magnets operating light shutter.

1,413,053. Electrically Heated Branding Die; Albert H. Onstad, Tacoma, Wash. App. filed Jan. 10, 1921. Heated by induction currents.

1,413,057. Electric Iron; Theodore C. Plath, Los Angeles, Cal. App. filed Nov. 8, 1920. Iron heated only while on stand.

1,413,091. Electric System of Power Transmission and Regenerative Braking; Clinton J. Axtell, Schenectady, N. Y. App. filed Feb. 4, 1918. Automatically adjusts braking load with speed change.

1,413,093. Electric Arrestor; Peter Bendmann, Frankfort-on-the-Main, Germany. App. filed April 1, 1921. Magnetically controlled switch for short-circuiting spark gap.

1,413,158. Motor Generator Drive; William Caple, Homestead, Pa. App. filed July 11, 1921. Two motors for driving any or all of four generators.

1,413,202. Timing Device; John M. Torrence, Decatur, Ga. App. filed May 25, 1920. Alarm for kitchen use.

1,413,226. Storage-Battery Cell; Carl F. High, Madison Wis. App. filed Nov. 22, 1920. Leakage prevented by arrangement of two covers.

1,413,239. Overload Protective Device; Edwin W. Seeger, Milwaukee, Wis. App. filed July 24, 1920. Motor relay cut out for starting.

1,413,250. Switch System for Mine Locomotive; William E. Wolfe, Wilder, Va. App. filed April 28, 1920. Trolley and reel gathering system.

1,413,276. Electric Regulation; Walter W. Hunzicker, Lafayette, Ind. App. filed Oct. 6, 1919. Lighting systems for electric cars.

1,413,304. Electric Welding Apparatus; Philip J. Walsh, San Francisco, Cal. App. filed Dec. 6, 1920. Remote switch operated by pressure on handle.

1,413,318. Engine Starter; Alvin E. Buchenberg, Toledo, Ohio. App. filed April 14, 1919. Electromagnet carries movable pinion to engage flywheel.

1,413,322. Electric Immersion Heater; David H. Clark, Orangeburg, N. Y. App. filed July 2, 1921.

1,413,329. Selector; Paul Gnifke, Milwaukee, Wis. App. filed July 16, 1917. Step-by-step selector for telephone.

1,413,357. Electrical Transmission System; Paul A. Raibourn, New York, N. Y. App. filed Dec. 29, 1920. Carrier-current signaling system for central stations.

1,413,368. Machine-Switching Telephone System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Nov. 1919. Circuits for impulse and supervisory relays.

1,413,374. Electromagnet; Charles E. Avery, Trenton, N. J. App. filed July 10, 1917. Armature vibrates in a submultiple of energizing current.

1,413,390. Pressure Variable Resistance; Alexander Churchward, New York, N. Y. App. filed June 24, 1919. Ventilating system for carbon-pile pressure resistances.

1,413,501. Switch-Controlling System; Franklin A. Stearn, Paterson, N. J. App. filed Dec. 16, 1919. Machine-switching telephone apparatus.

1,413,544. Controller for Alternating-Current Motors; Arthur Simon, Milwaukee, Wis. App. filed Dec. 26, 1919. Eliminates phase distortion on open-delta transformer loads.

(Issued April 25, 1922)

15,341 (reissue). Automatic Telephone Exchange System; Edward B. Craft, Hackensack, N. J. App. filed April 7, 1919. Automatic switch for trunk finder.

1,413,639. Switching Device; Lee R. Waller, Westmount, Quebec, Canada. App. filed Nov. 13, 1920. Step-by-step, for telephone systems.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Boston Elevated Railway Company will soon begin work on the superstructure for the addition to its power plant on First Street, cost about $900,000.

LOWELL, MASS.—Extensions to the ornamental street-lighting system on East Merrimack and Gorham Streets are under consideration.

NEW HAVEN, CONN.—A permit has been granted to the United Illuminating Company for the erection of a transformer station at 117 Tryon Street, to cost about $7,000.

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Middle Atlantic States

ARKPORT, N. Y.—The Public Service Commission has granted the village of Arkport permission to construct and operate an electric light and power system. Electricity for operating the proposed system will be obtained from the Hornel (N. Y.) Electric Company.

BROOKLYN, N. Y.—The Brooklyn Edison Company has awarded a general contract to Thomas Drysdale, 250 Baltic Street, for the erection of its new power plant at the foot of Sixty-sixth Street, to cost about $1,200,000.

DUNKIRK, N. Y.—A special election will be held May 24 to vote on the proposal to issue $1,400,000 in bonds for a municipal hydro-electric plant.

EAST AURORA, N. Y.—The East Aurora Electric Light Company will change its entire system this year to 25 cycles, three phase, for lighting and power service. A 12-mile, 22,000-volt transmission line is being erected to furnish electricity to maintain this system. A. R. Tremaine, Lancaster, is manager.

MEDINA, N. Y.—S. A. Cook & Company will construct a new power house at their furniture factory.

NEW YORK, N. Y.—A new power plant will be installed in connection with a seven-story building to be erected at the Teachers' College at 120th Street and Broadway, to cost about $1,500,000.

NEW YORK, N. Y.—The New York Edison Company will build a substation at 38 Bowery, to cost about $30,000.

NEW YORK, N. Y.—The International Paper Company, 80 Broad Street, has preliminary plans under way for the construction of a series of hydro-electric plants in the vicinity of Sherman Island and other points in northern New York and has acquired power sites capable of devoloping 40,000 hp. The plans include transmission and distributing lines for general commercial service. The initial plant of 20,000 hp. capacity will be located on Sherman Island.

CAMDEN, N. J.—Electric motors, switchboard and other electrical apparatus will be installed in the new four-story printing plant to be erected at Eighteenth and Federal Streets by the Haddon Press Corporation, affiliated with Harper & Brothers, Franklin Square, New York, to cost $250,000, including equipment.

CHATHAM, N. J.—The Commonwealth Electric Company, Summit, will extend its lines in Chatham Township to furnish service in territory which has heretofore been supplied by the Chatham municipal power plant.

JERSEY CITY, N. J.—The Public Service Electric Company, Newark, contemplates building an addition to its power station at Jersey City, to cost about $150,000. N. A. Carle is engineer.

NEWARK, N. J. — The Public Service Electric Company will construct new transmission lines from its Essex and Marion power plants to a point in Jersey City for service in connection with the construction of the new vehicular tunnel under the Hudson River, where a substation will be erected. The company has contracted to furnish the entire power supply in connection with the work.

RUTHERFORD, N. J.—The Council will install a new lighting system on Paterson Avenue. It is also proposed to install a new system in the East Rutherford business district.

CANADENSIS, PA. — The New Spruce Cabin Inn is having plans prepared for an electric power plant in connection with a new hotel. George W. Backoff, 49 Park Place, Newark, N. J., is engineer.

CHAMBERSBURG, PA.—Bids will be received by the Borough Council until May 15 for the construction of a municipal power plant, to cost about $150,000. Albert C. Wood, Stock Exchange Building, Philadelphia, is engineer.

FARRELL, PA.—The Shenango Valley Electric Light Company, Sharon, is planning to install an ornamental street-lighting system in Farrell, consisting of 103 standards, mounted with lamps of 400 cp., to be owned by the borough, for which the company will supply electricity. The company is also installing a new incandescent street-lighting system here, consisting of 263 lamps, of which fifty-eight will be of 250 cp. and the remainder of 100 cp. M. Pendleton, Sharon, is superintendent.

HEMPFIELD, PA.—Earl R. Myers has been granted a franchise to install a power plant and system for service in a portion of East Hempfield township.

JOHNSTOWN, PA. — The Penn Public Service Corporation has issued $4,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEW WINDSOR, MD.—The Council has taken over the property of the New Windsor Electric & Water Company to be operated by the municipality. Extensions and improvements will be made.

FAIRMONT, W. VA. — The West Penn Traction & Water Power Company, Pittsburgh, is negotiating for the purchase of the property of the Monongahela Power & Railway Company. If acquired, a transmission line will be erected to connect the two systems, and extensions and improvements made in the plant and lines of the Monongahela company.

IAEGER, W. VA.—The Pocahontas Red Ash Coal Corporation, recently organized, is planning to erect a power plant at its local properties and the installation of electric mining machinery. James G. Magowan is president.

RICHMOND, VA.—A new lighting system will be installed on Main Street from Eighteenth Street to Monroe Park, for which the sum of $28,000 has been appropriated.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer of the United States Army until May 25 for sixteen storage batteries (Circular PR 11094-1 CP), also, until May 27 for 30,000 SC type DA-10 batteries (Circular 10010-A-205 CP), and, until May 19 for 38,000 ft. cable and reels (Circular 10701-1 CP).

North Central States

ADA, OHIO.—A new steam-heating and power-plant and water system will be installed at the Ohio Northern University. The building will also house the machine shop, electrical and mechanical laboratories. Further information may be obtained by addressing C. R. Alden, Ohio Northern University.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until May 19 for paper-insulated, lead-covered cable. Bids will also be received at the same time and place for ornamental lamp standards.

COLUMBUS, OHIO.—Bids will be received by the Department of Public Welfare, Administration Building, until May 25 for the following: Engine and generating unit, boilers and stokers, for the Cleveland State Hospital; engine and generating unit, boiler and stoker, for the Institution for Feeble-Minded, Orient; generating unit, Ohio Penitentiary, Columbus; boilers and stokers, Ohio State Reformatory, Mansfield; boilers and stokers, Ohio Soldiers' & Sailors' Home, Sandusky; engine and equipment, Hospital for Epileptics, Gallipolis, and boilers, stokers, etc., for the Toledo State Hospital.

SALEM, OHIO.—The Salem Lighting Company contemplates improvements to its distribution system and the erection of a rural 2,300-volt distribution line along the high-tension line. R. Z. Zimmerman is general superintendent.

SPRINGFIELD, KY.—The power house of the Springfield & Campbellsville Utilities Company was recently destroyed by fire, causing a loss of about $100,000.

ATTICA, IND.—Improvements are being made to the municipal electric light and water plant, including the installation of a 1,000-kw. General Electric turbo-generator with condenser and switchboard equipment. B. H. Freeland is general superintendent.

HAMMOND, IND.—The Northern Indiana Gas & Electric Company has issued $7,000,000 in bonds, part of the proceeds to be used for extensions and improvements. C. H. Geist is president.

CHICAGO, ILL.—The Sanitary District of Chicago, 910 South Michigan Avenue, is preparing plans for a new hydro-electric plant, to cost about $3,000,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

MARENGO, ILL.—The Elgin & Belvidere Electric Railway Company will build a power plant, 50 ft. x 105 ft., to cost about $50,000.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company has acquired the property of the Ironwood & Bessemer Railway & Light Company, Ironwood, Mich. Extensions and improvements are contemplated, including a new hydro-electric generating plant, to cost about $1,600,000.

AUSTIN, MINN.—George A. Hermel & Company are planning to erect a two-story power house and a refrigerating and cold-storage plant. Henry I. Church is engineer.

JEFFERSON, IOWA.—The Jefferson Electric Company is installing two 300-hp. water-tube boilers, to replace present boilers, and one 500-hp. engine. Percy Gray is secretary.

LAKE CITY, IOWA.—A new company, it is reported, will be organized to construct and operate an electric plant in Lake City. H. B. Yetter is interested in the project.

MAQUOKETA, IOWA.—Bonds to the amount of $70,000 have been voted for extensions to the municipal electric light plant. The new unit will furnish electricity for lighting the residential part of the city. The present plant furnishes service in the business section.

MAQUOKETA, IOWA.—The Iowa Electric Company, Cedar Rapids, is completing plans for the construction of a hydro-electric plant on the South Fork of the Maquoketa River, to cost about $175,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

LIBERTY, MO.—Bids will be received by the City Clerk until May 17 for two motor-driven centrifugal pumps, with switchboard, starters, etc., complete, for the waterworks system. W. E. Barnes is engineer.

LENNOX, S. D.—The local electric light plant, owned by H. B. McFarland, was recently destroyed by fire. The Northern States Power Company, Sioux Falls, it is reported, is making arrangements to furnish permanent service in Lennox.

BEAVER CITY, NEB.—The municipal electric light plant was recently destroyed by fire.

CLAY CENTER, KAN.—The Republican River Power Company contemplates the construction of a hydro-electric power plant at its present dam on the Republican River, to cost about $150,000.

Southern States

BELHAVEN, N. C.—The Council is considering plans for doubling the output of the municipal electric light plant. William C. Olson, Kinston, is consulting engineer.

DONATION, N. C.—The National Soapstone Company, First National Bank Building, Roanoke, Va., plans to erect a power house at its local works. George W Hutchinson, Express Building, Roanoke, is engineer.

LENOIR, N. C.—A hydro-electric development on Wilson's Creek, near Lenoir, to cost about $100,000, is contemplated by Kistler & Milner, Morgantown.

QUINCY, FLA.—At an election to be held May 16 the proposal to issue $98,000 in bonds for improvements to the municipal electric light, water and sewer systems will be submitted to the voters.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company contemplates extensions to its electric plant and system, to cost about $150,000.

EVERGREEN, ALA.—Bids will be received by the City Council until June 1 for electrical equipment for the proposed municipal power plant. W. W. Hill, Auburn, is consulting engineer.

MOBILE, ALA.—The Mobile Electric Company is planning to install a new street-lighting system.

BATESVILLE, MISS.—Bonds to the amount of $25,000 have been voted for the installation of a municipal electric plant.

BOONEVILLE, MISS.—The Light, Water & Ice Company may possibly install a series street-lighting system. Further information may be obtained from C. W. Bolton.

LAFAYETTE, LA.—Extensions are contemplated to the municipal light plant to increase the output to 500 kw., to cost about $100,000. A Diesel engine and generator will be installed.

FAIRLAND, OKLA.—Bonds to the amount of $21,500 have been voted for the installation of an electric distributing system. H. G. Olmstead & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

OKEENE, OKLA.—Bonds to the amount of $45,000 have been voted for extensions and improvements to the municipal power plant. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CELINA, TEX.—The Council has authorized estimates of cost made for a municipal electric plant. Montgomery & Ward, Wichita Falls, are engineers.

LIVINGSTON, TEX.—The Council is having revised plans prepared for the installation of a municipal electric light and power system and will call for new bids at an early date. E. E. Sands, Houston, is consulting engineer.

SAN ANTONIO, TEX.—The San Antonio Public Service Company has awarded contract for a 15,625-kva. turbo-generator for its station "B" power plant and two 500-hp. boilers. E. H. Kifer is vice-president and general manager.

Pacific and Mountain States

LANGLEY, WASH.—The Langley Light & Power Company is planning to install a boiler (already purchased), a 40-hp. steam engine and a 30-kva. alternator and to make some line extensions. Philip Simon is president and manager.

OLYMPIA, WASH.—A petition has been presented to the City Council by business men asking for the installation of a new ornamental lighting system in the business section of the city, to cost about $14,000.

TACOMA, WASH.—The City Council has passed an ordinance authorizing the Mayor to enter into a contract with the Consumers' Central Heating Company for the purchase of steam to generate electricity required for the city over and above the capacity of the municipal plant at Nisqually.

ALBANY, ORE.—The Mountain States Power Company contemplates the erection of a 60,000-volt transmission line to connect its local plant with the power station at Dallas to provide an alternate supply for the city.

PORTLAND, ORE.—The Federal Power Commission has granted the Portland Railway, Light & Power Company permission to appropriate water from the Oak Grove and Three Links branches of the Clackamas River to develop about 40,000 hp. The plans provide for an ultimate development of 100,000 hp., to cost about $10,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has been granted permission by the State Water Commission to construct a hydro-electric plant on Deer Creek, Fresno County, with initial capacity of 8,800 hp., to cost about $1,200,000.

FULLERTON, CAL.—Bids will be received by the City Trustees until May 23 for the installation of an ornamental street-lighting system, comprising 156 standards. Benjamin F. Dupuy is city engineer.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until May 19 for a synchronous-condenser installation. (Specification No. P-261.) James P. Vroman is secretary.

OAKLAND, CAL.—Plans are being prepared for an ornamental street-lighting system on San Pablo and Telegraph Avenues and Broadway, combined trolley and lamp poles to be used, each mounted with two 1,500-cp. lamps. D'Arcy Ryan is engineer.

SAN FRANCISCO, CAL.—The Great Western Power Company has issued $2,000,000 in bonds, part of the proceeds to be used for a hydro-electric plant and for extensions and improvements.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has made application to the State Water Commission for permission to use sites and water power as follows for proposed hydro-electric plants: Clear Creek, Butte County, to develop 4,781 hp., to cost about $254,000; Fordyce Creek, Butte County, 17,035 hp., $745,000; Deer Creek, Alpine County, 15,945 hp., $357,000, and North Fork of Feather River, Butte County, 3,586 hp., $182,000.

STOCKTON, CAL.—The Western States Gas & Electric Company has been granted permission by the State Water Commission to construct a hydro-electric plant on the South Fork of the American River, Eldorado County, to develop 61,200 hp., to cost about $2,500,000.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has issued bonds for $5,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company contemplates extensions and improvements, to cost including equipment, about $150,000.

HARDIN, MONT.—The Federal Power Commission has granted the Big Horn Canyon Irrigation & Power Company, Hardin, a preliminary permit for a power plant at the mouth of Big Horn Canyon, 42 miles from Hardin.

BASIN, WYO.—A special election has been called to vote $60,000 in bonds for improvements to the municipal electric plant and waterworks station.

SHOSHONI, WYO.—The Wyoming Power Company has been granted permission by the Federal Power Commission to construct a hydro-electric plant at Boyseh Dam on the Big Horn River, Wyo.

CASTLE ROCK, COL.—Plans for the construction of a municipal electric light plant are under consideration by the City Council.

Canada

CLOVERDALE, B. C.—Plans are being prepared by J. O'Hara, municipal engineer, for a street-lighting system for Cloverdale.

NELSON, B. C.—The East Kootenay Power Company, Ltd., has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements, including a hydro-electric development on the Elk River, Kootenay Mining district.

VANCOUVER, B. C.—The Granby Consolidated Mining, Smelting & Power Company is planning to build a hydro-electric plant at its properties at Anyox, to cost about $400,000, including machinery.

ST. JOHN, N. B.—Contract has been awarded by the New Brunswick Hydro-Electric Commission for the erection of an electric transmission line, to supply energy to the city of St. John, to the Canadian Bridge Company, Ltd., Walkerville, Ont. Surveys for the proposed line have been completed to Moncton.

Electrical World

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What Will You Do with It?

WHAT will you do with the convention? Here is an investment in education, a presentation of experience, a free offering of opportunity organized by the National Electric Light Association and provided through the generous effort of many workers. It is a contribution of practical worth to every electrical man.

What will you do with it? These committee reports, the records of the discussion, your memoranda of what you heard and saw at Atlantic City, the definite suggestions and advice which it all conveyed are tools to work with, knowledge to plan with, inspiration and example to spur you on. Shall it be actively applied and purposely utilized or shall it be forgotten?

SELF-EDUCATION and employee education are one of the great problems of the utility executive today—be he the chief or the department head. Conditions, methods, objectives change more rapidly than ever before in the world's history. Technical training, the lessons of early experience, the laws and customs of the craft are more and more becoming background resources. To serve well, a man must be alive to the fast unfolding evolution of the industry and think with its leading minds.

To increase the efficiency of an organization staff through the broadening influence of education large sums of money are spent each year even by companies of moderate size. For our larger institutions the annual appropriation runs into a vast total. What does this money bring? Not book learning only—rather the quickening, steadying impulse that comes from contact with other men and other minds, from observation and knowledge of contemporary problems and how they are met.

The pressing need of these great modern business and engineering enterprises is for bigger, broader, better-thinking men. The great product of education within the organization comes through the disclosure to the observant executive of promising material for future leaders and its development from within.

THE only way in which this kind of education by contact and contemporary knowledge can be acquired by the central-station man is by direct travel to other plants, or the more practical medium of the annual gathering of the N.E.L.A., its meetings, its acquaintanceship, its conferences, its chance conversations and its printed records and reports. All cannot attend, but all can gain the material yield of the year's association activity.

The question is: Will you take the product of this convention seriously and utilize it as the great opportunity which in truth it is? Will you read these pages of contributed experience just from a sense of interest and duty or will you search for ideas and use them?

William Henry Atkins

Pioneer central-station executive, whose technical insight and business ability have benefited the industry for a generation.

IT IS the splendid distinction of the electrical industry that it is still young enough to enjoy the ardently active services of many able leaders who have contributed to its upbuilding from small beginnings. These men, with a vision strengthened by experience, controlled by matured judgment and directed by indomitable faith in the future of electrical service, take a keen personal pleasure in their work. Without blowing of personal trumpets they quietly go straight to the point of their problems, keep in phase with progress, inspire their subordinates to responsible achievement, and attain success over and over again by their openness of mind and practical understanding.

One of these responsible leaders among electrical men is William H. Atkins, for almost thirty-five years general superintendent of the Edison Electric Illuminating Company of Boston. Mr. Atkins was born at Waterville, Me., March 29, 1859, and after attending school in Maine and at Boston, resided in Portsmouth, N. H., until 1884, when he was seized with the desire to learn the electrical business. Moving to Brockton, Mass., he at once obtained a position with the New England Wiring Company, reporting for duty with a hammer, screwdriver and pair of pincers to help other recruits wire a local fire-engine house. He continued in the wiring field in various parts of New England until Dec. 1, 1887, when he was appointed an inspector for the Boston Edison company. His wiring jobs had included many pioneer installations, in some of which Mr. Edison was directly concerned and which were the first of their kind connected to the Boston system.

So energetic and thorough was Mr. Atkins' work from the first that he was soon made acting superintendent and shortly afterward general superintendent. In close association with C. L. Edgar, president of the company, Mr. Atkins' constructive influence, courage and alertness have been powerful factors in the development of the Boston company from a small urban central station to a metropolitan system serving over 600 square miles in eastern Massachusetts, supplying nearly 150,000 customers and operating about 175,000 kw. in generating equipment besides important interconnections. Every branch of the company's commercial and engineering operation is under his supervision. Courtesy and good will are his watchwords.

Mr. Atkins is a member of the Edison Pioneers and treasurer of the Association of Edison Illuminating Companies. He was a member of the executive committee of the National Electric Light Association from 1918 to 1922 and its treasurer from 1915 to 1919.

Editorial Comment

Electrical World, May 20, 1922

Volume 79 Number 20

Progress, Co-operation and Optimism Mark N. E. L. A. Convention

A LARGER-MINDED, more healthy, more ambitious National Electric Light Association was in convention at Atlantic City this week. It is only natural that consistent work should make each year show advance, and each convention should be better than all the others when looked at from that angle. But it can be truthfully and fairly said that this convention did mark some exceptional progress, as should be apparent from the complete report of all sessions presented in this issue.

The industry is back of the "better business" movement with a unanimous voice. Central-station companies know that they should now, and can now, do something to develop business, and the co-operation between central-station companies and the other branches of the industry in this movement shows that when a job is to be done the electrical industry can handle its own problems and do the job. The "Electrify America" movement is under way with a swing.

Another accomplishment which deserves sincere and hearty commendation is the concrete progress—and agreement—reached in co-operation with the telephone interests on the induction-interference problem. At Atlantic City this week this accomplishment was strikingly emphasized by the large number of telephone men in attendance and by the dramatic demonstration by the American Telephone & Telegraph Company which made possible a half hour of simultaneous meeting with the Pacific Coast association on Thursday evening. This is another evidence that the electrical industry can solve its own problems without outside compulsion or aid.

Deeper down, or perhaps merely more analytically, this industry has shown at this convention that it is closer to its work, that it is in more intimate contact with its problems of whatsoever nature they may be—finance, public relations, management, engineering, operating, accounting and, perhaps more than anything else, commercial. This is a most healthy sign and augurs well for continued solid progress.

Better Fixed-Capital Records Are Needed

CLOSE observers of utility affairs before state commissions have realized for a long time that better records of fixed capital would expedite procedure, help convince the regulating tribunal as to the reality of the investment claimed, and aid the utilities themselves in estimating the costs of projected work. Therefore it is a pleasure to call attention to the exceptionally fine treatment of this subject given in the report of the fixed-capital records committee this week at the N. E. L. A. convention. At present too many companies are working with very unsatisfactory data as to fixed capital. Information satisfactory to one department does not meet the needs of another; vital statistics as to property costs and physical data are either lacking or scattered, and there is a bad gap between book values and investment costs. In the report above mentioned the whole subject is co-ordinated with rare skill, the results of practice in a few exceptionally progressive cases are set forth and the groundwork is laid for a much broader detailed application of fixed-capital analysis than the industry has been accustomed to in general. We commend the study of this report to all executives concerned with utility finance and regulatory affairs.

Real Progress on Problem of Inductive Interference

THE adoption of a code of principles governing the handling of inductive-interference problems is the encouraging announcement made at the session of the inductive-interference committee at the Atlantic City convention. Naturally the joint general committee has not been able to arrive at an agreement that will suit everybody in every particular or that can be said to be final. Such an ideal is never reached in human affairs. The significant fact is that the committee has reached a unanimous agreement that is not only workable but the best real foundation for the work ever proposed. On it can be built a structure that will keep pace with the industry as it grows. Back of it is a story of honest effort at co-operation and attempts to reach a complete and thorough understanding that is far bigger than the code of principles and cannot be put into words. Only those who were at the meetings or who participated in the committee work can begin to appreciate this.

It is now incumbent on the central-station organizations of the country to back the work of the joint committee and put the code of principles into practice in the same spirit of honesty and fair play that led the engineers responsible for the work to make public interest paramount. Without this support the work of the men who have given their time unsparingly will be lost. The industry cannot afford such a loss.

Possibility of Avoiding Parallel Sessions Needs Reconsideration

THIS year's experience at the National Electric Light Association convention seems to indicate more than ever the need of finding some plan of arranging the program so that members can get the most out of the convention papers and discussions. So many parallel sessions of general interest are conducted that members find it bewildering trying to decide which session they shall attend. Aside from making it difficult for members to attend the sessions they desire, the present method of procedure has the objection that it draws attendance away from some sessions, which thereby suffer from insufficient discussion.

One suggestion which embodies the nucleus of a solution deserves careful consideration. It is that simultaneous committee reports be presented in the various geographical sections at regular intervals throughout the year and that the national committee chairmen present the high points of these periodic reports and discussions in general session before the entire membership at the national convention.

This plan would have the additional advantage of reducing the time lag in presenting information. At present the membership has to wait until the end of the association year for reports from the committees. The proposed plan would enable the presentation of information as it becomes available. At the end of the year it could be compiled and presented in the usual form.

Whether this method or some other will solve the problem remains to be seen. However, the situation deserves the earnest consideration of every one, and especially of a committee of the N. E. L. A., which should be appointed at once.

Development of Small Water Powers

DESPITE the handwriting on the wall bearing menace of shortening coal supply and rising costs, comparatively little is being done toward full utilization of our water powers. In particular, the small streams that do not promise the founding of a big enterprise very generally run to waste. We in this country are somewhat contemptuous of small things, even of small gains, and consequently are not prone to bother with falls that promise at most a few hundred horsepower. Abroad, on the other hand—in France, for instance—they would be promptly set to work in the common interest. In that country there are scores, if not hundreds, of such small developments, each one helping to save the hard-won and costly coal. The little rivers we have in mind commonly have no considerable fall at any one convenient place, but may have fifty or a hundred feet drop in a mile or two, often with facilities for cheap storage to a moderate amount. Their development involves foresight and special methods, perfectly well known but too rarely used.

There is, in particular, often excellent opportunity for the installation of automatic stations with asynchronous generators controlled very simply from the main point of load distribution. There should be one control station with attendance, perhaps not the largest of the group, with automatic auxiliaries along the stream at the other available falls. Our total drop of a hundred feet may be then actually developed in three or four units, with storage preferably at one of the upper falls. The several stations can be used just like the generators in a single station, each being cut in when needed. In fact, with upstream storage, the generators would be cut in in succession as the peak came on and taken off with the diminishing load. The real problem for consideration is the relative cost of the separate installations as compared with hydraulic unification in its bearing on overhead expense, the operating expense being almost the same.

With widely separated stations unification is almost out of the question, and it becomes entirely so in the not unusual cases where the powers are on neighboring streams. A beginning has been made in this line of work, but if full benefit is to be obtained from the co-ordinated operation of falls giving only a hundred horsepower or less, complete advantage must be taken of automatic operation. How far the scheme can be advantageously worked out in supplying feeders for larger networks remains to be seen, but there are plenty of cases where at low stages of the main supply a few hundred kilowatts from other sources would be most advantageous. We should welcome reports from stations thus aggregated, for knowledge of successful operation would be of great benefit in the conservation of the water supply that on small streams as on large is now going to waste.

Engineering Education—Can It Include Business Education?

EDUCATION for the profession of engineering has been a constant topic of discussion for many years. Both educators and the employers of engineering graduates have taken active part. There has been little difference of opinion as to the desirable qualities and abilities of the young engineer, but a great deal as to how these qualities and abilities may be imparted during the period of formal training. On the side of the employer complaint is made that the product of the colleges is usually wanting in such things as power of expression, initiative, independence of thought, readiness to accept responsibility, and in the scientific and technical equipment pertaining to his special branch of engineering. This criticism has often been accompanied by suggestions of new courses for inclusion in the curricula of engineering colleges and the adoption of methods which would stimulate the development of the qualities usually found to be lacking.

The second public conference on commercial engineering held at the Carnegie Institute of Technology the last week in April, called by the United States Commissioner of Education, is probably the greatest single effort that has yet been made toward reaching definite conclusions on this interesting and important topic. The conference was largely attended, delegates were drawn from every branch of industry and from the principal schools of engineering of the country, a number of important papers were presented, and there was much individual comment and discussion. Viewpoints and suggestions of industry, as outlined above, were renewed, special emphasis being laid upon the need of industry that young engineers should have had training in business, financial and commercial branches of study. Data were presented showing the extent to which these courses are already included in our principal schools, and several instances of new curricula in "commercial engineering" were described.

On the other hand, there was a decided evidence that educators as a whole are skeptical as to the value of the inclusion of business courses in the normal four-year undergraduate curriculum. Briefly stated, the reply of the teachers of engineering is that instruction in the fundamental scientific studies is on all accounts the most important problem in engineering education, that the four years' course is all too short for giving these fundamental studies and the beginnings of engineering specialization, that the present content of general and cultural studies is about the maximum that can be tolerated, and that the graduate of the present standard course is really better qualified for learning the mechanism of business in engineering industry than he would be if his technical training were curtailed in the interest of instruction in modern business methods.

There remains, notwithstanding these contentions, the pressure of business competition and the demand for young material as nearly as possible fitted for entering into efficient participation in industry. From this point of view it is natural that industry should lose sight of the importance to men supposed to have technical training of instruction in the foundations of that training, which are to be found only in the underlying sciences. For the most part, industry has seen only the present problem of efficient increase in production, rather than the building of a structure which can meet readily the technical problems involved in the expansion of industry through the introduction of new methods. Furthermore, as seen by the educators, the methods of business and commerce vary widely in different fields of industry and may be acquired perhaps to best advantage by experience within the industries themselves and after leaving college, while, on the other hand, college is the only place where sound training in the technical principles of the profession may be satisfactorily given.

The question is one which reaches to the very roots of the engineering profession and industry. While the conference at Pittsburgh cannot be said to have reached any definite conclusion, it nevertheless had this outstanding feature, that it threw great light on the problems of the educators on the one hand and those who use the products of education on the other. Undoubtedly young men entering industry may be better equipped than they are at present. It cannot be said, however, that this added equipment can be attempted with profit in our present standard four years' course in engineering. Therefore such additional training, if it must be given in the college, can only be had at the expense of a longer period of formal training. After all, this is only a natural result. A good engineer is not necessarily a good business man, and vice versa. A man may perhaps be both, but he cannot expect to be unless he devotes the proper period of training to each great field.

Detailed Analysis of Service Outages Essential to Greater Reliability

COMPILATION of data on service outages of power-plant equipment is highly commendable, but it is of little avail unless it is followed to a conclusion as to why the interruptions occurred. An excellent suggestion along this line was made at the prime-movers session of the Technical Section of the National Electric Light Association at Atlantic City this week, one which should be seriously considered and observed by users of turbo-generators at large. It was that very complete and detailed records be kept of the *causes* of service outages, so that operators and manufacturers may get together on some definite basis for eliminating them. As E. H. Sniffen of the Westinghouse Electric & Manufacturing Company pointed out, the outages which have occurred are not due solely to weaknesses in design. In some cases proper care has not been exercised in the erection and operation of the equipment. If the operators and manufacturers will jointly study the reasons for outages, they will be able to make these most important adjuncts of electric service systems more nearly 100 per cent reliable.

The same suggestions can be applied to advantage in connection with all apparatus in which operators are concerned. Economy of performance is very important, but its usefulness is small if service equipment representing a large investment is forced to lie idle because of the failure of one piece of apparatus in the chain. Reliability is the chief consideration in electric service apparatus, and it can be greatly increased by detailed analysis of the causes of outage and by co-operation between operators and manufacturers.

New Light on the Atom

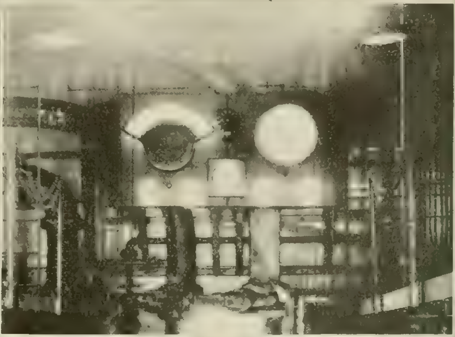
TO A PERSON who has not followed the electron theory the suggestion that the atoms of all substances are made up of the same constituents, namely, electric charges, may seem quite incomprehensible. As early as 1815 Prout ventured the belief that the atomic weights of the different elements were whole numbers and, that of hydrogen being one, all the elements were aggregates of the atoms of hydrogen. Since his time many facts have appeared in support of this idea, and it now appears that we are on the verge of a conclusive proof as to its accuracy. When we come to the results of experimental research by Soddy, J. J. Thomson, Rutherford, Langmuir and others, we find the whole field opening up into a mass of evidence which cannot be questioned. Perhaps the most striking results in this field are the identity of electric particles which may be obtained from all substances, the fact that the atomic weight of radioactive lead varies according to its origin, and the obtaining of hydrogen from nitrogen.

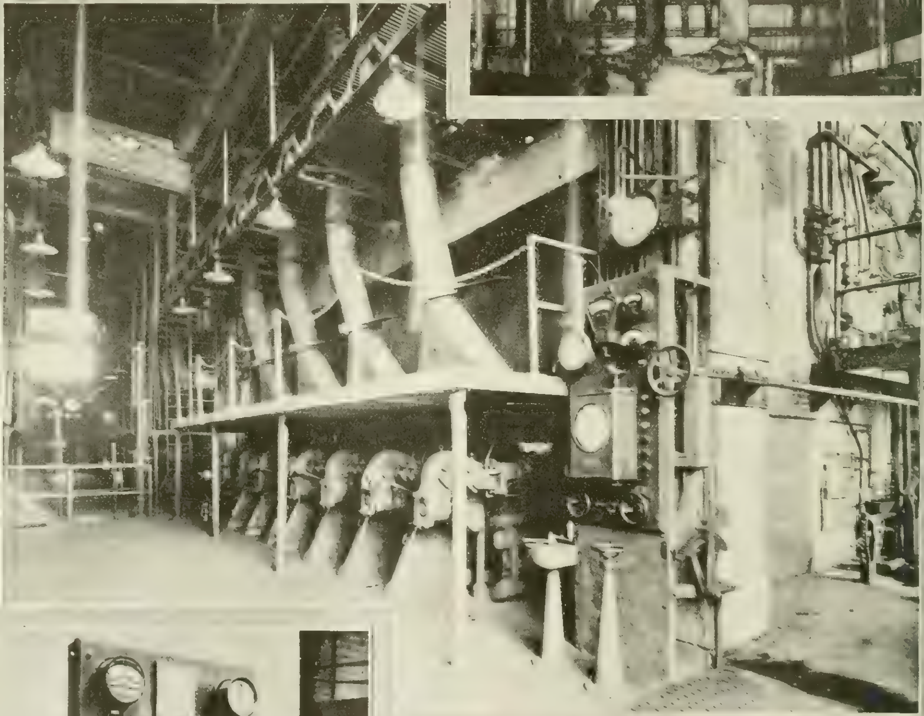
One of the greatest difficulties in the further substantiation of this theory of a common nature for all the elements has been the fact that the atomic weights of some of them do not appear as whole numbers, as would be required if all were made up, say, of the fundamental hydrogen. Now even this difficulty is disappearing with a further study of the elements which occur in two or more forms all having identical chemical properties but different atomic weights. Such pairs or groups of elements are known as isotopes.

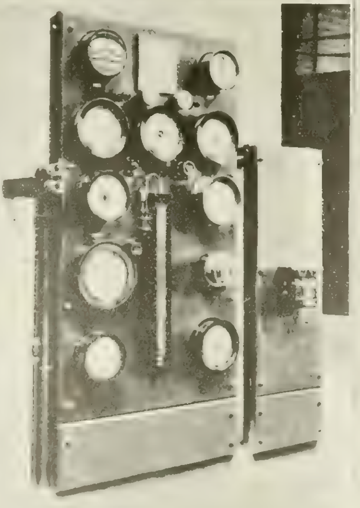
The gradual accumulation of evidence now indicates that the nucleus of the atom of any element consists of a number of free positive charges or protons, the nucleus of hydrogen having one, and the nuclei of other elements having numbers equal to the corresponding atomic number of the element. Electrons in number equal to the number of protons in the nucleus surround the nucleus in some definite arrangement. The electrons determine the chemical properties of the substance. Since they are much lighter than the protons, the latter determine the atomic weights. The atom of an isotope has associated with it in some way additional hydrogen atoms, which do not, however, upset the equilibrium adjustment between the protons of the nucleus and the surrounding electrons. In this way the atomic weight of isotopes may vary without showing a corresponding variation in chemical properties.

Great light has recently been thrown on the fractional values of atomic weights of certain substances by the brilliant work of F. W. Aston, working with J. J. Thomson's method of positive-ray analysis. He has shown that a large proportion of the elements showing fractional atomic weights are merely mixtures of isotopes of the same element and that the mass of each of these component isotopes is invariably a whole number. This removes one of the greatest difficulties and proves practically beyond question that the atoms of all the elements are made up of the protons and electrons.

Centralization of Instruments and Control an Aid to Greater Economy







THE present tendency toward the more extensive use of instruments that will make possible observation of mechanical operating conditions and toward the centralization of these instruments and control apparatus is highly commendable and ought to become still stronger. Equipment carrying high-economy guarantees will not alone assure the best plant economy. Means must be had to facilitate the observation of the conditions under which the apparatus is operating and to adjust these conditions if they depart too widely from those under which the apparatus is designed to give its best performance. Instruments and control apparatus should be centrally located where they may be used in conjunction with one another. Methods to this end used in plants of progressive companies include the individual boiler instrument and control panels, the centralized boiler-room meter and control board, the turbine and auxiliary panelboard and the heat-balance board for boiler room and turbine room combined.

Business Revival Dominates the N. E. L. A. Convention

Returning Prosperity Heartens the Electrical Industry Inter-Association Understanding Growing Closer Public Relations Becoming More Intimate —Mastery of Technical and Commercial Problems Constantly Advancing

THE returning tide of better business flooded the forty-fifth convention of the National Electric Light Association with optimism this week at Atlantic City, when delegates and guests from every corner of the United States met to discuss anew the far-reaching problems of the central-station industry. For the first time in the long and brilliant history of the great organization, a business-development symposium occupied a place of honor on the crowded program, and for the first time definite fundamental suggestions were advanced for the resolution of the difficult issues of inductive interference into a simpler form making possible their ultimate suppression as inter-utility problems bearing within themselves the seeds of discord. New also to the industry was the spirit of closer friendship and team play evident at the convention between its component branches, and the signs of engineering and commercial progress, of improved conceptions of responsibility in public service, of greater precision and larger ideas in accounting, and, best of all, the evidence of a true gain in public relations and a sincere and determined policy of making real friends with the public, justified the conviction that golden years of service and development are ahead.

On Friday morning a telephonic message was received from Secretary of Commerce Hoover, who regretted his inability to be present at the convention and expressed his firm belief in wide interconnection of electrical lines and the establishment of superpower systems. Mr. Hoover said that he was detained in Washington because of the urgency of the coal situation, and he felt that he had served the electrical industry better there than he would have served it had he attended the meeting.

Election of Officers

The following officers were nominated and elected at the concluding general and executive session on Friday morning:

President, Frank W. Smith, United Electric Light & Power Company, New York.

First vice-president, Walter H. Johnson, Philadelphia Electric Company, Philadelphia.

Second vice-president, Franklin T. Griffith, Portland Railway, Light & Power Company, Portland, Ore.

Third vice-president, J. E. Davidson, Nebraska Power Company, Omaha.

Fourth vice-president, R. F. Pack, Northern States Power Company, Minneapolis.

Treasurer, Walter Neumuller, New York Edison Company, New York.

These additions to the executive committee as members at large were made: T. A. Kenney, Consumers' Power Company, Jackson, Mich.; P. S. Arkwright, Georgia Railway & Power Company, Atlanta, and H. C. Abell, Electric Bond & Share Company, New York W. E. Robertson of the Robertson-Cataract Electric Company, Buffalo, was re-elected as a representative of the Electric Supply Jobbers' Association, and James R. Strong, president of the National Association of Electrical Contractors and Dealers, was elected to represent the contractor-dealers of the country, provision having been made in the by-laws for that purpose. During the morning session Mr. Strong made a short address on the "better business" movement.

Frank W. Smith, the retiring first vice-president, who now assumes the presidency of the association, was born in Alden, N. Y., June 22, 1867. From the time he was thirteen he has been continuously in the service of the United Electric Light & Power Company of New York. His first big advancement was to general clerk and then to paymaster. In 1891 he was made assistant auditor and eight years later he was elected assistant secretary of the company. In 1905 he became secretary and eleven years later was elected to the combined office of vice-president and general manager.

During Mr. Smith's administration of the affairs of the United Electric Light & Power Company he has built the great Sherman Creek generating station, supplying energy to the upper part of New York City, as well as a number of substations and a modern service building, but perhaps his finest achievement is the new Hell Gate Station on the East River, recently described in detail in the ELECTRICAL WORLD. He has been an active advocate of the electric vehicle and took a prominent part in reorganizing the N. E. L. A. along broader lines of activity. For a number of years he has headed the association's lamp committee, the annual report of which is a comprehensive chronicle of vital facts relating to electric lighting.

APPOINTMENT OF TECHNICAL COMMITTEE CHAIRMEN AND MEMBERS REVISED

A slightly revised method of appointing chairmen and members of technical committees was proposed and acted on at the opening session of the Technical Section on Monday afternoon. The selection of the chairmen will be the duty of the chairman-elect of the section as before, but will hereafter be based on the approval of the vice-chairman-elect and six members-at-large of the incoming executive committee. Advantage will be taken of the opinions and knowledge of geographic sections by automatically making the chairmen of the geographic section committees also members of the corresponding national committees.

The procedure of appointment prescribed by constitutional amendment will be as follows:

The chairman-elect, with the approval of the vice-chairman-elect and the six members-at-large of the incoming executive committee of the section, shall appoint the chairman of each of the committees, such committees including automatically the chairman of each of the geographic divisions, and he may with the approval of the executive committee appoint such other members of such committees as may be deemed necessary.

First General and Executive Session

President Bump Strikes Optimistic Note—Executive Manager Aylesworth Describes Work of Year — Encouraging Reports

IN OPENING the convention President Bump contrasted the conditions of a year ago, when the country was swept by a wave of pessimism, with conditions today, when the outlook for all branches of the industry is brighter, healthier and bigger than ever before in its history. He said that the utilities can look forward confidently to a broad investment market which will justify proceeding with plans for the extension of service. A careful survey indicates, said Mr. Bump, that there is more new work planned and under way at the present time than at any time in recent years, if not at any time in the history of the industry.

Mr. Bump told his hearers that the electric light and power industry is in a position today to finance increased facilities. Idle capacity in his estimation will be a practical impossibility for many years to come in an industry which has as yet realized only a small percentage of its possibilities.

Briefly reviewing the work of the association during the year, Mr. Bump called attention to the "Electrify America" movement and to the work of the committees on customer ownership, rural line extensions, savings banks, education, inductive interference and public information. As typical of the value of association committee work to the industry, the result of the activities of the insurance committee was cited. Through the efforts of this committee lower fire insurance rates on electrical properties will become effective as of April 15, and it is anticipated that the savings effected in this one activity will be equal to or greater than the total dues collected by the association from member utility companies during the year.

The report of Treasurer H. C. Abell and that of the finance committee, of which Joseph B. McCall, president Philadelphia Electric Company, is chairman, were next presented.

OUTSTANDING WORK OF THE YEAR

Some of the outstanding work of the year was featured in the report of Executive Manager M. H. Aylesworth. The Technical Section has worked assiduously for better construction, more reliable equipment and greater efficiency in the production, distribution and utilization of electricity, and Mr. Aylesworth said that it is one of the greatest assets of the association to be able to command the services of so great a body of experts on its vital engineering problems. No other body of men, he said, is animated by higher ideals or works more unselfishly in the public interest than the technical staffs of public utility organizations. The successful outcome of the co-operative work of the Technical Section with the telephone interests was especially commended.

During the year there has evolved from the work of the Commercial Section a great national movement on business development in which all of the other branches of the industry have joined. Upon the central-station companies of the country, Mr. Aylesworth said, will fall the brunt of the work of shaping and directing the campaigns, and he hoped that enough enthusiasm would be obtained from the conference to make the ultimate success of the movement to electrify America a certainty.

The excellence of the work done by the various state committees on public utility information and by the Public Relations Section in cultivating good will for the industry was brought to the attention of the convention by Mr. Aylesworth, who also told of the work of the Accounting Section in further perfecting its uniform classification of accounts and in co-operating with the Federal Power Commission and the National Association of Railway and Utilities Commissioners on accounting matters.

In any summary of the conditions which surround the electric light and power industry today, said Mr. Aylesworth, two issues present themselves for attention, the necessities of growth and how they are to be financed. In the speaker's estimation it must be apparent to every observant operator that the field for expansion in the electrical industry is almost limitless. Last year almost two billion dollars was expended for new building, setting for the nation a mark never before approached. The greater part of this huge expenditure was made in cities for the purpose of housing their people. Hence there came into being a vast and still growing increase in the domestic load of the electric light and power companies, for not only is every new urban dwelling erected in this progressive country connected with central-station lines as a matter of course, but outlets for appliances are provided on a scale undreamed of a few years ago. This is not all. Campaigns for the revival of business are being waged. Prosperity is on the threshold, and as it enters an industrial load far greater than any in the past must be carried by the central stations. The outlook is roseate indeed, and no one will wonder that, faced by so imperative a demand, the program for new construction adopted by the companies is of unprecedented size. But to measure up to the opportunities presented requires large amounts of capital. Fortunately money can now be had at lower rates than have prevailed for many years; operating expenses have been considerably reduced and, what is most significant of all, junior securities to the value of $60,000,000 were last year sold to customers.

Insull Pleads for Intensive Public Relations Work

In reporting on the Public Relations Section work, Martin J. Insull of Chicago, chairman of the section, said that while the industry as a whole seems to appreciate the necessity of a better understanding on the part of the public of the problems of the electric light and power companies the individual of the industry does not yet seem to understand that in order to accomplish this he or she must make it his or her personal job. The work of improving public relations, he said, is not like a technical problem to be worked out by experts and forgotten. All that the Public Relations Section can do is to point the way toward the ends to be accomplished, and the results must come from the actual work and co-operation of individuals in the industry.

As between finance and public relations, Mr. Insull is of the opinion that the latter is the more important because people with money to invest are not attracted to a business to which the public is antagonistic. He said that it cannot be impressed too strongly on executives that the education of employees in the fundamental economics of the electric light and power business is a very important part of their duty not only to their individual company but to the industry.

Commenting on the work already done in advertising and through the state committees on public information in addition to that carried on by means of motion pictures, Mr. Insull said that "public relations as an association activity has only had a distinct place for the past two years. Therefore the surface has only been scratched, but the results so far obtained do indicate the great possibilities of this work in placing the industry in its proper position in the public mind."

Simplified Bookkeeping System Outlined

E. J. Fowler, chairman of the Accounting National Section, in his annual address outlined a simplified system of bookkeeping which has been in satisfactory use in Baltimore for several years and has recently been installed in two offices of the Public Service Company of Northern Illinois. It is described elsewhere.

This year for the first time the Accounting Section has made a definite, persistent and reasonably successful effort to encourage and help in organizing Accounting Section work in the geographic divisions and in co-ordinating it with the work of the National Accounting Section. Owing to the fact that meter readers, cashiers, collectors and employees at the stock-transfer windows, all connected with the accounting department, meet and deal with the public, Mr. Fowler suggested that these men be educated and broadened because of their potential influence in creating good will for the company.

Business Development

R. H. Tillman of Baltimore, chairman of the Commercial Section, accentuated the part played by the section in the formation of the joint committee for business development and the ready

F. W. SMITH
Vice President
United Elec Light & Power Co.

M. H. AYLESWORTH
Executive Secretary
N. E. L. A.

W. H. JOHNSON
Vice President
Philadelphia Electric Co.

FRANKLIN T. GRIFFITH
President
Portland Railway, Lt. & Pr. Co.

J. E. DAVIDSON
Vice-President and General
Manager, Nebraska Power Co

R. F. PACK
Vice-President Northern States
Power Co. Minneapolis

Incoming President Smith, Executive Manager Aylesworth, and the four vice-presidents elected for the coming year response from other interests to the movement. He said that the committees and bureaus of the Commercial National Section had devoted much time in formulating recommendations and assisting in every way possible this business movement because they were confident it would bring telling commercial results. Only through concerted action of the combined forces of the industry, he maintained, could the electrical business be brought out from under the cloud of depression. Mr. Tillman was of the opinion that the industry is now on the threshold of its greatest opportunity of making its usefulness felt.

RECOMMENDATIONS OF CHAIRMAN CARLE

The constitutional amendment which automatically makes the chairmen of geographical-section technical committees also members of the corresponding national technical committees has been very effective in co-ordinating the work of the geographical and national committees, said N. A. Carle, chairman of the Technical Section, in his address. As a result of this the chief objection which has formerly been raised to geographic technical committees is eliminated. Considerable benefit has also resulted from conducting simultaneous meetings in different parts of the country and exchanging comments thereafter. These dual meetings have enabled many members to partake in discussions who found it difficult to do so before owing to the remoteness of the meeting places. With dual meetings held in November and national meetings in September and January, Mr. Carle believes that the greatest benefit can be rendered to the membership at large.

At present the personnel of many small companies cannot be utilized in committees because the companies cannot afford to pay traveling expenses to four or five meetings during the year. Mr. Carle declared that this obstacle could be removed if each section would defray the expenses of two men to each of the national technical committee meetings. Considerable interest in reports of the technical committees has been shown during the past year by colleges, more than six hundred reprints of the prime movers and overhead systems committee reports being distributed this year and the colleges being the principal recipients. To increase their interest still further and develop good will, disseminate the information available more extensively and take advantage of the opportunity of educating the men who are going into the industry, it was recommended that college sections be organized and modeled along the lines of existing company sections. If this is favorably considered, a committee should be appointed to outline the general plans. Machinery for undertaking this work is already available in the geographic sections.

The reason for extending the Technical Section chairman's term over two years is no longer operative with the present method of conducting the section activities, and it was recommended that the chairman's term be limited to one year hereafter.

RATE RESEARCH

The rate research committee, Alex Dow chairman, after reviewing the progress of *Rate Research*, which, under the editorship of Charles E. Neil, has continued to abstract court and commission decisions affecting public utilities, and the "Rate Book," now enlarged to cover cities having a population of 20,000 or more and paying a profit to the association, summarized briefly the trend of the year's regulation and legislation.

For the first time the committee felt it advisable to make a recommendation as to a power-factor clause in rate schedules, asserting "that where power factor is one of the elements considered in a scheduled rate, or in a rider applicable to a scheduled rate, the preferable method of measuring power factor for the purpose of billing is by comparison of readings of a watt-hour meter and those of a meter registering reactive ampere-hours—that is to say, a so-called reactive-component meter. We have heretofore," the committee continued, "looked with hope and favor upon the possible use of a kilovolt-ampere-hour meter, but experience to date is that such instruments are not comparable in accuracy with the standard kilowatt-hour meters, whereas the reactive-component meter is substantially identical in construction and has the same limits of accuracy as the meters to which we and our customers now give full credence. We recognize the difficulty of specifying power factor in terms of the quadratic relations of readings of the two meters, but we point out that it is very simply arrived at by the use of a table showing the ratio of the reactive kilovolt-hours to kilowatt-hours."

The committee reported little change in the status of coal clauses or in the method of their application. Their satisfactory operation had justified them.

WIRING

For some time the wiring committee, R. S. Hale chairman, has worked through sub-committees with a view to formulating standards as to the amount of wiring that should be installed under different conditions. This subject has two aspects, one as to the number of circuits that should be put in for a given area, and the second as to the number of sockets or convenience outlets that should be put into a given room. The committee was not ready to offer definite standards for universal adoption, but recommended that they be fully discussed not only by the central-station people but also by the contractors, architects and real-estate men. In the meantime the committee, believing that the subject of selling wiring should have more attention, has provided for a large sub-committee of commercial men on this particular subject. Educational work must be done with the following groups, named in the order of their importance: Electrical contractors, architects, building contractors, and the public. The so-called "electrical home" exhibit, it was believed, affords the opportunity to demonstrate and explain the merits of electrical equipment to the greatest number of people at the least expense.

The manufacture of the old non-standard plugs and receptacles is rapidly disappearing, and a large number of the manufacturers of heating devices, as well as many of the manufacturers of portable lamps, are using and selling the so-called double-T-type standard plugs.

The principle of the recommendation of the committee in regard to the 660-watt rule was to give up the rating of circuits by the nominal connected load or name-plate rating of small motors, etc., and, instead, to control the size of the final circuit first by the fuse and second, when desired, by providing that each final circuit shall supply not over a certain number of square feet of area (the figure appearing to be in the neighborhood of 800 sq.ft.), or the same thing can be accomplished by providing that the final circuit shall not feed more than a certain number of rooms, say five or six. In regard to the fuse, the code rule has been changed to 10 amp., and a very large number of inspection districts are allowing 15 amp. either openly or tacitly. At least one company reports that it is using 20-amp. fuses on the final circuit in its district without any sign of trouble.

Various tests and investigations were made by the committee covering relative bending durability of No. 16 and No. 18 lamp cord, all-rubber portable cord and the effect of steel reinforcement on binding durability. The results of these tests were published in a comprehensive manner as an appendix to the committee's report.

The "life" tests of various types of wiring under dry and damp atmospheric conditions which were started in 1917 are being continued. The scheduled physical and insulation resistance tests are not due until the fall of the current year, when a five-year period will be completed.

Second General and Executive Session

Symposium on Business Development Outstanding Feature—Address by Louis F. Musil on Budget Procedure in Management Control

WEDNESDAY'S session was dominated by the symposium on business development reported at length elsewhere, which proved a highly successful innovation. Another very interesting feature was the address on budget procedure by Louis F. Musil, treasurer of the Cities Service Company, New York.

COMPANY EMPLOYEES' ORGANIZATION

A frank statement of the causes which have led to the present general indifference toward company section activity and the suggestion of changes which are considered necessary to insure even a promise of renewed interest from the report of the company employees' organizations committee, R. B. Grove, chairman. The indifference, it is stated, is due primarily to the fact that the company sections have no definite

No. 1—**E. W. Lloyd**, General Contract Agent Commonwealth Edison Company.

No. 4—**William L. Goodwin**, Assistant to President Society for Electrical Development.

No. 2—**M. S. Sloan**, President Brooklyn Edison Company.

No. 3—**H. A. Wagner**, President Consolidated Gas, Electric Light & Power Co. of Baltimore.

No. 5—**F. W. Smith**, Vice-President United Electric Light & Power Company.

No. 6—**Arthur Williams**, Commercial Manager New York Edison Company.

Executives Who Are Always Outstanding Figures at N. E. L. A. Conventions

No. 1—**Alex Dow**, President Detroit Edison Company.

No. 2—**S. Z. Mitchell** (at left), President Electric Bond & Share Company. **Martin J. Insull** (at right), Vice-President Middle West Utilities Company.

No. 3—**M. R. Bump**, Chief Engineer H. L. Doherty & Company.

No. 4—**Guy E. Tripp** (at left), Chairman of the Board Westinghouse Electric & Manufacturing Co. **L. A. Osborne** (at right), Vice-President Westinghouse Electric & Manufacturing Co.

place in the national organization, that they have not been represented directly or indirectly on the national executive committee, that they have no official representation on national committees and that no specific work or responsibility is assigned to them by the constitution of the national organization.

To stimulate activity the following plan is suggested:

1. That the name of the committee be changed to "committee on company sections."
2. That the object of the committee be changed and that for future activities of the committee it be "To promote the organization of and foster the activities of company sections of the National Electric Light Association."
3. That the national organization chart be extended to include company sections, that a definite recognition of company sections be acknowledged by a statement in the constitution, and that company sections be granted automatic representation on state committees.
4. That provision be made on the program of the annual national convention for a meeting of those interested in company section activities.
5. That provision be made whereby Class B members shall be permitted to secure copies of individual national committee reports pertaining to subjects in which they are particularly interested.
6. That one copy of the entire *Proceedings* of each annual convention be sent free to each company section.

BUDGET PROCEDURE IN MANAGEMENT CONTROL

"The budget is too often used only to act as a check on dollars, and because of that reason its administration in many cases has been passed to that man or group of men who are able to check dollars very well, but on whom no recognized responsibility is vested for concurrence in or initiation of policies or programs which make it necessary for the dollars to be checked," declared Louis F. Musil, treasurer of the Cities Service Company, New York, in his address on "Budget Control" before the general and executive session on Wednesday. Mr. Musil pointed out that the most difficult task is the building in large enough numbers of executives who fully appreciate what is meant by, first, the acceptance and, second, the discharge of management responsibility. The difficulty is to pick from less experienced men those men with probable executive judgment and ability.

"The selection of future executives," said Mr. Musil, "may be made with more assurance and executives may be more successfully developed by the recognition and application of certain simple principles and procedure in organization and management. I call these budget principles and budget procedure." Mr. Musil pointed out that it is equally obvious that essentials of management are necessary to give the responsible executives full assurance that proper control is being exercised in operating problems as in the expenditure of capital funds which have for a long time been on a budget basis. "Every individual," he says, "who is charged with the responsibility of supervising the expenditure of human energy or capital should be required to predetermine the results to be obtained."

Mr. Musil submitted the following fundamentals which must be incorporated in any budget system:

1. The executive must recognize that his function is to create and enforce policies rather than to work out the problems resulting from such policies. If the expected results of policies laid down are predicted and mutually accepted, there will be little question in determining their merit or in determining the changes that may be necessary.
2. The executive must have knowledge of the control which is exercised by every individual in his organization to whom he subdivides responsibility. He must give evidence as to his knowledge of that control or the lack of that control and reward all individuals accordingly.
3. Individual merit can better be gaged by comparing a man's results with an accepted estimate by him of his future performance than by comparing his results with the results of some other individual.
4. It is therefore necessary for each individual in the order of his responsibility to recognize the necessity of adopting some common system of estimating the possibilities ahead of him.
5. Each individual must recognize the necessity of making his own estimate of what he is going to do and how he is going to do it before he or his associates or his executives can concede his qualifications or expect a full measure of results.
6. Each individual must further recognize that, through such a system, by the constant comparison of results with expectations, the leaks resulting from human omission and human judgment can most effectively be minimized.

MEMBERSHIP

The report of the membership committee, Walter Neumuller chairman, showed slight gains during the year in each class. The number of new members was large but was for the most part offset by cancellations. There were on April 30, 1922, 11,029 members, of which 1,134 were in class A and 8,110 in class B, the remainder being in the other six groups.

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Third General and Executive Session

W. S. Murray Refuses to Retract Views on Ontario Hydro System—Attorney General Daugherty Favors Customer Ownership

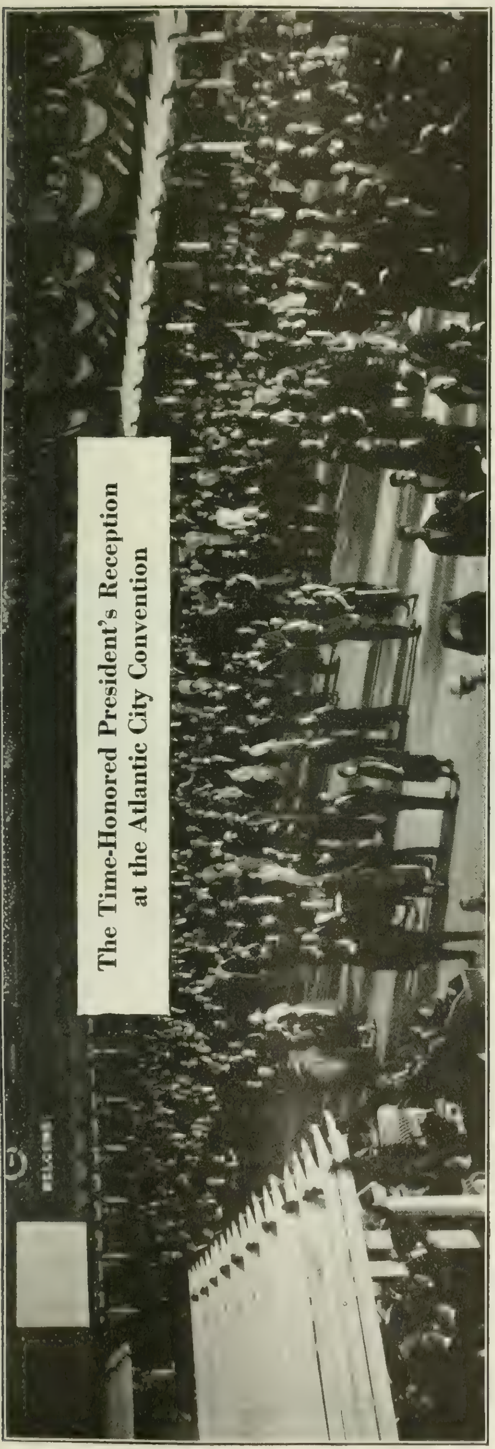
CARL D. JACKSON'S address, elsewhere reported, and W. S. Murray's emphatic refusal to retract his statements concerning the false economy of the Ontario Hydro-Electric Commission's system at the telegraphed request of a Hamilton (Ontario) newspaper marked Thursday's sessions.

GREAT SAVING MADE BY INSURANCE COMPANIES

Typifying the value of association work, the savings effected for the industry through the activities of the insurance committee, headed by S. E. Wolff, are especially noteworthy. On March 3, 1922, the insurance interests notified the association's committee that they would grant an increase in differential, making the same 25 per cent on liability, property damage and collision rates, effective as of March 1, 1922, on electric trucks. The actual saving will not amount to 25 per cent, however, because the insurance companies continue to rate electric trucks upon the experience of the gasoline truck. The net saving amounts to 16⅔ per cent.

On April 28, 1922, the insurance interests also notified the association's committee that they had granted a reduction in fire, theft and transportation rates amounting to about 33⅓ per cent, effective as of May 1, 1922. Inasmuch as the insurance interests have not classified the experience of the electric truck with that of the gasoline truck in respect to fire, theft and transportation rates, this reduction of 33⅓ per cent will be actual. According to the compilations made by the committee, this will result in reductions on electric truck insurance ranging from 20 per cent to 52 per cent.

Feeling that central-station companies were entitled to a reduction in their fire insurance costs, the committee entered into active and exhaustive negotations



The Time-Honored President's Reception at the Atlantic City Convention

with the fire insurance companies, seeking relief. As a result of this work the Central Traction and Lighting Bureau formulated and promulgated schedules for the rating of properties to rating bureaus and associations of underwriters doing business in the United States. The general adoption of these schedules must await the action of the insurance companies and regulatory bodies in the several states in which they must be filed.

At a convention of insurance interests held last September a resolution was passed to the effect that it was just and reasonable to expect a downward revision of rates for fire insurance on stations and substations. Based upon this commitment and other authentic assurances, it was the expectation of the committee that the promised reduction of rates would be made effective by Jan. 1, 1922, from a rate-making body, but lower rates have not been officially promulgated yet.

Relations with Savings Banks

Since the first of the year the committee on relations with savings banks, M. S. Sloan chairman, has been functioning. Its purpose is to obtain state legislation permitting savings banks and trust funds to invest in prime electric light and power company securities. The matter was presented to the National Conference of Mutual Savings Banks, and a joint committee was appointed. It was decided first to press for legislation in New York State, and comparative studies were made. Railroad bonds were taken as the gage. The data developed by the committee showed a total of $5,000,000,000 invested in electric light and power securities, about half of which is in bonds and notes. About 1,450,000 individuals have invested in these securities. Of the bonds insurance companies own approximately $300,000,000, and the 30,000 banks of the country have invested $1,700,000,000 in public utility funds. The report further showed the revenue, capacity and output growth of the industry.

In comparing railroad and public utility bonds fifty prime railroad and twenty-four prime electric light and power company bonds were chosen. The railroad securities totaled $1,001,700,000 and those of the utilities $714,600,000. The average interest rate paid by the railroads was 5½ per cent and by the utilities 4.23 per cent. The railroad earned their interest 2.4 times against 4.7 times for the utilities. The average quoted price of the railroad securities was 75.89 and of the utilities 92.25, while the yield on the former was 5.80 per cent against 5.86 per cent on the latter. Another index of safety was given which showed that 0.84 per cent of all railroad securities were in default, while only 0.14 per cent of power and light securities were defective.

Already twelve states permit investment of savings or trust funds in utility securities, and the effort now is to obtain similar action in the other states. For political reasons New York was omitted last year.

Customer Ownership

That conditions during the past year have become more favorable to the sale of public utility securities was pointed out by the report of the customer ownership committee, John M. Gilchrist chairman. The companies which have gone out vigorously to sell securities to their customers have met with better results than they expected. More thought by a larger number of people has been given to the subject, and this had led to broader and deeper consideration as to the general financial requirements which will attend the public utility business in the future and to the great necessity as well as the great advantages of financing by the sale of stock to customers. The conclusion has been definitely arrived at that customer ownership is not to be looked upon as a war measure destined to fade out with the return of normal conditions, but from a financing standpoint alone will become more and more important each year in the future. The committee directed much effort toward encouraging customer ownership among the member companies. In addition to its personal work communications were sent out during the year explaining what had been done and offering assistance to companies in getting campaigns started.

For the guidance of member companies the committee endeavored to collect in its report as complete data as possible from as large a number of companies engaged in this kind of selling as could be induced to make full reports of their activities. While information was gathered during the year indicating that more than 200 companies are engaged in the sale of securities to customers, full information was received from a little less than half this number. From these statistics the following interesting facts were learned:

The eighty-four companies reporting show that approximately 570,000 shares have been sold during the year. The ratio of total stockholders to total customers for all of the companies is one to seventeen. The average purchase for all the companies under the customer-ownership plan is seven shares per stockholder.

Selling cost per share was as high as $9 in one instance, but the average for the thirty-five companies was $4.30. One large company has been able to reduce its selling cost $1 per share in the last year. In the case of two large companies the cost has been reduced to 94 cents and 70 cents per share. These figures include all advertising expenses and commissions to salesmen.

Although the committee was unanimous in the belief that this form of financing is sound and desirable from all points, there is great danger, it thought, in hurrying into financial plans which have not been well worked out.

An address by Haley Fiske, president of the Metropolitan Life Insurance Company, on "Light and Power Securities as Investments for Life Insurance Companies," was very well received. Mr. Fiske's address will be printed in abstract in an early issue of the ELECTRICAL WORLD.

AMERICAN AND CANADIAN UTILITIES COMPARED

W. S. Murray, in speaking of his report on the Hydro-Electric Power Commission of Ontario, recently published by the National Electric Light Association, said that he had nothing to add to or subtract from the conclusion he then drew. The accuracy of his statement to the effect that electric power is being furnished at less cost to the people on the American side than on the Canadian side of the Niagara River was questioned by the Hamilton (Ontario) *Spectator*. In a telegram to the convention that paper invited Mr. Murray to retract the statement in fairness to the communities of the Canadian Niagara district and the power commissions and companies of Ontario. Mr. Murray showed how the industries in Canada are discriminated against by the Hydro-Electric Power Commission in favor of the residence consumer and voter. He maintained that there was nothing to retract and that the facts show that power supplied by the privately owned electric utilities of the United States is more adequate, more reliable and cheaper than power supplied from the government owned and controlled system of the Hydro-Electric Power Commission of Ontario.

SIMPLIFIED PRACTICE

William A. Durgin, representative of the Department of Commerce, spoke of the simplified practice which the department is offering as an aid in stabilizing American business and fortifying the American living standard. The Department of Commerce, he said, is interested in the application of the general principle—the elimination of the waste now incident to excess stock and investment, of the slowing of repetitive production, of decreased turnover, of absence of interchangeability, of excessive cost of repair and maintenance and of the handicap of American products in the foreign field. He suggested that if the National Electric Light Association was interested in the movement it appoint a small working group to act as a contact committee to the Department of Commerce.

ATTORNEY-GENERAL OPPOSED TO GOVERNMENT OWNERSHIP

Although unable to be present at the convention because of pressure of official business, Harry M. Daugherty, Attorney-General of the United States, sent his speech to be read. In it he traced the marvelous growth of the electric light and power industry and showed how great an investment it now represents and how large a number of stockholders are interested in its success. "Regardless of class or color or means, more money belonging to the people," the Attorney-General said, "is invested in the utilities represented in the electrical industry than in any other utility in the world, except the steam railroads. This is the character of public ownership, I am frank to say, of which I am in favor. I am not in favor of political, governmental or municipal ownership."

"The electric light and power companies of the country are publicly owned," he said, "for they have more than 1,600,000 security holders among the citizens of this country. That is true public ownership, with the incentive of private development, investment and management, under fair public regulation, and it is preferable to the political ownership and political management which always follow where the municipality or the government owns a public utility."

Fourth General and Executive Session

Rural Service, Water-Power Development, Lamps, Technical Advice, Electrical Resources and Accident Prevention Reports

THE nominating committee's report on officers for the coming year was presented, as usual, at the closing session. The names of the new officers are printed on page 993.

AWARDING OF PRIZES

The Doherty prize this year was awarded to W. H. Evans of the Philadelphia Electric Company for his paper on "More and Better Business."

The Billings prize was awarded to Walter H. Feldmann of the Consolidated Gas, Electric Light & Power Company of Baltimore for his paper on "The Electrification of Ice Plants."

Rural Service

A comprehensive analysis of the farm service situation was presented in the report of the rural lines committee, of which G. C. Neff is chairman. There are 6,448,366 farms in the United States, six million of which are east of a north and south line drawn along the western boundary of the Dakotas. There are approximately two-thirds as many farm homes as there are residential customers now served with electric service. With an assumed population density allowing a possibility of three customers per mile of rural system, two million miles of distribution lines will be required to furnish service to these six million farms. As yet only a small percentage of these farms have electric service, and there has not been much uniformity in the method of supplying such service.

The committee has made a careful summary of the salient features of the rules governing rural service which are in effect in various states and has included these rules in an appendix to its report. There has been considerable controversy respecting what constitutes a rural consumer, but one fundamental to be kept in mind is that such consumers must not be called upon to pay more than their proportionate share of the cost of service and fixed costs.

Snapshots Up and Down the Boardwalk

No. 1.—**S. E. Doane**, Chief Engineer National Lamp Works of the General Electric Company.
No. 2—**W. L. Wadsworth**, Northern States Power Company.
No. 3—**C. E. Greenwood**, Edison Electric Illuminating Company.
No. 4—**H. N. McConnell**, Electric Bond & Share Company.
No. 5—**W. G. Kelly**, Commonwealth Edison Company.
No. 6—**L. C. Bradley**, Stone & Webster.
No. 7—**A. K. Baylor**, General Electric Company.

The most common error met with in handling the factors entering in the cost of rural lines has been that of underestimation. Some have gone so far as to state that there are no overhead costs and that the bare cost of labor and material is the final answer.

Too much has been said about the use of cheap construction. On the basis of unit strength and maintenance costs rural lines are not different from those in the city or urban territory. In physical aspects the lines will probably carry less mechanical load than the city lines. The problem is therefore one of cutting out excess material to reduce costs without sacrificing strength and life.

In constructing rural lines proper regard should be given to maintenance costs and continuity of service. The maintenance cost of rural lines, owing to remote location and the poor condition of country roads during certain periods of the year, is many times the cost of maintaining distributing lines in urban districts, and consequently it is very important that rural lines shall be installed at as high a standard as that followed in urban districts, if not at an even higher one.

The successful development of rural electric service depends to some extent upon the amount of electrical energy that can be economically used by the farmer. The committee is making a study of the needs of the farmer and of the electrically driven equipment now available and hopes to assist in accelerating the development of additional machines suitable for farm service.

Progress in Water-Power Development

In its report to the convention the water-power committee cited the great developments that have taken place during the year and others that are in contemplation. The committee still has some differences with the Federal Power Commission over the interpretation of Regulation 16, especially with reference to the accrual of depreciation, because it does not take into account the vicissitudes of the business.

Chairman Franklin T. Griffith of Portland, Ore., reported anticipated expenditures on hydro-electric development aggregating $65,000,000 in 1922, as compared with total expenditures of $46,000,000 last year. Projects with a total installation of 744,000 kw. will be brought into operation this year. "Practically all developments now under construction are being made to meet increasing demands on operating utility companies," the report said, "and the cost figures given, representing as they do only the cost of the hydro-electric plants, do not cover a considerably larger sum expended and to be expanded in expansion of distribution and utilization systems."

Of the $46,000,000 spent for water-power development last year $38,000,000 was expended in the Pacific Coast States. The Pacific Coast is still maintaining its lead in hydro-electric development. "A great impetus would be given hydro-electric development," said Mr. Griffith, "if there could be inspired in the industry complete confidence in the feeling that hydro-electric development in the United States is to be made by private capital, subject to regulation, and with only reasonable governmental supervision. We are engaged in one of the most progressive of industries, one in which conservative investors of the country are steadily gaining confidence. We firmly believe that under private initiative and with private capital the latent water powers of the United States can be brought to the service of man in the most efficient and economical manner. We believe that under sane regulation the interests of the consuming public can be and will be fully conserved."

REPORT OF LAMP COMMITTEE

The lamp committee, Frank W. Smith chairman, reported that considerable progress had been made during the year in respect to standardization of 110, 115 and 120-volt lamps.

Just before the close of the year 1921 the committee advocated a campaign among member companies for "more and better lighting," which was indorsed by the national executive committee. This proposed activity developed into a broader movement than was originally considered, with the result that it was extended to include intensive business development in both the lighting and power fields.

ELECTRICAL RESOURCES OF NATION

After telling briefly of the co-operative work with the engineers' branch of the army in obtaining data on the power resources of the electric light and power companies in the important industrial regions, the committee on the electrical resources of the nation, M. S. Sloan chairman, recommended that means be devised to bring about close co-operation between the organizations now compiling statistics of the industry. The committee pointed out that there are no means at present for establishing from year to year just what the electrical resources of the nation are. A comprehensive, exact and authoritative year book is therefore suggested, which will co-ordinate all that others are doing and combine these data with information obtained at first hand. In conclusion the committee recommended that the utilities should not wait for the state commissions to institute actions, but should themselves present to the community exhaustive demonstrations of their productive assets.

TECHNICAL ADVISORY COMMITTEE

The technical advisory committee, Charles F. Scott chairman, in its report pointed out that technical work in the power industry concerns:

A. The present—operation; improving methods; determining best practice; improving appliances and methods for reliability and economy. This field is covered by the technical committees.

B. The future—research and development. A long-range outlook to the future; a study of larger problems; organized and co-ordinated research. This field was treated in a report by the technical advisory committee during the past year, in which a new policy of the association was proposed. It is expected that a conference on this subject between the public policy committee and the technical advisory committee may be held in the near future.

ACCIDENT PREVENTION

In the comprehensive detailed report made by the accident prevention committee, Charles B. Scott chairman, there was discernible a note of disappointment that more attention had not been given to safety measures by member companies. The report was subdivided for detailed presentation into a number of parts, through all of which, in addition to the humanitarian motive, ran the thought of the economies that would result from safety work. The committee announced the institution of the Insull medal, given by Samuel Insull for award for specially commendable work in successful resuscitation.

An explanation of the proposed California water-power act was given in detail by Paul Downing of the Pacific Gas & Electric Company of San Francisco and a review of the work of the public policy sub-committee on industrial interference was presented by Paul Stenzer of the United Gas Improvement Company of Philadelphia.

The usual committee reports on resolutions and on memorials were presented by Arthur Williams of the New York Edison Company and W. H. Onken, Jr., of the ELECTRICAL WORLD respectively. The president's address was highly commended, and the convention, which in point of attendance was probably the largest ever held, was brought to a conclusion with a short address from the president-elect, Frank W. Smith.

General Squier on "Wired Wireless"

AN ADDRESS by Gen. George O. Squier, Signal Corps, U. S. A., on the opportunities of electric light and power companies to win public good will by broadcasting entertainment and news over their circuits and through the lamp sockets attracted great interest at the session of the electrical apparatus committee. A report of General Squier's remarks will appear next week.

New N. E. L. A. Film Makes Decided Hit

A NEW film entitled "Yours to Command" was displayed at the Atlantic City convention and was exceedingly well received. The film is designed to show the public the dominant part electricity now plays in the life of the average individual, the illustrations being based in this case upon the use of electricity in the motion-picture industry. The film opens with the statement that few people realize the influence of electrical service in modern life and announces that the picture then being shown would be impossible without such service. The production of motion pictures is illustrated, showing the equipment of the modern "movie" studio and a company actually engaged in producing a feature film. This is followed by pictures showing the mechanical details of developing and fixing negatives, the printing of positive films from the negatives and the method by which the finished film is projected upon the screen. Intimate views of the mechanism, all of which is electrically operated, are shown.

The film then shows how electricity is applied in lighting the streets through which one approaches the theater and the use of electricity in sign advertising with many of its applications in manufacturing, commercial and home life. In conclusion, a graphic portrayal is given of the ownership of the central-station industry by more than 1,600,000 holders of electric light and power securities, and the indirect ownership of millions of insurance-policy holders and bank depositors is also brought out. It is expected that this film will be even more successful than the earlier film of the N. E. L. A., entitled "Back of the Button," produced by the association a year ago.

Industry Seeking Financial Aid and Good Will

Public Policy Committee of the N.E.L.A. Touches on Vital Issues Confronting the Electric Public Utilities of the Country

THE public policy committee of the National Electric Light Association a year ago, in its report, was able to strike a note of optimism for the light and power industry, notwithstanding the serious situation consequent on post-war reconstruction and deflation that then obtained. Its report this year is reassuringly optimistic as may be judged from the following excerpts.

"Although we never doubted the ability of our industry to adapt itself to changed conditions and counted on inventive intelligence and suppleness of mind to vanquish the various problems as they arose," said S. Z. Mitchell, the chairman of the committee, "we are nevertheless heartened and encouraged by the remarkable stability of electric power and light utilities through the period of depression. Even now, with the country in the grip of a nation-wide coal strike, the example of our industry in continuing to supply 100 per cent service is most inspiring.

"In matters of public policy we are equally fortunate. Whether because of the inherent strength of our business, or the moderation shown in the conduct of our affairs, or the care with which the problems have been approached, the fact remains that the electric light and power companies of the country have been singularly free from reproach and are in high favor with the public. . . .

COMMISSION REGULATION

"As an industry it has been our fixed policy to cooperate with the various public utility commissions to the end that regulation should be established on such a sound and equitable basis as to commend itself alike to the utilities and the public whom they serve. . . .

"There is no longer any doubt that in public service regulated monopoly is better for both the public and the investor than unregulated competition or state or municipal ownership. . . .

"Through the wide distribution of our securities and especially through customer ownership we have the much better form of direct public ownership and private operation under public supervision. . . .

"Although still in a process of evolution, regulation and control is now a permanent feature of our economic law. Manifestly it is still lacking in some of those elements of finality and precedent which have been developed in jurisprudence from the experience of ages; but it is none the less effective. Few reforms in government have ever been successfully or permanently established otherwise than step by step and by slow degrees. We should therefore in this formative period of regulation help evolve a system as perfect as possible. . . ."

FINANCE

The problem of financing, according to the committee, transcends all others, for unless the industry is successful in raising about three-quarters of a billion dollars of new capital yearly, development will be seriously checked. In large measure the basis of its credit is the stability and adequacy of its earning power. Investment in public utilities cannot be amortized. Investors in effect purchase a transferable annuity. The regularity of the return on invested capital in good times and bad will determine the amount of money which can be obtained in return for this annual payment. By stabilizing distributable earnings credit will be stabilized and capital at reasonable cost more readily obtained, and the industry can give that efficient service to which the community is entitled and at lower rates than possible with a fluctuating and uncertain return. Too frequent changes in rates or riders on contracts to tide things over temporarily or to ward off insolvency, said the committee, are not in keeping with enlightened public policy. A liberal return on the value of utilities is essential not only to their prosperity but to the well-being also of the communities served.

While keeping the rates at all times fair and reasonable to the consumer, the commissions in the public interest should be sure to see that at least a fair return is accorded the investor. A rate slightly too low, while meaning little in dollars and cents to any particular consumer, may mean much when it comes to the question of dependable service. To restrict unreasonably the return is comparable to starving the horse that is expected to carry the heavy load.

A plea was made for a greater sale of junior securities, and for a rate which will amply safeguard the principal.

It is a wonderful tribute to the soundness of the electric public utility business as a whole, the report continued, when, flanked on all sides by widespread depression and pessimism, and during the most trying period of its existence, out of a total of approximately five billions invested, only a very small fraction of 1 per cent in the bonds were in default. In view of this showing, additional channels for funds should be available through banks, insurance companies, trustees of funds and other agencies seeking conservative investments.

DEMOCRATIZATION OF THE INDUSTRY

As one of the outstanding factors of the electric light and power business, the committee called attention to the great impetus which has been given to the movement for customer ownership of securities. This movement, started years ago on the Pacific Coast, still continues to grow in popularity and strength, and today there are more than 1,600,000 holders of electric light and power securities. There is, in fact, today public ownership of utilities in the real and best sense of the word. The steadiness of the growth of customer ownership is the best warrant of its depth and permanence, and the readiness with which the users of electric service and the commissions have taken to this form of financing is a happy augury for the future. It has proved a great step forward in the establishment of enduring and sound public relations.

WATER-POWER DEVELOPMENT AND INTERCONNECTION

The regulations now in effect with reference to the development of water power under the federal law are still in some respects unsatisfactory and unworkable. Conferences have been held with the Federal Power Commission over the accounting rules and the base for determining when amortization of investment should begin, and while no decision has been handed down, the committee is not without hope that the suggestions and recommendations of the association will serve as a basis for a workable settlement of this problem.

In the matter of water-power development the industry must show some of its old-time vision and imagination. Even though engrossed with local business, it must not close its eyes to the nation and the nation's interests or to the questions, fundamental and vital, which in the end must be controlling, if there shall be national development and growth. The public has a right to insist that those water powers which are capable of economic development shall be utilized and that every effort shall be made to conserve our fuel supplies through the transmission and use of hydro-electric energy for power purposes now being wasted. On the other hand, it is not unreasonable to expect that the government's representatives will not retard this pioneering but will rather assist it through a liberal co-operative attitude.

As for interconnection, the advantages and economies resulting therefrom are already established and need no elucidation. Striking examples of interconnected systems are to be found in various sections of the country. Out of the experience gained in the operation of such systems, two outstanding facts appear: First, the service has been improved or maintained at the highest point of efficiency without the necessity for proportionately increased rates, and, second, ability to furnish service which otherwise would not be possible has resulted in increased demands with increased benefits to those who use the service. Thus, with the widening of interconnected zone networks, it becomes feasible to extend electric distribution systems into suburban and rural communities.

Electricity on the Farm

There has been an increasing interest in rural-line extensions and eagerness on the part of power companies to develop this class of business wherever the earnings will permit. To those who have not yet taken up the matter the committee commended it most heartily. Nothing is more welcome to the farmers than electric service or contributes so much toward lightening the burden of their lives.

This is not the time to enlarge upon the limitless possibilities of electricity on the farm, the report went on, or on the obligation to give the farmer service. No nation such as ours is stronger than its agriculture, and outside of industrial centers nothing contributes so much to the wealth and stability of cities as growing and prosperous farm communities. Of the accuracy of this statement history furnishes abundant proof. Any movement, therefore, to build up the city at the expense of the farming community is short-sighted. It was with great pleasure that the committee noted the larger views taken of this matter as exemplified in the growing popularity of and faith in state regulation as contrasted with so-called municipal "home rule." Under the former the extension of electric service to rural communities is encouraged, while under the latter such service, except at prohibitive cost, is often denied the farmer, to the detriment of the state.

State Bureaus of Public Information

The one supreme danger that threatens the permanency and credit of the electrical industry is the dissemination of false statements or erroneous information by misinformed or ambitious demagogues. To overcome popular misconceptions, prejudice and error, the truth must be published and circulated widely. The companies have taken the people into partnership with them through stock sales. The people should as partners have a clear knowledge of the problems and affairs of the company. This knowledge should not come from those who exploit the industry for their own selfish ends, but at first hand from the source. For this purpose there have been formed in twenty-five states committees on public utility information in charge of men who are well informed and of good judgment.

Thus far the work has been well done, and a change in the attitude toward public utilities is discernible. So important is this work that the public policy committee had no hesitancy in suggesting to utilities in states not already possessing such committees on public utility information that they align themselves definitely and squarely with the movement. The electric companies seek only to publish the truth and to correct certain economic fallacies.

The Opportunities Before the Industry

"The world war, with its incalculable waste and havoc and financial disturbance," concluded the committee, "postponed for a few years the development of the electric light and power industry at its accustomed and normally ever-increasing rate. But the war and the war's aftermath are, in America, receding into the past, and our industry is faced with an imperative demand for electrical development of great magnitude. National prosperity will soon once more prevail, and prosperity brings with it problems as great as those of troublous times. We must be ready to solve them. To our industry they will present themselves in the main as financial ones. To carry out the program of electrical development which foresight dictates it is necessary to obtain new capital in the sum of approximately three-quarters of a billion dollars a year for the next five years. In accomplishing this huge task the aid of the people we serve is a most important factor. The public policy committee is glad to note that the old indifferent attitude is rapidly giving way and that there is clearly to be seen on every hand a greater readiness to invest in the securities of the industry. With the growth of public friendship and well-deserved confidence it will be placed beyond peradventure that the people of America are to be adequately and efficiently supplied with the electric light and power so essential to their progress and their welfare."

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Wonderful Demonstration Given of Transcontinental Telephony

TWO members of the association addressed the convention by long-distance telephone Thursday night from San Francisco. Bancroft Gherardi, vice-president of the American Telephone & Telegraph Company, acted as chairman of the long-distance meeting at the Atlantic City end. Those who addressed the convention from a meeting at San Francisco were R. H. Ballard of Los Angeles, vice-president of the Southern California Edison Company and former president of the association, and John A. Britton of San Francisco, vice-president of the Pacific Gas & Electric Company. J. C. Nowell, vice-president of the Pacific Telephone & Telegraph Company, also conveyed his greetings to the Atlantic City convention from San Francisco.

The addresses made in San Francisco were plainly audible to every one in the convention hall through the use of amplifiers, and the speakers in California expressed their thanks for the applause which came to their ears across the continent.

Some Post-War Problems of the Utilities*

Need of Legislation to Give Utility Securities a Wider Market — Advantages of Customer Ownership—Trend in Legislation and Regulation

By Carl D. Jackson

President National Association of Railway and Utilities Commissioners

ABNORMAL war conditions directly affecting public utility service and finance served to bring home clearly to the country fundamental economic laws. The public came more clearly to understand the importance of all kinds of public utility service in respect to every phase of daily life and recognized that adequate service could be obtained only through fair treatment of investors' capital dedicated to public use. The war period also served to emphasize the short-sighted financial policy of many utility corporations and the necessity for broader and more far-seeing and elastic policies in this respect if the utilities are to meet the full measure of public obligation on their part. Difficult as was the situation for many utilities during the war period, it is plain that post-war conditions have brought in their wake problems that must be met wisely if future progress is not to be seriously retarded. A greatly increasing demand for utility service is an outstanding characteristic of our economic development. In the electrical field alone the possibilities of development—the absolute necessity of such development—is clearly seen and is as yet immeasurable, so great are the possibilities. The inventive genius, the spirit of American enterprise, can be retarded in this field only by short-sighted public policy. Regulation in the public interest, jealous of the rights of the public on the one hand and obligated to give fair treatment to utility interests on the other hand, can be taken as assured.

Carl D. Jackson

Harm of Tax-Exempt Securities

The capital requirements of which I shall shortly speak, which must be met if we are to reap the economic benefits in sight, are not only very great in amount, but the supply of capital is more or less controlled and curtailed by certain governmental policies calculated to affect very adversely not only the utility industry but all productive industry in the country. I refer, of course, to the tremendous flood of tax-exempt securities already issued and being issued in increased magnitude.

The public utility requirements in the immediate future for gas, electric light and power, telephone facilities and street railways are estimated to be about $850,000,000 annually. Steam railroads should have $1,000,000,000 annually. It is estimated that not more than $500,000,000 may be secured from institutions such as banks, trust companies, insurance companies, etc. After making allowances for all possible sources of capital, the estimate is that more than $1,000,000,000 will be required from the individual investors if the utilities are to meet the service requirements the public has a right to demand, and unless the individual investor is willing to supply this capital, necessary development cannot take place. Hydro-electric development will demand an increasing amount of capital if the country is to reap the benefits of this source of energy.

The present federal tax laws must necessarily handicap the securing of capital upon the most reasonable rates of interest, but the issuance of tax-exempt securities has deprived every industry, including the public utility industry, of a very important source of capital, and such capital as is now thus secured from the individual investor is generally secured on onerous terms.

The amount of wholly tax-exempt issues outstanding on Jan. 1 of this year is variously estimated, but very conservatively placed by Secretary Mellon at $10,660,000,000. This includes the wholly tax-exempt 3½ per cent Liberty bonds, amounting to $1,500,000,000. By far the larger proportion consists of municipal or state obligations. Unconsciously and without knowing the effects of the tax-exempt policy, we are rapidly building up in this country a tax-free privileged class. Tax exemption is not only economically unsound, it is un-American and undemocratic and wholly foreign to our institutions.

Public Utility Securities as Preferred Investments

The unquestioned desirability of a large volume of public utility securities for permanent investment is generally recognized. Such investments in the utility field, however, have not in many states received the full legal recognition to which they are entitled because of the highly important public function they are performing and the solid nature of the security offered. The system of regulation now in force in most states entitles the utility industry to the same recognition accorded the older branch of utility service represented by steam roads.

There are thirty-one states in which there appears to be an entire absence of statutory authorization to savings banks for investment in gas, electric, telephone or electric railway securities, and two others in which authorization is lacking except for electric railways. The history of public utility securities entitles them to confidence. Practically all such issues are supervised by state agencies of responsible authority. The utilities are essential to every-day modern life. The welfare and progress of the country depend upon their encouragement and development. Archaic statutes enacted to meet situations of half a century ago should give way to non-discriminatory provisions recognizing the public interest in utility investment and placing these public utilities on a fair competitive basis in the money market.

Public utilities must have capital if they are adequately to perform the service that the future will demand. Every legitimate source for this necessary capital should be open to the public utilities on fair terms without discrimination. A substantial portion of such capital will come directly from the consumer himself.

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*Abstract of address before the National Electric Light Association at Atlantic City, N. J., May 18, 1922.

Customer ownership should be encouraged in every way, not entirely because it is a source of capital, but because it constitutes the simplest form of actual public ownership and because the reciprocal responsibilities of customers and utility management will thus be emphasized. While such direct ownership will tend to enlighten public policy, it is also certain to impress emphatically on utility management the outstanding necessity for the best public service. On one hand, you will have public ownership and on the other hand public service.

Public Versus Government Ownership

The tendency is, I believe, toward public ownership rather than government ownership. Such experience as we have had of direct government control and operation has left an indelible impress on the public mind of an unfavorable nature. It would be most unfortunate and disastrous to the public interest were the country to be deprived of individual initiative and enterprise that is prepared to accomplish in the future in the electrical world still more wonderful results than it has accomplished in the past. Government was not established and was not intended to be formed for the purpose of great industrial undertakings, demanding the highest skill, efficiency and economy, knowing neither municipal nor state lines. Wise and fair regulation will encourage development and operating economies without stifling enterprise and at the same time will give to the public the full benefit of reasonable rates. The acceptance of high ideals in the performance of the great public service on the part of utilities will be an assurance against such a calamity as government ownership.

Importance of Interconnection

The problem is that of bringing the cheaply generated energy of the more efficient plants to the ultimate consumer in the most economical manner. It is being solved through the growing network of interconnecting lines. Its effect is quite evident in my own state—Wisconsin. There a number of smaller communities own their own distributing system or generating plant, or both, generally established at a time when the larger and more economic sources of energy were not available. In 1915 only twenty-eight purchased energy from the large private sources of supply and seventy-nine generated their own energy. At present sixty-six are purchasing energy and only twenty-nine developing it. In the meantime many of these municipal plants have been sold and the municipalities have gone out of government operation.

Trend of Legislation

The tendency during abnormal times growing out of the war was to seek a remedy for every unfavorable condition through legislation. There has been an insistent demand for new boards or bureaus to deal with almost every phase of activity. The return to normal will be marked by willingness to give freer reign to the working out of economic laws which in the end must control. This war spirit is exemplified by the habit of calling for legislation to cure every supposed injustice, to interfere with established machinery, and to fix rules of procedure or evidence. When such attempts are aimed at making ineffective the most fundamental principles of constitutional right and protection, the seriousness of the situation becomes apparent to everybody. Commissions, like other boards or administrative bodies, are established in compliance and to comply with the law and constitutional principles. When, as sometimes happens, serious questions arise as to the proper course of administration, such boards or commissions should welcome judicial review and interpretation, and if in the course of an orderly procedure in court for the protection of constitutional rights it shall appear to interested parties that technical or unreasonable rules of evidence are applied, believed to be prejudical, the remedy is not by legislation but by having such rules of evidence duly passed upon by the courts after fair presentation. This government, our institutions, our most highly prized rights, are dependent upon the constitutional and legal provisions for the protection of everybody. Any attempt to change or interfere with the orderly and due processes of courts in maintaining such rights is aimed at the liberties of the people.

Some post-war problems will arise from time to time out of the gradually lowering level of cost from the peak of the war period. The consuming public has not taken the trouble to ascertain that the cost of utility service in many lines has been but little increased over the cost in the pre-war period and has never been increased in proportion to the general price-level increase. It is estimated that the average increased cost of electrical energy to the consumer throughout the country did not reach the general level of pre-war times. The principal assurance therefore in such fields lies in new efficiencies and economies, the benefit of which will be shared by the public. For such efficiencies the utility is entitled to its share of reward.

Regulation

Problems of regulation are coming to be better understood, and commissions and courts are breaking away from such doctrines as theoretical loss in value through so-called depreciation and the arbitrary cutting down of legitimate investment for the purpose of meeting a theoretical loss in value having no relation to cost of retirement and that will never occur, which cutting down of investment can only add to any possible difficulty of meeting any loss in retirements if it should occur. It is to be hoped that the uniform system of accounts proposed by the National Association of Railway and Utility Commissioners may be generally adopted and become the basis of a more uniform and fair treatment of such questions. Another error that is sometimes made is in treating "investment" as though it were synonymous with "original cost," the latter term meaning original cost of physical property still existing. Often "investment" and "original cost" may mean the same thing, but sometimes they may be materially different. Investment may be absolutely necessary, especially in the earlier years of enterprise which represents something beside the original cost of tangible property. Most of the commissions have recognized this fact, though no general rule seems to be possible, and the commissions, it seems to me, rightly scrutinize claims of this nature with care, recognizing such claims only where equity pretty clearly calls for that treatment.

Development of the Electrical Business

A Symposium by

Henry L. Doherty
President
Henry L. Doherty & Company

Guy E. Tripp
Chairman of the Board
Westinghouse Electric & Manufacturing Company

W. E. Robertson
General Manager
Robertson-Cataract Electric Company, Buffalo

W. W. Freeman
President Society for Electrical Development, Inc., and
President Union Gas & Electric Company, Cincinnati

Farquson Johnson
Executive Manager
National Association of Electrical Contractors and Dealers

H. A. Lane
Director
Joint Committee for Business Development, N. E. L. A.

ONE of the outstanding features of the forty-fifth convention of the National Electric Light Association at Atlantic City this week was the symposium on business development held on Wednesday morning. To this symposium all the branches of the industry were invited to contribute, and representatives appeared as follows: For the electric light and power interests, Henry L. Doherty, president Henry L. Doherty & Company, New York; representing the electrical manufacturers, Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company. The electrical supply jobber was ably represented by W. E. Robertson, general manager of the Robertson-Cataract Electric Company, Buffalo. James R. Strong, president of the National Association of Electrical Contractors and Dealers, was unavoidably detained, and Farquson Johnson, executive manager of the association, spoke in his stead. The Society for Electrical Development was represented by W. W. Freeman, past-president of the National Electric Light Association and president of the society. H. A. Lane, director of the joint committee for business development, spoke for the organization which is expected to carry on the work.

Owing to a lack of understanding on the part of the industry as to just what sort of work the joint committee for business development is to take up, it was emphasized that first and foremost there would be no campaign, but a continued and sustained effort spreading over a number of years to interest all branches of the industry in co-operatively working for a greater electrical development of the country; second, that the purpose was not to establish a big machine at a central point to carry out a plan, but to get local interest back of the movement through the formation of co-operative leagues in every large city. In this work the central-station company is expected to take a leading part.

JOINT SALES EFFORT NEEDED

Quoting the oft-repeated statement that "electricity is only in its infancy," Henry L. Doherty said the truth of the matter is that electricity is today the best developed science we have, but the science has been developed in all of its various stages so rapidly that it can truthfully be said that the applications of electricity in relation to its opportunities are still in their infancy. He intimated that what is needed is joint sales efforts and still more joint sales efforts, because it will be true for many years to come that the engineers can point out actually developed apparatus for the application of electricity faster than the sales efforts of the industry can realize upon the opportunities.

Every sound business proposition, he said, is based upon the fact that it supplies some service or commodity to its customer at far less than its true value. There are natural limits that fix prices. The lower price is limited by the cost of production. Nothing can be sold permanently at a price less than its cost of production. The higher price is fixed by the fact that nothing can be sold above its value to the user. Between these limits the price must lie, and almost universally the price is fixed only slightly above the cost of production, regardless of how great the value may be to the user.

Big business, said Mr. Doherty, cannot haggle and bargain, but must serve all at a published schedule and serve all at the lowest possible cost. We build, he said, a water-power plant in some sparsely settled section of the country and carry energy to the near-by market, supplying electricity in many places where central-station service has never been had before. Perhaps many of the power users in the district have been generating power at a cost of five or six times what is charged them, and the users start out with a dividend from business of perhaps five-sixths of their entire previous costs for power. Yet, said Mr. Doherty, these users who have received such huge benefits later show a desire to quarrel with the central station if it happens to make any profit out of the relatively small payments it receives from the sale of energy, in the light of the value of the service to the public.

Mr. Doherty expressed the opinion that the great business successes of the country have generally been made by the men who have entirely lost sight of the money profits they would make out of business. Success has largely been achieved by the men who have loved the game. All men probably have sufficient altruism in their make-up, Mr. Doherty continued, to prefer to sell something valuable to the buyer rather than something that has no value, and in his opinion every salesman can work better if he thoroughly appreciates the fact that he is selling something to the buyer which is vastly more valuable to that buyer than the amount he pays for it.

From the standpoint of the central-station company whose object it is to get the best appliances into the hands of its customers and which is not interested in competitive selling, Mr. Doherty contended that the utilities are in every instance doing vastly more in their salesmanship to benefit the public than the benefit which is realized by the utilities. The greater the development of the use of electricity the more possible it becomes to serve sparsely settled districts, so that intensfied salesmanship is cumulative in its good effect. If electric service is used for any purpose in one house or one factory, said Mr. Doherty, why stop until it is used in every other home and every other factory? Some day, he said, a study will be made of every bit of human labor that is done with the idea of applying electricity as an aid thereto, and he expressed the hope that the inauguration of the joint sales effort would soon bring about that consummation.

Viewpoint of Manufacturer

Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, outlined very clearly the work to be done by the manufacturer, jobber and contractor-dealer and how that work should dovetail with the work of the central station. In General Tripp's estimation whatever is the soundest method of distribution will in the end lead the procession, and the relative character of public service which is rendered in the development of the central-station field forms one of the best tests. The complete address of General Tripp is printed elsewhere in this issue.

The Jobbers Anxious to Co-operate

W. E. Robertson of Buffalo expressed the appreciation of the jobbers for the appointment this year, by invitation of the N. E. L. A., of one of their number as a member of the executive committee of the central-station organization. This is the first time that such action has been taken and indicates the growing recognition of the interdependence of the industry's different branches. "Instead of being overawed by central-station men, I have been overwhelmed by their consideration," declared the speaker. He then expressed the appreciation of the jobbers of the prospective attendance of President Bump of the N. E. L. A. at the forthcoming Hot Springs convention of the Electric Supply Jobbers' Association. This will be the first time that a president of the National Electric Light Association has adressed that branch of the industry.

Mr. Robertson said that the jobbers' ability to help in creating the larger market for electrical service and equipment is twofold, first, through the co-operative effort in larger cities of jobbers as important factors in distribution, working with the manufacturers' representatives, contractor-dealers and central stations in putting on campaigns such as the "home electric," electric shows, special drives for seasonal devices and similar movements.

Contractor-Dealers Indorse the Movement

The executive manager of the National Association of Electrical Contractors and Dealers, F. Johnson, said that the joint committee on business development has the unqualified indorsement of the contractors' association. An earnest and honest effort has been made to create a spirit of enthusiasm for the movement among the contractor-dealers of the country. So far only slight success has attended the efforts, and this Mr. Johnson attributed to the fact that central-station companies and electrical contractors are about as close together in co-operation as capital and labor. This, he said, was a mistake because their interests are the same. Both should face the situation fairly and squarely, and they should work together for the public and for the good of all.

Program Especially Appropriate Now

W. W. Freeman, speaking as president of the Society for Electrical Development, pledged the unqualified support and participation of that organization in the movement. From his experience as a central-station executive, Mr. Freeman said that it was obligatory upon the public utilities to serve and expand their facilities to meet the growing demands of the public. It was also expedient from a financial point of view that the development be intensive so that the public utility might realize the largest income from its investment. Unlike other businesses, the turnover in the electric light and power industry is very small, and in the interests of stability every effort should be made to increase it. Time was, he said, when a revenue of $3 per capita was considered fair, but today a revenue of $13 per capita is no more satisfactory than the smaller sum was in former days.

The "Electrify America" Movement

H. A. Lane, director of the joint committee for business development, in outlining the plans for the movement, said:

"In the movement to electrify America it has been very aptly said that unified effort could be very well expressed as 'Work together and win together.' The financiers of the country are optimistic in their views as to the future of business. With this optimistic view it behooves all branches not only of the electrical industry but of every kind of business to lay plans to revive now dormant business into very aggressive action. Because the electrical industry is of such immense proportions, the American public perhaps looks, at least in a measure, to this industry to lead the way and to express its faith in the future of America. Now that the price of money has decreased, the leaders of the electrical industry feel that it is the proper time to undertake boldly the resumption of normal and of greatly increased business activity."

This note was first sounded by President Bump when he invited representatives of the electrical organizations to a meeting early in the year. The suggestion made by him was most heartily indorsed, and as a result of the meeting the joint committee for business development was created. The personnel of this joint committee includes representatives not only of the national electrical associations and those affiliated with them but of individual business organizations. In the formation of this joint committee the main purpose was to crystallize all past efforts into a well-defined program which would have for its ultimate purpose the initiation of local business development activities in every city.

The joint committee is to act as the clearing house for activities so that from the experience of others local interests may take advantage of what has been accomplished and duplicate in a measure the achievements of other towns. "By working together we will win together," said Mr. Lane, "and the electrical industry as well as all other branches of business will be stimulated and normal conditions restored."

The Manufacturer, Jobber and Contractor-Dealer[*]

How the Functions of One Dovetail Into the Others', and the Relation Each Bears to the Electric Light and Power Industry

BY GUY E. TRIPP
Chairman of the Board
Westinghouse Electric & Manufacturing Company

I HESITATE to speak at all upon the subject of developing the business of the electric light and power industry in the presence of this body of experts, and I resolutely decline to talk about specific or detailed methods, because I realize that my only safeguard is to deal in generalities. There are at least two kinds of generalities available to me—one way being to use my ingenuity in stating in as many ways as possible that we all ought to get together and push the business, and the other way being to select one or two general problems of the industry and tell you what I think about them. The one which most interests me is the relation of the electric light and power company, the manufacturer, the jobber and the dealer. This particular subject is a complicated and delicate one, notwithstanding that the field of endeavor of each of the parties is theoretically clear and the end to be achieved is agreed upon on all sides. I will not risk myself so far as to discuss the ethics of this relationship, but I am going to say a word or two about its action and reaction in the field of development of the business of the electric light and power company.

GUY E. TRIPP

EVOLUTION OF THE JOBBER

In the early days of electricity the inventor-manufacturer covered the whole field, just in the same manner that steamboat and steam-locomotive inventor-manufacturers covered their field; that is to say, they built the machines and they operated them. The rapid growth of the electric light and street-railway business into a public necessity soon relegated the manufacturer in the main to his own job because both jobs got too much for him. Up to this time there was no demand for the work of the jobber, and the two other parties had the field to themselves. It was only when the people in the electrical industry, both the manufacturer and the electric light and power company, awoke to their shortcomings as business developers that a job was made for the jobber.

The life of the pioneer jobber was not always happy in those days when electric light companies followed the practice of furnishing free lamp renewals and cut prices on other supplies—a method of lottery management which defied accurate accounting on the part of the utility and furnished a kind of competition which drove the jobber to despair. But the jobber lived on, not because he was of much account as a load builder for the light or railway company, but for the reason that he was a convenient warehouse for the company itself. He carried supplies which could be had at a moment's notice, and that was worth a good deal.

It has been only in very recent years that the jobber has had his opportunity as an important ally of the utility in the field of new-business development, and it is only in a comparatively recent time that the electric light and power companies have recognized the great value of the jobber and dealer in the capacity of load builders. The general position of these interests in the electrical trade, so far as it has been developed, is a perfectly logical result of the evolution of the business. Of course, the lines of endeavor are not clearly drawn. Manufacturers are still in the field as operators of public utilities, and they are also in the jobbing field, and to a lesser degree some light and power companies are still in the dealer field, although they have kept out of the domain of the manufacturer.

For the purpose of a discussion of business getting it makes little difference whether a public utility is operated by an electrical manufacturer or not, but the policy of the manufacturer or the light and power company in entering the dealer business may produce an effect which may either increase or decrease the rate of the growth of the light and power company's load.

The relation of the jobber to the dealer is a most important factor in the situation, and I shall refer to it a little further along in this paper. I mention it now only for the purpose of giving notice that I am going to place upon the jobber some responsibility for the dealer, and also to charge the dealer to the account of the jobber as an asset.

ATTITUDE OF MANUFACTURER TO JOBBER

But first I ask your attention to the attitude of the manufacturer toward the jobber, and here there are a number of features involved. What the manufacturer wants is a wide distribution of his goods, and where in any locality this is accomplished by dealing through independent jobbing houses, no better results being possible of attainment by investing his money in the creation of new jobbing houses or by the purchase of existing ones, the manufacturer, since he ordinarily has other uses for his money, will probably not wish to make the investment.

There is, however, one complication which I see no way to avoid, and that is that the jobber in practice, by reason of obtaining quantity discounts and for other reasons, often finds it expedient to tie up with one manufacturer or another as his sole representative in one or all lines of apparatus. Therefore we have in such cases a situation of the jobbing houses being recognized as the agents of one manufacturer or another. This sets up a condition under which, on account of the keen competition, manufacturers become critical—many times overcritical—of the distribution outlet furnished by the agent's jobber, often for reasons quite apart from the jobber's abiilty, and this is a force which tends to induce the manufacturer either to enlarge the outlet or create new ones.

What the ultimate result of this tendency will finally

Speech delivered before National Electric Light Association at Atlantic City, May 17, 1922.

be it is difficult to state, but, if it should come about without any plan or program, simply through force of circumstances that the large manufacturers should to a still larger extent control their own jobbing houses, it brings forward an interesting problem as to what the effect will be upon the independent jobbers. By "independent" I mean those who buy their goods from any source which they choose and offer any kind of apparatus without restriction. They, of course, are bound to be in competition in some cases with the houses owned by the manufacturer, and, therefore, as to those cases at least, there must be a conflict of interests; but there is certainly one direction in which they can establish themselves in the strongest possible defensive position, and that is by allying themselves with the central-station company.

THE JOBBER AS AN ALLY OF THE CONTRACTOR-DEALER

If an independent jobber becomes a valuable load builder for the central station in his territory, he may be sure of co-operation and support, and that is the central point to which my remarks have led, viz., that the greatest opportunity for the highest development of the business of the jobber, independent or otherwise, lies in the direction of establishing himself, not as a mere vender of electrical appliances, but as a great power in the development of the electric light and power field of the country.

It is easy to say that if a jobber attends to his own business and sells goods, the result will be what I have just mentioned; but that is not the answer. His numerous salesmen are all available to spread proper propaganda in favor of the central-station company. He can furnish service to his customer of a character which will minimize criticism of service of the central station, and in general he can so conduct himself as to compel the central station to become his ally. But his most fruitful field is that of the dealer and contractor. By the selection, education, support and encouragement of the right men in these departments which furnish the touch with the public, the jobber may be able to build up a capable trade organization which will not only support his own business but which will also be a business-building organization for the central stations and which will command their support. He is, in fact, in the unique position in the electrical industry—a position which does not exist, I think, in the ordinary jobbing trade—of being able to secure valuable trade indorsement of a powerful interested party. He is a free agent and is no longer in the position of being ground between the upper and nether millstones of the manufacturer and the dealer central station of an earlier time.

I am not prepared to say that the present tendency of the manufacturer to control his distribution outlet will grow to any larger proportion than now exists or whether it is actually sound from an economic standpoint, but I do believe that whatever the future development may be, it will be the result of a slow growth and come about from the efforts of the electrical distribution business to find itself; and that the pivotal point around which the whole problem swings is the question which system is most demanded in the process of growth and development in the electric public utility field, and that demand will be measured by the relative value of the support which a given system furnishes in the matter of central-station business development, and central-station business development is only another name for public service.

GROWTH OF SUPERPOWER SYSTEMS

All interests in the public utility field realize that the electric light and power business is taking on a new form of development and is rapidly becoming a national public utility. The growth and rapid expansion of superpower lines, which entirely ignore state boundaries and reach into the operation of our national railway system, and the federal water-power act providing for water-power development on rivers coming within the jurisdiction of the United States government—and most of the important powers are on such rivers—inevitably tend to bring the industry more and more under the eye of the federal government.

This, together with the growth of powerful holding companies, whose operating properties cover large territories, necessarily has an effect upon the problem of distribution of electrical apparatus, and it would appear obvious that the effect will be in some case unfavorable to the small local jobber. If this is so, we should naturally look in the future to seeing an increase in the number of larger jobbing houses of the character of many with which we are familiar, covering a wide territory.

I should not, however, regard this evolution as at all inimical to the independent jobber. It simply furnishes an enlarged opportunity for outstanding vision, courage and ability. It also furnishes a greater field for a more comprehensive co-operation with the central-station interests and for the establishment of a business-getting value which will be an insurance for the future.

If I have made myself intelligible, you will understand that I have been leading up to the following summary of the situation between the manufacturer, the jobber, the jobber controlled by the manufacturer and the independent jobber—viz., whatever is the soundest method of distribution will in the end lead the procession, and one of the tests of which is the soundest, generally speaking, will be the relative character of public service which either one system or the other renders in the development of the field of the central-station company.

CENTRAL STATIONS MUST PROVIDE FAIR FIELD

I have devoted a lot of space to the outline of one of the tests which I think will help to determine the best method of distribution of electrical supplies and have based my whole argument on the premise that the central-station companies will furnish an equal opportunity of endeavor, and that they will judge the activities of all who work in their field solely from a standpoint of results, with a full understanding that co-operation means joint action.

I regard the problem as essentially a local one and believe that it is impossible to proclaim a policy which can be reduced to a list of rules and regulations for individual power companies, but in general if the manufactures, the jobber and the dealer are to be regarded as branches of the industry whose value is to be measured by the help they give in the development of the business of central-station companies, then the National Electric Light Association must carry the banner of a fair field and no favors.

Technical Sessions

Program

MONDAY, MAY 15

Address of chairman, N. A. Carle.

Report of committee and vote on constitutional amendments.

PARALLEL SESSION

Report of committee on hydraulic power, Markham Cheever.

Report of committee on underground systems, D. W. Roper.

Report of committee on safety rules, Thomas Sproule

TUESDAY, MAY 16

Report of prime movers committee, H. P Liversidge.

PARALLEL SESSION

Report of committee on inductive interference, A. E. Silver.

Report of joint public policy sub-committee on inductive interference, R. F. Pack for N E. L. A. and Bancroft Gherardi for the A. T. & T. Co.

WEDNESDAY, MAY 17

Report of committee on electrical apparatus, A. H. Lawton.

THURSDAY, MAY 18

Report of committee on overhead systems, L. M. Klauber.

PARALLEL SESSION

Report of meter committee, W L. Wadsworth.

Paper, "Analysis of Economic Loss Due to Power Factor—Basic Meterable Factors," R. C. Fryer, J. E. Doran and J. B. Hodtum.

THE spirit of co-operation manifested by power and communication interests in attacking the inductive-interference problem and the general opinion that causes of service interruption should be carefully analyzed to eliminate them characterized the activities of the technical sessions of the National Electric Light Association convention this week. The importance of specifically defining the duty cycle of circuit breakers and the desirability of considering the safety code from a broad rather than a local point of view were leading topics at two of the sessions. Increasing attention to automatic operation of stations and out-door construction was also given.

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Inductive Interference

With a better and broader understanding of the situation, said A. E. Silver, chairman, inductive interference is generally recognized as a problem mutual in all its aspects, including the contributing causes, remedial measures and responsibilities of the signal and supply companies for its prevention or reduction. In its broad aspect the problem is not only one of mitigating present difficulties, but, what is more important, it is a problem of advancing and developing the art to the end that power and signal systems may be brought together harmoniously in rendering service in all communities.

A plan for the solution of inductive-interference problems has been recommended to the joint general committee representing the telephone and power interests, which includes co-operative planning for all new construction and general methods of co-ordination of both classes of lines by the use of precautionary methods which can be reasonably applied under conditions generally prevailing as distinguished from special situations.

Printed copies of the principles and practices for the inductive co-ordination of supply and signal systems completed since the printing of the regular committee report brought what some speakers described as a love feast in the discussion, which was remarkable not only because of the spirit of friendliness and co-operation but also because of the presence of some thirty-eight representatives of the American Telephone & Telegraph Company and the active participation of many of these men in the discussion.

R. F. Pack, in presenting the second report of the joint public policy committee for the National Electric Light Association, outlined the organization and earlier report of the committee and then presented the group of principles which he announced as having been agreed on by the representatives of both the light and power and telephone interests. The principles recognize broadly that both classes of service are essential to the public, that the problem is mutual and the solution must be co-operative. They emphasize first the duty of co-ordinating the signal and power systems to prevent interference due to the inductive susceptiveness of the signal circuits or the inductive influence of the power circuits. Complete co-operation, including mutual discussion of plans for construction or changes in either system's operating conditions, comes second, and detailed principles for the location of signal and power lines on the highway follows the specific recognition that highway use is essential to the economical and effective operation of both classes of service. Confidence, conference, co-operation and co-ordination were presented by Mr. Pack as essentials in carrying out and making effective the principles, which he characterized as useless unless they were taken home and applied by the power and telephone companies in the spirit in which they were developed.

That there must be contact sufficient to insure a sympathetic understanding of the other man's problem before there could be effective co-operation was the gist of Bancroft Gherardi's report for the Bell telephone companies. On this basis he announced that steps had been taken to insure that the various Bell company officials and employees should know personally the men of the power organizations with which they must deal. Other speakers were L. H. Kennard, Bell Telephone Company of Pennsylvania; Paul Spencer, United Gas Improvement Company; J. A. Stewart, New York Telephone Company; Farley Osgood, Public Service Electric Company of New Jersey; A. D. Colvin, Hartford Electric Light Company; J. H. Matthews, Illinois Commerce Commission; G. C. Neff, Wisconsin River Power Company; C. P. Cooper, Ohio Bell Telephone Company; A. B. Campbell, Iowa Railroad Commission; P. M. Downing, Pacific Gas & Electric Company; E. H. Everett, New England Telephone Company; C. B. Hayden, Railroad Commission of Wisconsin, and W. E. Mitchell, Alabama Power Company.

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Prime Movers

Operating under the impetus established by the work of the prime movers committee during the last few years, this committee, under the excellent guidance of H. P. Liversidge of the Philadelphia Electric Company, presented a report this year which is the equal of previous years' reports in content as well as volume. The details are presented elsewhere in this issue.

The record which was presented on turbine outages and the efficiency and operating expenses of powdered fuel installations attracted the most discussion. O. F. Jungren of the General Electric Company expatiated on the relative advantages of single-drum and double-drum-type turbines, while F. Hodgkinson of the Westinghouse Electric & Manufacturing Company undertook to reply to many of his comments. Mr. Jungren contended that the temperature stresses, weight and size of the double-drum turbine are greater than those of the single-drum type, whereas Mr. Hodgkinson maintained the opposite. They agreed, however, that the conclusions regarding the relative merits of these types could hardly be drawn from the data presented, because most of the units were constructed under stress during the war period. Mr. Hodgkinson also pointed out that it is difficult to produce the most economical and reliable turbine and still meet competition. Since the construction of these turbines some very extensive investigations have been made to determine the causes of outages so that the possibilities of their recurring are very remote. Owing to the race for the greatest capacity at the lowest speed, the greatest development is likely to be in low-pressure turbines, Mr. Hodgkinson declared. He also expressed the belief that the next step will be toward higher pressure, possibly 500 lb. or 600 lb., but not toward higher temperatures. Hence the problem will be to separate the moisture which condenses in the lower-pressure stages. Turbines developed along these lines may not be so economical as the present ones, but the fuel economy of the plant should be increased. Stage bleeding for feed-water heating seems to be the tendency, and manufacturers must be prepared to permit the drawing off of steam at 150 deg. to 200 deg. Fahr. It is possible that heaters may be incorporated in the turbines so long as they do not imperil the structure of the turbine, Mr. Hodgkinson declared.

The real significance of the turbine committee's report on outages of turbines was sensed by E. S. Sniffen, Westinghouse Electric & Manufacturing Company, in the opinion of I. E. Moultrop, Edison Electric Illuminating Company of Boston. Mr. Sniffen pointed out that the real value of the data is the opportunity they offer to ascertain the causes of service interruption. He declared that if the turbine sub-committee on co-operation with the manufacturers would endeavor to classify still further the causes of outages so that manufacturers would have some basis on which to work in preventing their recurrence results of real value could be obtained. He also pointed out that it is necessary to determine what care shall be exercised in erecting them, and what operating rules shall be enforced.

Mr. Moultrop emphasized the fact that reliability ranks first in importance and economy second. A few per cent decrease in economy is of little importance when compared with the investment in turbine equipment which will lie idle when a unit is out of service.

Experience with Powdered Fuel

Some results of efficiency tests at the Lakeside powdered-fuel station of the Milwaukee Electric Railway & Light Company and operating costs per kilowatt-hour were given by John Anderson of that company. He declared that if members are willing to accept the facts which he presented, they would no longer question the advisability of installing powdered fuel. The plant has been operating for fourteen months, one-half the time with one 20,000-kw. unit installed and the remainder of the time with 40,000-kw. in equipment installed. During that time 200,000,000 kw.-hr. has been generated without interruptions. Since operating conditions have not been adjusted to the point where the guaranteed turbine water rate has been obtained, and since continuous fuel composition has not been obtained, the most favorable economy and operating results have not been secured so far. Nevertheless, with coal varying from 9,000 to 13,500 B.t.u. and 15 per cent ash, and with a night load only 30 per cent of the day load, the following results have been obtained. Station water rate, 12.7 lb. per kilowatt-hour; steam for auxiliaries (allowing for banking of boilers), 2.4 per cent; boiler efficiency, 84.2 to 85.9 per cent (during steaming periods); over-all plant efficiency, 83.2 to 84.48 per cent; B.t.u. per kilowatt-hour (net), 19,097, and thermal efficiency (net), 17.88 per cent. When more normal conditions are obtained, Mr. Anderson feels confident that a thermal efficiency of 19.2 per cent and a boiler and economizer efficiency of 88 per cent will be obtained. From the tests which have been made he has come to the conclusion that the coal must be dried to contain not more than 7 or 8 per cent moisture, since anything in excess of this amount will cause irregular feeding of the fuel and increase the cost of conveying it. With a unit coal cost of $28.78 per 1,000,000 B.t.u. and a unit labor cost of 62.5 cents per man-hour, a total operating expense of 0.5053 cent per kilowatt-hour has been obtained. These figures also can be improved, he declared, when operating conditions become more normal.

Since it was necessary to do considerable pioneering in constructing this plant, it cost more than one should cost now that more experience is available. Mr. Anderson declared that if a plant were constructed now it could probably be built for 10 per cent less than the Lakeside plant. Answering some comments which have been raised regarding trouble with ash issuing from smokestacks of powdered-fuel installations, Mr. Anderson pointed out that 70 per cent of the ash is being removed at Lakeside before it enters the stacks by utilizing washers in the breeching back of the boilers.

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Electrical Apparatus

The more definite basis which has been established for rating oil circuit breakers and the account which was presented of automatic substations which have been installed recently constituted the principal features of the electrical apparatus committee report Wednesday afternoon, but the discussion extended into other fields. The features of the report are presented elsewhere. Notable among the subjects considered in the discussion were regulation of radio broadcasting, the standardization of service voltages, closed-circuit generator ventilation, use of inert gases to stifle generator fires and effectiveness of differential relays in disconnecting generators developing internal trouble. However, the chief discussion centered around what constitutes the duty cycle of an oil circuit breaker.

H. R. Summerhayes, General Electric Company, pointed out that the reason for proposing that the duty cycle start with the breakers in the closed position was that most breakers are in this position when they are subjected to a short circuit. When the short circuit occurs before the breaker is closed, the circuit conditions are usually investigated before the breaker is reclosed, so that it is possible to utilize a breaker rated on the one-shot basis. Mr. Summerhayes declared that manufacturers are willing to rate circuit breakers on any duty cycle so long as it is definite.

In answer to Philip Torchio, New York Edison Company, who asked why a duty cycle should ever be considered as starting with the breaker open, C. H. Roth, of Roth Brothers & Company, Chicago, pointed out that the Power Club considers that a breaker has performed its function after it has successfully opened a circuit so that the cycle should end with the breaker open. Mr. Torchio, however, contended that the requirement of a breaker is not only to open but to

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A. H. LAWTON
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L. M. KLAUBER
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MARKHAM CHEEVER
Chief Engineer and
General Superintendent
Utah Power & Light Co.

W. L. WADSWORTH
Superintendent of Meters
Minneapolis General Electric Co

D. W. ROPER
Superintendent Street Department
Commonwealth Edison Co

A. E. SILVER
Electrical Engineer
Electric Bond & Share Co

THOMAS SPROULE
Assistant to General
Superintendent of Distribution
Public Service Electric Co. of N.J.

Chairmen of technical committees who presented reports at the Atlantic City convention and names of their respective committees: Mr. Liversidge, committee on prime movers; Mr. Lawton, committee on electrical apparatus; Mr. Klauber, committee on overhead systems; Mr. Cheever, committee on hydraulic power; Mr. Wadsworth, committee on meters; Mr. Roper, committee on underground systems; Mr. Silver, committee on inductive interference; Mr. Sproule, committee on safety rules.

be able to close again. This requirement can be met, said Mr. Summerhayes, even with the duty cycle preferred by the Power Club by specifying a three-shot rating where two-shot duty is expected. The only purpose of adopting a definite duty cycle is to permit the comparison of breaker performance. G. L. Knight, Brooklyn Edison Company, referred to some extensive tests of oil circuit breakers in Baltimore, the results of which should dispel the fears of many central-station companies. These tests indicated that the majority of breakers would open five or six times at least. He also referred to straight-through disk-connecting switches which manufacturers will make available shortly as a means of eliminating the necessity of locks.

Recommendation was not made to standardize service voltages at this time, because of the difficulty which many central stations anticipate in adapting their systems to one standard. A tentative standard of 115 volts is therefore retained with recognized departures of 110 volts and 120 volts. However, a motion was made and passed that it was the consensus of opinion of the electrical apparatus meeting that the recommendation on service voltage be indorsed with a view toward ultimate adoption by the association.

The high points of the radio conference at Washington, so far as it bears on the central-station use of radio, were reviewed by C. T. Sinclair, Pennsylvania Water & Power Company, who pointed out that N. E. L. A. representatives at the conference proposed modifications of wave lengths where the radio telephone is used by central station companies. It was also brought out at the conference that an unnecessary handicap would be placed on central stations in the use of radio if the telephone operators are required to pass the radio operators' examination now required for broadcasting in general. Since the broadcasting which would be done by central stations is not required to extend beyond its system, and since the reception of other broadcasting on the central-station radio system would be a decided disadvantage in interstation communication, it was recommended that central-station radio-telephone systems should not operate at broadcasting frequencies. Wave bands of 3,300 m. to 2,850 m. and 1,650 m. to 1,550 m. were proposed. Permission was given by the conference to operate central-station radio stations with only a general knowledge of sending and receiving and the ability to receive Morse code at ten words per minute.

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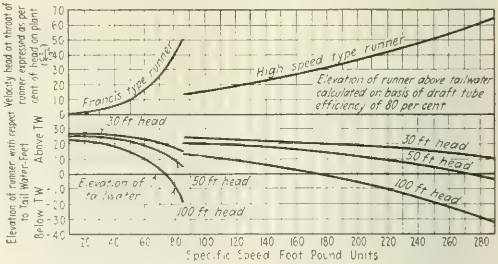
Hydraulic Power

So much valuable material was accumulated by the hydraulic power committee, Markham Cheever chairman, during the year that the committee found it possible to make only a general résumé of its efforts. The investigation indicates that the principal progress in the design and construction of waterwheels and governors includes the further development of the high-speed runner, the flaring-draft tube, the further application of the overhung runner to the reaction turbine, the adaptation of governors to such special requirements as remote-control and automatic plants, and the further refinement of structural details of both wheels and governors. The development of larger units and lower heads has increased the demand for wheels of high specific speed. To meet this demand the unshrouded or propeller type of runner is rapidly developing in various forms.

One of the most interesting developments in turbine design is the inverted turbine which overcomes excessive draft-tube excavation and permits of inspection without stoplogs in the mouth of the tube. The ejector turbine is also an interesting development. This turbine makes provision for admitting water from the casing directly into the draft tube below the runner. In times of flood and high backwater this high-velocity bypassed water is used to increase the draft head and tends to maintain the power.

The success of outdoor substations in practically all climates has focused the attention of the designer on the possibility of further capital saving through the omission of the building housing the generating equipment. Operators at the present time do not favor the outdoor generating stations, believing that the objections to them outweigh the saving in capital cost.

The discussion of this report centered on the difference in operating conditions which will exist when hydro-electric plants are installed outdoors or half outdoors, the reasons for using semi-outdoor construction and the value of hydraulic instruments.



COMPARISON OF FRANCIS AND PROPELLER TYPE RUNNERS

Since the placing of units outdoors involves a changed problem of ventilation and prevention of condensation of moisture on the windings, manufacturers are eager to get the operating viewpoint, said F. C. Hanker, Westinghouse Electric & Manufacturing Company. In considering outdoor construction, however, H. L. Wills, Georgia Railway & Power Company, warned that a company should not lean over backward and hesitate to adopt it just because it had not been done before. By proper housing the unit can be made as immune from weather conditions as if it were placed indoors, and repairs can be as easily taken care of by transferring the parts to an adjacent repair shop as by distributing them all over the floor of an indoor station.

Semi-outdoor construction at the Mitchell Dam plant of the Alabama Power Company, now under construction, was forced by the use of the backwater suppressors, declared J. M. Barry. In other words, to take advantage of the back-water suppressors the waterwheels had to be placed opposite the spillways. The wide separation of the generators thereby required virtually prohibited a single superstructure. Instead, separate inclosures with a removable roof are placed over each generator so that a single gantry crane can be used to handle any generator or waterwheel part.

L. M. Pharis referred to a semi-outdoor generating station of the Utah Power & Light Company which has been in satisfactory operation since 1918. No units have had to be dismantled since installation. Another plant is under construction which will have generators with totally exposed thrust bearings and generator frame caps.

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Overhead Systems

Standard specifications for construction materials used on overhead systems and a method by which such standards may be formally adopted and promulgated by the association were among the chief subjects considered in the report of the overhead systems committee, L. M. Klauber chairman. The report also included new specifications for Western red-cedar poles, studies of the timber preservation situation, information on insulator practice and research, and construction and maintenance equipment and methods.

The specifications for construction materials have been modified so that now forty-four standards are ready to be studied and adopted by the association.

A résumé of the timber preservation situation emphasizes the fact that preservation is essential, and the open-tank treatment is especially commended. Four lines involving 3,626 poles are covered in the investigation. Of these poles 906 were treated with creosote in open tanks, and after being in service from nine to fourteen years only seventy, or 7.7 per cent, showed signs of decay. On the other hand, of the 1,001 poles to which a brush treatment with either creosote or carbolineum was given, 847, or 84 per cent, showed signs of decay.

As regards ravages of termites in wood poles, one company found that 80 per cent of the poles set before 1916 were affected. At present the best method of preventing their attacks seems to be impregnation of the timber with coal-tar creosote.

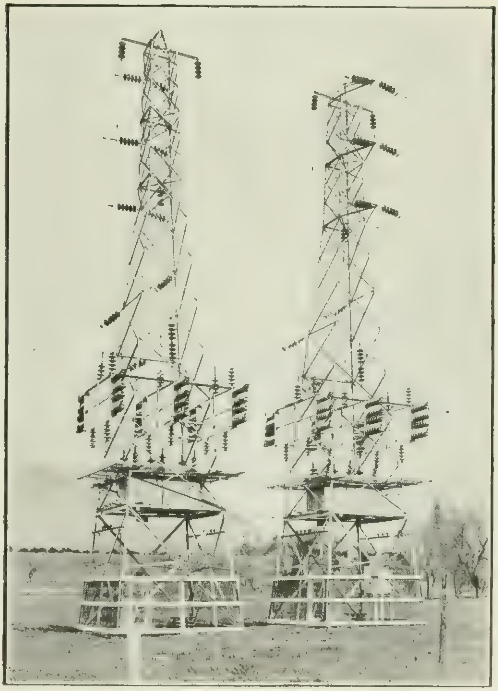
Considering insulator practice, the general expression among companies using either the suspension or the pin type is much more optimistic. Overinsulation is often desirable and may be economically justified in the majority of cases. Research on insulators during the past year consisted for the most part of an accelerated life test under non-humid conditions, corresponding to a period of actual life in service of ten years.

Work done on high-voltage transmission shows the consensus of opinion to be that 220-kv. transmission differs from that at 165 kv. in magnitude only and that no extraordinary or new phenomena need be expected. Experiments that have been in progress upon a 27-mile length of one of the Big Creek lines of the Southern California Edison Company indicate that corona losses with this voltage are in accord with the Peek formulas.

From the reception given a questionnaire sent out to ascertain the advisability of higher-voltage distribution lines it is evident that this is a subject of great interest and worthy of study. For many situations the well-standardized 2,300-volt and 4,000-volt systems are proving entirely inadequate or uneconomical. Several distribution lines operating at 6,600 volts, 11,000 volts and even higher voltages are being used to serve extensive areas.

The forty-odd items reported on the construction-materials specifications section of the report of the overhead-systems committee and the pole specifications in the report were formally accepted in the meeting of the committee on Thursday afternoon as recommended uniform tentative practices for use during the coming year by the members of the association.

The need of seasoning cross-arms as called for in the tentative specifications was questioned by John S. Ware of the Public Service Electric Company of New Jersey, and he suggested that the percentage of sap wood should be left to the judgment of the purchaser. The cross grain and check restrictions were characterized by Mr. Ware as too stringent. A plea for simplification and condensation of specifications was also made, including a suggestion that the new method of designating the classes of poles was enough like the old to cause some confusion. Thomas Sproule of the Public Service Electric Company of New Jersey urged getting away from designating poles by top dimensions and the adoption of butt dimensions.



COMBINED TRANSMISSION LINE SUPPORT AND OUTDOOR SUBSTATION

W. K. Vanderpoel of the same company made a plea for the establishment of an inspection routine commensurate with the size of each member company for the inspection of construction materials.

H. W. Young of the Delta-Star Company said that tests made on the self-renewing fuse in Los Angeles recently were very satisfactory. Three fuses are used in each conductor of the circuit, and the second fuse went into service in from 30 cycles to 60 cycles after the first blew on a 50-cycle circuit. With about 500 transformers equipped, L. L. Elden of the Edison Illuminating Company of Boston said his company had found it possible to operate distribution transformers controlled by thermal indicators at a maximum of 175 per cent of rating night after night, and at 110 per cent of rating during the hot summer months, without the loss of a single transformer.

Some disagreement was indicated by Mr. Elden as to the consistency of the claim that corrections for ambient temperature should be made in temperature control of distribution transformers when the practice is not followed with substation transformers. Tests indicate that the temperature-indicating device should be installed directly over the transformer core so that the stream of warm oil from the coils will strike it. The devices should be placed away from the influence of the temperature of the case. That 7,500 farmers in Wisconsin have electric service, which, on a basis of three customers per mile, indicates approximately 2,500 miles of circuit, was asserted by G. C. Neff, Madison, Wis., with the commission records of that state as authority. This is nearly equal to the entire mileage of pole lines in the city of Chicago, said Mr. Neff, and on this basis he estimated that if all the farms in the country were served, the mileage of lines would equal those needed for city and suburban service.

Safety Rules

The report of the safety rules committee, Thomas Sproule chairman, was presented as a progress report and was a résumé of the activities of the committee since the last convention. They have consisted principally of a study of the third edition of the National Electrical Safety Code as revised and issued about one year ago. A complete list of the rules of the code which have been discussed by the committee is included, together with recommendations for such changes as were thought desirable, in order that the code may more nearly conform to well-established practice.

The committee has strongly expressed itself as favoring the unqualified indorsement of the National Electrical Safety Code as the standard for the preparation of regulatory rules. This indorsement is expressed notwithstanding the fact that there are important rules included to which the committee cannot agree.

It is the hope of the committee that all rules difficult of interpretation or which result in unnecessarily expensive construction will be promptly brought to its attention.

In the discussion on the safety rules committee's report the need felt by some of the state utility commissions for specifications that cover more things than hazardous conditions was brought out by J. H. Matthews, service engineer of the Illinois Commerce Commission. He called attention to the fact that regulatory commissions must consider character and quality of service.

Lack of knowledge of the National Electrical Safety Code on the part of utility managers, many of whom had never even heard of it, was given by A. B. Campbell, engineer of the Iowa Railroad Commission, as a common situation in his experience in dealing with the smaller utilities.

A recent section of the New York, New Haven & Hartford Railroad in sending out wholesale notices to telephone and power companies for the reconstruction of crossings in accordance with the American Railway Association specifications, which are more severe than the electrical safety code, aroused a lively discussion.

That the National Electrical Safety Code was not intended to be retroactive and should apply only to new construction, and also that it must not be expected to meet the complete approval of any body or even of any one individual, was the view expressed by Dr. M. G. Lloyd of the Bureau of Standards in closing the discussion. He also expressed gratification at the new method of working out changes of the code through the committee formed under the supervision of the American Engineering Standards Committee.

Underground Systems

The collection of data on failure of underground cable operating at voltages from 6,600 to 25,000 inclusive is a feature of the report of the underground-systems committee, D. W. Roper chairman. The aggregate of all systems covered represents 4,675 miles of cable, on most of which approximately 12,000 volts is employed. The results for 1921 show a total of 467 cable and 192 joint failures, which is equal to 14.1 failures per 100 miles. If the failures attributed to external injury be omitted from the figures, the average failures per 100 miles of cable would be 10.4, or 8 per cent lower than for 1920. On a total of 76 miles of cable reported as purchased under N. E. L. A. specifications there were only four cable failures, equivalent to 5.3 per 100 miles. Failures on systems operating at voltages from 24,000 to 27,000 are not appreciably greater than on systems operating at approximately 12,000 volts. Out of the total of 659 cable failures the causes of 227 were unknown, while the rest were distributed as follows: Electrolysis, 67; adjacent cable failure, 54; other external injury, 52; defective joint, 45; overloading, 37; moisture in cable, 32; lightning, 30; dielectric loss, 26; cracking of sheath, 23; sharp bend in cable, 18; defective cable, 16; overheating not due to overloading, 15; moisture in joint, 13; known causes other than stated, 4.

The most common practice in new conduit construction favors not more than sixteen and preferably twelve ducts in one run. The need for a duct with a diameter as large as 4 in. has been questioned by a few operating engineers, but it continues to be widely used. Nearly all companies are making every effort to segregate the high-tension cables in separate runs from those containing the low-tension cables. Cable loss runs between 3.5 watts and 5.5 watts per square foot of conduit surface for high-tension cables and at considerably more for low-tension cables. Reports on temperature indicate a steep temperature gradient from cable to earth and a dangerous loading of the conduit run. Large conduit lines of thirty or forty ducts are very undesirable as they impose a serious limitation on the amount of current that can be carried in the cable. This is particularly important in the vicinity of stations and substations where the greatest obstruction occurs.

Much attention has been given to the engineering design of conduits and manholes, to provide ample space for training and for the proper location of the cable splices and conduit terminals, and also to the designing of conduit terminals to afford continuous fire protection. Of thirty-four companies reporting ten use fiber exclusively with average separation of 1 in. of concrete mixture, while nine companies use vitrified tile exclusively, covering the joints with very little concrete mortar between ducts. Eight use both with a tendency toward working into the fiber class exclusively. Only three companies reported using stone conduit.

Several companies have purchased kenotron rectifying sets for cable-testing purposes, but these have not been entirely satisfactory. However, it is hoped that the difficulties and shortcomings will shortly be eliminated.

Actual quotations from the cable manufacturers demonstrate that by reducing the thickness of insulation to an amount which is sufficient to pass the tests required by the N. E. L. A. and the A. I. E. E. with a reasonable margin, the price of the cable can be materially reduced, the saving being as much as 15 per cent, or more in some cases. By not taking advantage of the recent development in cable manufacture a number of operating companies are installing larger ducts than necessary, at an increased cost. With cables now furnished the dielectric losses are so low that the critical temperature is no longer the limiting temperature for safe operation. Instead, the limit is now imposed by the maximum permissible temperature at which impregnated paper insulation can be operated without deterioration. Since manufacturers and engineers differ by 20 deg. C. on this limiting temperature, the committee has arranged with the Massachusetts Institute of Technology to make a special research on the subject.

CABLE JOINT TROUBLES INCREASE AT HIGHER VOLTAGES

That joints of a type satisfactory on 9,000-volt underground cable had not proved satisfactory on 12,000-volt cables and are absolutely unsatisfactory at higher voltages up to 33,000 volts was asserted by W. L. Abbott, Commonwealth Edison Company. He said that it was possible to make up joints in the laboratory that would stand up under any reasonable test. The same joints made up and put into service in a cable installation for 33,000 volts stood up for a week under potential without load but broke down quickly when load transmission was undertaken.

Difficulties with lead-covered cables coated with cement mortar for fireproofing purposes were outlined by H. S. Phelps of the Philadelphia Electric Company.

The Hochstadter type of cable, it appeared in the discussion, had developed no cases of trouble in America, where it is not extensively used, but some trouble was reported from English experience as due to electrolytic action between the copper strips and lead sheath. Five out of six manufacturers will guarantee single-conductor cable for five years on 66,000-volt Y-connected circuits, said D. W. Beeman of New Bedford, who described investigations involving the feasibility of using such cables. D. W. Roper of the Commonwealth Edison Company, Chicago, told of the use of 60,000-volt cable in Paris and of 40,000-volt, three-conductor cable in Spain, as well as of a recent order placed in England for 50,000-volt, three-conductor cable for use in Holland. F. D. Wyatt of the Union Gas & Electric Company of Cincinnati called attention to the report of the Superpower Commission of the Netherlands, in which underground three-conductor cables for interconnection purposes operated at 50,000 volts were proposed and also single-conductor 70,000-volt cable for underground use.

In response to questions, Mr. Roper stated that the Commonwealth Edison Company utilized recording thermometers in idle ducts to keep check on duct temperatures. The thermocouple indicator is used for surveys to determine the temperature gradient between manholes. He asserted that the best information available indicated that American manufacturers can produce cable with as low dielectric losses as can the European manufacturers.

Meters

The value of centralizing the maintenance of switchboard meters, instruments and relays is the underlying note in the report of the meter committee, of which W. L. Wadsworth was chairman.

An extensive study was made of many switchboard instruments, both direct-current and alternating-current, to determine the best types to use under any condition, requirements, location, means to facilitate testing, etc.

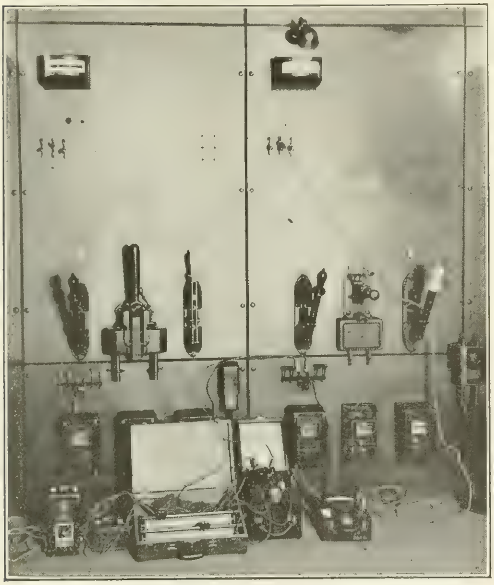
During the past year special consideration has been given to the revision of the "Electrical Meterman's Handbook." Many unimportant parts have been reduced or cut out entirely as obsolete and new subject matter has been added. Another important practice indorsed by the committee after consulting with manufacturers was the standardization of indoor-type instrument transformers used in consumers' installations, with particular reference to over-all distance between primary terminals of current transformers, template drilling dimensions, polarity and polarity marking.

A recent survey of demand rates in use in the United States and Canada shows commonly in use five different demand schedules, the "flat demand rate," "Wright demand method," "Hopkinson demand rate," "block Hopkinson demand rate" and "Doherty or three-charge rate." Of 418 companies in cities of 20,000 population and more in the United States and of twenty companies in like cities in Canada, 374 utilities are making no correction for power factor of consumer, fifty-three companies are making twenty-one different corrections, and eleven companies are not reporting their rates.

In the standardization of meter and instrument design and construction several recommendations have been made such as counter-clockwise rotation of moving elements of watt-hour meters, space provided on the metal covers of watt-hour meters for serial numbers and the standardization of terminal chambers to simplify laboratory tests and the installation of meters when used with safety cabinets. Three manufacturing companies are now prepared to supply bottom-connected direct-current watt-hour meters. Information on new developments has also been collected.

KVA. AS BASIS FOR DEMAND BILLING

Virtually the entire discussion at the meter session was devoted to the effect of poor power factor on losses in the system. The discussion was opened by R. C. Fryer, Union Gas & Electric Company, Cincinnati, who outlined the conclusions which this company has reached as a result of a study to determine where the greatest loss occurs and to determine how the charges for service may be equitably redistributed in such a way that the customer will be induced to correct his power factor and thus release the equipment for other use. The conclusions reached are not intended to offer a method of increasing revenue. Mr. Fryer pointed out that the major proportion of the loss is not reflected in coal consumption but in the extra investment necessary because of the poor power factor. This being the case, and since about 75 per cent of the power plant investment is in electrical equipment, he considers that the kilovolt-ampere demand is the best basis for establishing the return on the investment. The speaker was careful to state that he is not so certain that energy should be measured on the kilovolt-ampere-hour basis, believing that the present kilowatt-hour method is preferable until further knowledge is obtained. Five different instruments to measure kilovolt-ampere-hours are available, but only one is developed, the speaker declared, which is sufficiently accurate over the full range of power factors. He also called attention to a recently developed meter originating from some co-operative work between the University of Cincinnati and the Union Gas & Electric Company. This meter will measure six factors, namely, kilowatt-hours, kilowatt demand (block interval), reactive kilovolt-amperes, kilovolt-ampere demand (block interval), reactive kilovolt-ampere-hours, and average power factor. This involves the use of two in-phase watt-hour meters and two reactive-component meters integrally connected to a pantagraph. The instrument, according to tests, is as accurate as present watt-hour meters. Owing to the expense of providing and installing the instruments, it is questionable whether it would be economical to use them at the present time except on the larger consumers' circuits. However, the speaker pointed out that it is the smaller company which is largely responsible for poor power factor. Since an inducement to improve power factor can be offered consumers in the form of a rate schedule through the use of this instrument, he expressed the belief that the use of this or some other instrument may be the means of building bigger business.


RELAYS SHOULD BE TESTED AT LEAST EVERY SIX MONTHS TO SECURE PROPER OPERATION

Panel for 11,000-volt cables (right) and connections for testing induction and instantaneous relays. A special 0.5-kw. transformer excited from lighting circuit has slide-wire control in the primary side. Secondary circuit connects with the relay through a portable ammeter. Relays are adjusted with the cable out of service and the circuit breaker is tripped by each relay at the close of the test to prove the condition of the trip circuit and breaker.

The question in adopting any instrument as a basis for reducing power factor is how many complications will be involved by installing and maintaining it and what the initial cost will be. Considering all these factors, G. A. Sawin, Westinghouse Electric & Manufacturing Company, expressed a preference for the new development.

L. L. Elden, Edison Electric Illuminating Company of Boston, emphasized the fact that small companies are the ones causing poor power factor, but the instruments which are available for detecting this at the present time are too expensive. Static condensers have been employed for correcting conditions, but their price is prohibitive. Any one who can find a solution for the power-factor problem will do more for the industry than by any other means, declared Mr. Elden.

C. W. Bates, Philadelphia Electric Company, declared that he is not certain whether the customers should not buy magnetizing current for alternating-current motors in the same way as they buy kilowatt-hours, instead of trying to install power-factor corrective apparatus. Attention was called to a way of determining reactive kilovolt-ampere demand from the motor rating.

A new development in power-factor meters which also records energy consumption was announced by H. J. Blakeslee, the States Company, who said that the new instrument consists essentially of two single-phase watt-hour meters and a graphic attachment which enables determination of power factor at any instant.

Considerable difficulty has been experienced by some companies in enforcing power-factor clauses, because it has been difficult to make the public comprehend the meaning of power factor. For this reason E. P. Peck, Utica (N. Y.) Gas & Electric Company, suggested that the meter committee or some other committee of the N. E. L. A. define power factor in simple terms which a layman can understand.

The remainder of the discussion at the meter session hinged on the question of whether the meter committee should extend the courses for educating meter men, or whether this work should be turned over to the educational bureau. O. J. Bushnell, Commonwealth Edison Company, Chicago, took the latter stand, whereas E. R. Horrell, Sangamo Electric & Manufacturing Company, favored the extension of the course. Mr. Bushnell also contended that raising the price of the meterman's handbook would limit its distribution where most needed. Mr. Horrell recommended that some steps be made to place the handbook in the hands of the smaller companies, which have the most need of it. He also pointed out that the geographic divisions have through the holding of open committee meetings brought information to many company men who have been unable to attend national conventions.

Schuchardt Chairman-Elect

Officers of the Technical Section for the coming year were elected at the second session of this section on Tuesday afternoon. The new chairman is R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company. H. P. Liversidge, L. M. Klauber and C. F. Hershfeld are the new vice-chairmen. A. Jackson Marshall is the secretary-elect.

Commercial Sessions

Program

MONDAY, MAY 15

Address of chairman, R. H. Tillman.

Report of Electric Vehicle Bureau, C. R. Skinner, Jr.

Report of committee on garages and garage rates, F. F. Sampson.

Report of committee on transportation, F. M. Feiker.

Report of committee on publicity, Norman Maul.

Report of exhibition committee, H. T. Luscomb.

Paper, "Electric Trucks in the Service of the American Railway Express Company," R. E. M. Cowie.

Report of committee on commercial service and relations with customers, Harold Wright.

TUESDAY, MAY 16

Report of Lighting Sales Bureau, L. R. Wallis.

Report of division on educational exhibits, Clarence L. Law.

Report of division on residence lighting, M. Luckiesh.

Report of division on industrial lighting, J. Daniels.

Report of division on street and highway lighting, A. D. Cameron.

Report of division on lighting of large buildings, Arthur S. Ives.

Report of division on commercial aspects of lamp equipment, G. H. Stickney.

Report of division on sign, display and billboard lighting, P. B. Zimmerman.

Report of division on store lighting, W. E. Rolinson.

Report of lighting department (joint committee for business development), P. B. Zimmerman.

Address, "Lighting Education," Ward Harrison.

Report of committee on wiring, G. E. Miller.

Report of department on wiring (joint committee for business development), A. K. Baylor.

WEDNESDAY, MAY 17

Report of Bureau on Merchandise Sales, C. E. Greenwood.

Report of division on central-station merchandising service, Thomas Berger.

Report of division on electric cooking and heating, C. O. Dunten.

Report of division on standardizing and testing, R. S. Hale.

Report of division on relations with manufacturers, F. D. Pembleton.

Report of department on appliances (joint committee for business development), C. E. Greenwood.

Report of committee on electrically equipped furniture, Joseph F. Becker.

THURSDAY, MAY 18

Report of Power Sales Bureau, Charles K. Nichols.

Report of division on electric power economics, John W. Meyer.

Report of division on industrial heating applications, V. M. F. Tallman.

Report of division on material handling, R. H. McLain.

Report of committee on education, Fred R. Jenkins.

Report of committee on "Electrical Salesman's Handbook," George H. Jones.

THE commercial sessions were well attended and well supported by discussion. The work of the year presented in the reports forms a rich harvest of data and experience, and the keynote of all the meetings seemed to be that at last the time had come to go ahead and here were tools to work with. Responsibility for results was put squarely up to the central-station executive by speakers in each session, who stressed particularly the fact that we must "sell" ourselves in the use of every kind of electric service before we can hope to "sell" the public. Throughout the program the plans of the joint committee for electrical development were made a feature of each session, and the part which the central-station man must play in leading the movement in his community was made plain.

Electric Vehicles

The development of the market for electric vehicles shows slow but steady progress. The central-station income from this source in the city of Chicago is about $800,000 and in New York more than $1,000,000, a consumption there of over 30,000,000 kw.-hr. for vehicle battery charging. During the years 1920-21 central-station companies of the United States purchased 109 electric trucks, and 800 trucks have been sold in the two years 1920-21 in the New York metropolitan district alone. These facts are presented in the report of the Electric Vehicle Bureau as evidence of the immediate scope and possibilities of the electric vehicle as a central-station load.

One of the important subjects studied by the bureau this year has been the standardization of charging plugs, battery cradles and other vehicle features. A meeting of manufacturers was called, and the 150-amp. charging plug was settled upon for all electric street trucks. Progress has been made in other directions.

The committee on comparative data for transportation engineering has been engaged in compiling operating costs on electric trucks as compared with gasoline cars and horses. A large amount of truck experience has been examined, and the subject is being presented to the transportation engineering profession.

A very constructive work has been performed by the committee on garages and garage rates in the compilation of a list of all the charging stations in the country, to the end that electric vehicle owners may establish charging stations in the territory in which their cars are operated. These data are still in process of preparation, and a study of the various ages of electric trucks now in service is being made, with the object of lengthening the period of serviceable life.

An interesting feature of the commercial session on Monday devoted to the Electric Vehicle Bureau was an address by Robert E. M. Cowie, vice-president American Railway Express Company. This company operates 17,500 horse-drawn vehicles, several thousand gasoline vehicles and about 1,444 electric units, but 83⅓ per cent of all the motor vehicles purchased for the metropolitan district of New York in the past year have been electric. The problem of supplanting other types of trucks with "electrics" is a problem of financing the investment and insuring adequate charging service for the local utilities, but the superiority of the electric vehicle has been satisfactorily established, in the company's experience, for large city service.

Elimination of Waste

F. M. Feiker, New York, in discussing the status of the electric vehicle pointed out that the present wide general interest in the elimination of waste in industry affords a ready-made opportunity for the electric vehicle.

N. T. Wilcox, Keokuk, Iowa, said it should be appreciated that conditions have changed and there are now available sufficient data to enable the electric vehicle to go ahead. Therefore the central-station company should forget the inevitable disappointments and delays of the pioneering period and develop this valuable afterpeak load. But the central-station man must convince himself before he can hope to convince his customers.

George B. Foster, Boston, stressed the need for more general enlightenment of central-station employees on vehicle subjects. Every electrical man, he said, has a groundwork of information about gas cars and should be ready to answer questions about the electric vehicle.

One of the most vital aspects of the whole vehicle situation, it was agreed in this discussion, is the need of adequate service facilities. The American Railway Express Company itself has had to withdraw electric vehicles from some cities because of improper servicing. Moreover, a careful study must be made of transportation costs in different classes of service, with comparisons between electric and other vehicles.

In answer to a quetsion, F. E. Whitney, Philadelphia, announced that the insurance companies had decided to allow a differential in favor of electric vehicles of 25 per cent on fire and theft and practically 50 per cent less than the gas-car rate on personal liability and casualty insurance.

A study of transportation costs was urged as an objective for the coming year with particular attention to proper figuring of depreciation, so that the industry may be able to develop the transportation field with the advantage of accurate knowledge.

Commercial Service and Customer Relations

In carrying out its work during the past year the committee on commercial service and relations with customers, Harold Wright chairman, followed the recommendations of the committee for 1921 with good results. The committee has prepared nine "Service Suggestions" pamphlets and a chart and order system forms were offered to interested companies. The "Service Suggestions" were mailed to the commercial managers of the various companies, and the comments on their value have been very satisfactory.

G. E. Miller, Cleveland, in the discussion of this paper, stressed the practical benefits which had resulted from the fact that the committee had not held up the products of its work until convention time, but had sent its bulletins periodically.

George Neil, Hammond, Ind., urged the continued use of more and more pictures in disseminating this commercial service data, since "pictures talk where words will not."

Lighting

Although the Lighting Sales Bureau, L. R. Wallis chairman, functioned this year with a reduced personnel, the full scope of its activities is covered in its report. The industrial lighting division deals briefly with tests made during the year, showing that the ease and speed with which an object is seen depends on illumination. Results of further productive intensity tests are given, with data on the status and provisions of industrial lighting codes.

It is suggested that the proper lighting of large buildings should be studied, not as a whole, but with consideration of the separate parts or rooms, and this applies to department stores as well as other large buildings. The value of different types of such buildings to the central-station company is discussed, and the advantage of good lighting to the buildings is outlined and a bibliography on the subject presented.

To the subject of store lighting particular attention is given. The activities of the past year in this field are reviewed and solutions suggested to meet the existing problems. A series of charts presents in a most impressive way the opportunity for store lighting which waits unnoticed all about the contractors and central stations in every city.

Street lighting is reported as the "only phase of electrical activity in which progression was unimpeded," for more street-lighting material was purchased and installed than in the previous year. There has been a definite trend toward the development of "white-way" lighting with important developments in Kansas City, Cleveland, Durham, N. C., and St. Paul. The introduction this year of a method for efficiency and economically lighting country roads and highways marks a distinctly fundamental event.

P. B. Zimmerman, chairman of the lighting department of the joint committee for business development, reviewed the work of that committee, pointing out that the Lighting Sales Bureau occupies a focal position in the campaign for better business, as it stands as the principal point of contact with the public. At present 59 per cent of the revenue of the central-station company is obtained from lighting business. Likewise 69 per cent of the jobbers' sales and 68 per cent of the dealers' sales are derived from business directly affected by lighting. It is extremely important, therefore, in these days when the popular interest is so concentrated on appliances, that effort be concentrated on lighting development even in excess of the natural proportion.

Ward Harrison, National Lamp Works, delivered an address on lighting education. Citing the case of the telephone, he pointed out the tremendous opportunity for the development of lighting business which waits only upon the public appreciation of the value of proper lighting intensity. It is a problem of education as to scientific facts.

G. E. Miller, vice-chairman of the wiring committee, urged more attention to the commercial side of the wiring problem as the very fundamental of new-business development. There are many cities, he said, well saturated as to the number of homes which are wired and using service, but there are few of these homes which are themselves saturated electrically, because the use of electricity in them is limited by the knowledge of the dwellers. The great necessity, therefore, is to spread the idea so that the public will generally appreciate not only the many ways in which electricity can be helpfully used in a household today but the extent to which it can be utilized with increased comfort and satisfaction.

When the first practicable automobile came into use, Mr. Miller said, there were one million residence customers connected to central-station lines in this country, and see what has happened in the meantime. The automobile people have outsold the electrical industry in a most spectacular way. The average household consumer today has an annual bill of about $30; but compare this with what the average man spends on his car. "We don't know how to advertise and we don't take the trouble to learn how to do our job with thoroughness," said Mr. Miller. It is said that 80 per cent of the people have a mentality not exceeding that of a child twelve years old. It is therefore necessary in advertising to present a message so clearly and definitely that it is not necessary for the public to use any degree of imagination for themselves.

Therefore you must picture the benefits that wiring will bring before you can sell wiring, and if this is adequately done, every residence consumer can be developed to the point where he will pay the central station a revenue of $75 to $100 a year. This can be done by stimulating architects and home builders to increase the size of wiring installations, and in Cleveland they have been very successful in this work. In one case plans for twenty houses were submitted and the outlets increased 50 per cent by suggestion.

A. K. Baylor, chairman of the wiring department of the joint committee for business development, presented a report of his committee, sketching the work of the department in outline and submitting the guide book on wiring in which its recommendations are embodied. He stressed the point that it must be remembered that every appliance is a dead and useless thing until it is connected to the central station. Therefore it is the idea of the use of the appliance which must be sold in order to sell the appliance and the desire for wiring and for electric service.

Merchandising

Four points were given particular attention in the report of the Merchandise Sales Bureau, C. E. Greenwood chairman. These were the importance of central-station merchandising service in the upbuilding of a broader program of commercial activity, the vital necessity of close co-ordination in the relationships with appliance manufacturers, the need for better methods of standardizing and testing household devices, and a general consideration of the electric cooking and heating market as an opportunity for sales promotion.

A committee of manufacturers was established as part of the executive committee, and such moot points as a wider "spread" for the dealer, quantity as a basis for discounts and methods of advertising co-operation were discussed. The contact proved educational and resultful, but no definite report on the work of the committee has been presented.

PROPER ILLUMINATION OF THE HOME SHOWN BY MINIATURE APARTMENT IN LIGHTING EXHIBIT

The division on electric cooking and heating expresses optimism as to the opportunity for the development not only of domestic-range business, but hotel, restaurant, club and society load, and lists three essentials for success: (1) A rate that will get the business; (2) an engineering department familiar with the characteristics of a range load, and (3) an organization "sold" on the merits of electric cooking. It takes up in detail training the sales force, trial installations, deferred payments, demonstrations, handling repairs and other practical aspects.

ELECTRICALLY EQUIPPED FURNITURE

That electrically equipped furniture is no longer a theory but has become an accomplished fact was emphasized in the report of the electrically equipped furniture committee, Joseph F. Becker chairman. Not only have complete suits of furniture been so equipped for exhibition purposes, but individual pieces, such as the vanity table and spinet desk, are being manufactured in large numbers and cataloged by some of the prominent furniture manufacturers. Electrically equipped furniture has aroused keen interest not only on the part of the public but on that of prominent furniture dealers as well. Only standard fittings such as the market now affords have been recommended by the committee in its specifications, which may be used by any furniture manufacturer distributing his products anywhere in the United States.

F. D. Pembleton reported on the work of the division on relations with manufacturers. No definite results can be cited, but the contact established has been most satisfactory as an influence in the stimulation of co-operation. Two meetings have been held with the manufacturers to the end that more economical distribution and a more effective advertising co-ordination may be worked out.

VALUE OF COOKING LOAD HAS BEEN GREATLY UNDERESTIMATED

F. T. Wilcox, Keokuk, Iowa, said that central-station men have long been skeptical of the diversity factor in cooking load but now see that it is much more than was expected. If there were lighting only, a residence would consume 250 kw.-hr. a year, but with range and water heater connected a consumption of from 3,000 kw.-hr. to 5,000 kw.-hr. can be expected. He cited the case of Rochester, where a consumption of 1,300 kw.-hr. is obtained in installations with a double-throw switch from the range alone, and 3,600 kw.-hr. from the customer. It will take time, he said, to develop this business in a big way, but it is the hope of all forward-thinking central-station men.

H. L. Grant urged the elimination of seldom-used types of flatirons and other devices to save waste. There must be a wide spread, he said, between the manufacturer's cost and the retail price in this industry, just as there is in any other industry, and the greatest impulse for the sale of cooking equipment will come from ample margins and satisfying profits on sales. The dealer must be encouraged to help the industry by receiving protection from the central-station company and a margin of profit as a reward for his efforts favorably comparable with the earnings of other merchants.

On the call of Mr. Byrne of Omaha, a count was taken of the number of men in the room who use electric ranges in their own homes. There were twenty, less than 10 per cent of the audience.

J. F. Roche won applause by describing his personal experience in his own household. To sell ranges, he said, every electrical man who can obtain a range rate should cook by electricity because if he cannot convince his own wife he can hardly hope to convince somebody else's wife. From the standpoint of service nothing is so good in its public relations influence as a range well sold, and the business should be developed from the service point of view instead of the kilowatt-hour standpoint. Mr. Roche said that his family had been cooking by electricity for ten years and there are eleven people in the household, eight of them children, using twenty-five appliances. His monthly bill averages in the neighborhood of $10. "We must begin," he said, "on the development of the cooking field by selling to ourselves."

J. F. Orr of Boise reported fully 1,350 ranges in operation in that city of 21,000 residence customers. All these ranges have been sold at list price with charge for connections.

Industrial Load

Investigations and work by the Power Sales Bureau, C. K. Nichols chairman, were continued along the same lines that have been found successful in previous years. Many of the data prepared by the bureau have already been published in the association bulletin, it being believed this would afford much quicker distribution.

The industrial heating division has made a careful study of the possibilities for the development of central-station business through large heating load, and while the opportunity is great, what is needed is men competent to develop it. Accordingly, this division early decided to devote the major part of its efforts to the educational features of the electric heating problem.

As the handling of material with electric power has become such an important field for development of a power load, a material-handling division of the bureau was formed rather late in the year and presented an oral report at the convention.

During the year requests have been made for the bureau to supply speakers at meetings and conventions of manufacturers to deliver papers on the use of electric power by the particular industry whose representatives were to assemble. This activity should be stimulated in every possible way and should be an important part of the future work of the bureau.

Included in the report is a very complete bibliography of all addresses, papers and committee reports published in the *Proceedings* or monthly *Bulletins* of the National Electric Light Association.

EDUCATION

The education committee, Fred R. Jenkins chairman, reported a marked increase in the use of the commercial courses and attributed this to the gradual betterment of the business and financial situation, resulting in the companies again becoming more actively interested in the commercial branch of the business.

An encouraging feature of the past year's business has been the adoption of the courses by some of the smaller companies in the large holding organizations. All the commercial courses, as in former years, have proved to be self-supporting. The committee has under consideration combinations of the two courses to take care of certain requirements of the various branches of the business.

Discussion in the power session centered largely around the subject of industrial heating. M. F. Tallman, Boston, announced that, in addition to the division report, five other papers have been prepared and will be published on the following subjects: (1) "Melting Gray Iron by Electricity," (2) "Malleable Cast Iron and Its Production in the Electric Furnace," (3) "Handling Electric Heating Apparatus by Central Stations," (4) "Use of Electric Heating in Brass Manufacturing Operations," and (5) "A Directory of the Makers and Users of Electrical Heating Equipment." It is little appreciated, he said, how great is the volume of business offered by industrial heating. The average of a large number of installations which he has reviewed shows an annual consumption of 2,140 kw.-hr. for every kilowatt connected, which at a 2.44-cent rate returns an annual revenue of $51 per kilowatt.

Dr. C. F. Hirshfeld, Detroit, spoke of the general ignorance as to the true importance of the electric heating opportunity. The average central-station man considers only the thermal comparison between electric heating and heating by other processes, ignoring the other potentialities involved. But it is the total finished cost that counts. Individual costs of procedure are not essential, for economies due to small number of rejections or to safety or speed or reduction in the materials required combine to produce a net efficiency. The industrial heating load at the present time is 1,250,000 kw., compared with a motor load of 10,000,000 kw. Therefore the heating load is more than one-tenth of the motor load already. Dr. Hirshfeld predicted that the industrial heating load will grow to be two and a half to three times the motor load. The improvements in equipment make electric heating of value to industry. Therefore industry will demand it, and the central station will be obliged to provide it.

Wirt Scott, Mansfield, Ohio, cited some typical cases of men who had investigated industrial heating five or eight years ago and, having condemned it, still refuse to give it attention. He warned against overengineering in industrial heating installations and making them unnecessarily expensive.

H. H. Holding, Newark, N. J., said that up to now more attention has been paid to producing textbooks than to the actual education of men, and the industry should now endeavor to develop at least one trained industrial heating man in each central-station company. G. E. Miller, Cleveland, moved a vote of thanks to the General Electric Company and the Westinghouse Electric & Manufacturing Company for the industrial heating courses which they have established for the education of central-station salesmen.

Commercial Section Officers Elected

AT THE close of the session the nominating committee presented its report and these Commercial Section officers were elected for the coming year: Chairman, O. R. Hogue, Commonwealth Edison Company, Chicago; vice-chairmen, N. T. Wilcox, Mississippi River Power Company, Keokuk; G. E. Miller, Cleveland Electric Illuminating Company, and W. E. Putnam, Idaho Power Company, Boise; executive committee, R. H. Tillman, Consolidated Gas, Electric & Power Company, Baltimore; Morse Dell Plain, Northern Indiana Gas & Electric Company, Hammond, Ind.; Clarence Law, New York Edison Company, New York, and Rawson Collier, Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

C. K. NICHOLS
Superintendent Power Bureau
New York Edison Co.

C. E. GREENWOOD
Appliance Department,
Edison Electric
Illuminating Co. of Boston

L. R. WALLIS
Superintendent Sales Department
Edison Electric
Illuminating Co. of Boston

HAROLD WRIGHT
Chief Clerk
Commonwealth Edison Co.

J. F. BECKER
Sales Manager
United Elect. Light & Power Co.

C. L. LAW
Manager of Bureau of
Illuminating Engineering
New York Edison Co.

NORMAN MAUL
Manager Editorial Bureau
New York Edison Co.

H. T. LUSCOMB
General Engineer of Contract
and Inspection Department
New York Edison Co.

Chairmen of commercial committees who presented reports at the Atlantic City convention and the committees that they head: Mr. Nichols, committee on power sales; Mr. Greenwood, committee on merchandise sales; Mr. Wallis, committee on lighting sales; Mr. Wright, committee on commercial service and relations with customers; Mr. Becker, committee on electrically equipped furniture; Mr. Law, committee on educational exhibits; Mr. Maul, committee on publicity; Mr. Luscomb, committee on exhibition.

Accounting Sessions

Program

TUESDAY, MAY 16

Address of chairman, E. J. Fowler.
Report of committee on accounting education, Fred R. Jenkins.
Report of committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers.
Report of committee on budget, Harry A. Snow.
Report of committee on Accounting Service to Member Companies and the Monthly Bulletin, W. A. Jones.

WEDNESDAY, MAY 17

Report of committee on federal income-tax procedure, F. B. Odlum.
Address George C. Mathews, Chief Statistician Railroad Commission of Wisconsin.
Report of committee on customers' records and billing methods, J. D. Jacobus.
Report of committee on accounts payable records, E. A. Davis.

THURSDAY, MAY 18

Report of committee on fixed capital records, J. H. Lobban.
Report of committee on security holders' records, Robert Davey.
Report of committee on purchasing and storeroom accounting, W. F. Stevens.

GREAT interest in the development of budgeting to include construction, operation, materials and supplies and cash requirements, from the dual angles of forecast and control, was shown at the first accounting session. Chairman E. J. Fowler opened with a strong appeal to members to realize the responsibilities of committee work when accepting membership on such bodies, urging them to make these clear to their superiors in carrying forward these duties. Attendance by geographic chairmen at group and executive committee meetings was urged. A good record has been made this year in this respect.

Uniform Classification

Although the committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers chairman, held no formal meetings during the year, its informal activity was considerable. Its most important work was in connection with a system of accounts for the use of licenses of the Federal Power Commission. Some very valuable results were accomplished also in connection with a conference of public service commission statisticians for the purpose of considering the "Commissioners' Uniform System of Accounts for Electrical Corporations." At this conference some very objectionable modifications to that system of accounts were opposed, and the committee not only pointed out the objections to the proposed changes, but further called attention to the fact that if nation-wide uniformity in the classification of accounts is to be secured, all proposals for amendments of the commissioners' classification ought, before consideration by any individual commission, to be submitted to the appropriate committee of the commissioners' association.

After this report had been abstracted by Chairman Meyers, O. C. Semple of the New York Public Service Commission inquired as to the views of the association regarding depreciation accounting. Several speakers outlined their opposition to the straight-line theory based on estimated equipment life and urged reserving funds for depreciation on the basis of experience and judgment. A full statement of the viewpoint of the association was published by it in connection with recent testimony before the Federal Power Commission. Paul Jones, H. L. Doherty & Company, New York, opposed any requirement that utilities report property in a depreciated condition. James Lawrence, vice-president American Light & Traction Company, New York, stated that in 1923 his companies would use the new classification of accounts.

A detailed discussion of topics common to the four types of budgets is given in the report of the budget committee, H. A. Snow, chairman. The committee belives that no company should operate without a construction budget. Its possibilities are manifold since it serves as a statement of construction requirements, as an instrument of control over capital expenditures, as an engineer's report and as a statement of monthly distribution of construction expenditures. The committee points out that the preparation of the construction budget is the most important factor in the budget scheme and should be executed according to a definite program and one that is sure of obtaining the best judgment and opinion of all parties responsible for the design, construction and operating policies of the company.

An extended discussion followed the reading of this report by Chairman Snow. D. W. Harris, New York City, urged allowing each individual in a public utility who has control of the expenditure of money a voice in budget planning. Alex Dow, president Detroit Edison Company, cited the value of the budget of the type described by the committee. Experience in handling a budget increases the accuracy of its predictions. In 1920 the company lost 70,000 kw., or one-third of its total load, and this came so suddenly that it was very difficult to anticipate either financial or material requirements. The company had an eighteen-million-dollar construction program that year and spent $16,000,000. Although the budget was limited as to its accuracy under these emergency conditions, it none the less had much value, and Mr. Dow said that in the long run the budget system will enable an executive to keep reasonably close track from day to day of what is needed in the way of equipment and money. The range of error under normal conditions is such that the slowing down of three or four days in payments will bring the bank balance and receipts into line. Mr. Dow urged the importance of watching estimates closely and keeping them from over-running in budget making. A variation of 10 per cent should be explained by the budget estimator.

Customers' Records

In its report for the year 1922 the customers' records and billing methods committee, J. D. Jacobus chairman, prepared a classification of the elements that enter into the cost of a bill and the keeping of customers' accounting records. This classification was forwarded to member companies, and while the number of reports received as compared with those sent out was not large, they covered a vast territory and for that reason are interesting, as they represent practically every section of the country. These reports have been classified as follows: Companies having up to 10,000 meters; companies having from 10,000 to 25,000 meters; companies having from 25,000 to 50,000 meters; companies having from 50,000 to 100,000 meters, and companies having more than 100,000 meters.

Code numbers have been assigned, and in the event of member companies desiring specific information it can be readily obtained from the records on file at the association headquarters.

The Baltimore plan of bookkeeping without books occupied the entire time for discusion of the report of the committee on customers' records and billing methods. Briefly, the method consists of bills to which a stub is atached. This stub is torn off and constitutes the office record of the customers' account, and the bill is sent out. Seventy-five per cent of the bills are paid on or before the due date and are therefore cash transactions. The remaining 25 per cent are delinquents and are carried in proper filing arangements until they are paid, or the next month's bills are made out and the balances transferred, when they become reference files only.

Up to March 1, 1922, there were 1,399 subscribers to the elementary course and 286 subscribers to the advanced course in accounting which are being conducted by the accounting educational committee, Fred R. Jenkins chairman. The Accounting Section now has chairmen representing committees in nine geographic divisions. The general plan of the geographic division committees consists of dividing the territory among their members, each member getting in touch with the various companies and working with them through an appointed representative.

Following Mr. Jenkins' presentation of this report, H. M. Edwards, New York, arose and paid high tribute to the former's association work in accounting education. Brief appreciative reference was then made to the lecture course in business economics by Dean Harriman of the Northwestern School of Commerce, now being given to employees and executives of the Insull properties.

That a uniform classification of acounting for electric utilities is probably impossible unless it be the one agreed on by the Accounting National Section and the committee of the National Association of Railway and Utilities Commissioners was the warning given by George C. Matthews in discussing the uniform classifica-

W. F. STEVENS
Superintendent Supply Department
Edison Electric Illuminating Co. of Boston

ROBERT DAVEY
Secretary Accounting Operations
Consumers Power Co.

H. A. SNOW
Statistician
Detroit Edison Co.

W. J. MEYERS
Secretary
The United
Electric Light & Power Co.

J. D. JACOBUS
Chief Clerk Customers' Accts
Detroit Edison Co

F. B. ODLUM
Attorney
Electric Bond & Share Co

E. A. DAVIS
Middle West Utilities Co.

FRED R. JENKINS
Mgr., Central Station Institute
Commonwealth Edison Co.

Chairmen of accounting committees who presented reports at Atlantic City Convention: Mr. Stevens, committee on purchasing and storeroom accounting; Mr. Davey, committee on security holders' records; Mr. Snow, committee on budget; Mr. Meyers, committee on classification of accounts; Mr. Jacobus, committee on customers' records and billing methods; Mr. Odlum, committee on federal income tax procedure; Mr. Davis, committee on accounts payable records; Mr. Jenkins, committee on accounting education.

tion of accounts before the second session of the Accounting Section, Wednesday afternoon. This is due to the fact that the various commissions cannot be expected to push the adoption of the classification unless there is an active demand for it and support from the utilities interested, as there is not a pressing enough need from the commission viewpoint alone.

The scope of the work outlined by the committee on accounts payable records covers methods of vouchering, forms, filing methods, accounts-payable ledgers and cash-disbursement records. E. A. Davis, the chairman, indicated that, the committee having been organized only a couple of months ago, it was impossible to reach conclusions of a definite character on any matters under study. He said that the committee work as planned would be based largely on close co-operative work with the geographic division committees.

The first annual report of the committee on fixed-capital records, J. H. Lobban chairman, indicates that nearly all of the electric light and power companies make their write-offs of property retired by work orders, but less than 20 per cent are able to determine the exact amount of credit to property other than by estimate. Information was received by the committee from seventy-one companies, describing their method of construction accounting and keeping property records, and the conclusions to be drawn from these replies are given in the report. The advantages of keeping property records, items which should be included in any property record and the cost of property records are outlined, and the appendix shows a detailed property records routine, including twenty-nine diagrams and forms.

In the discussion it was agreed that much quicker and more favorable action by commissions was attainable in rate and capitalization cases where utilities maintain adequate fixed-capital records. H. J. Lewall, Philadelphia, for the American Gas Association, congratulated the committee on its work.

The security holders' records committee, Robert Davey chairman, endeavored during the year to draw up a uniform records system which might be adopted by any company entering into the customer-ownership field, such system to take up the work immediately following a sale or a subscription. Among the subjects discussed are the following: The form of receipt to be issued at the time the sale is made and before the delivery of stock certificate or official stock subscription receipt, the relative merits of the plan of issuing official stock subscription receipts and the pass-book form under the partial-payment plan, a method of reporting to the general office by district officers for companies operating in various districts, record of partial payments, the addressograph method of compiling lists and dividend checks, issuance and delivery of stock certificates, and the method of completing the accounting on the general office books. The text is amplified by forms for use in applying the suggested system.

W. Paxton Little, Niagara Falls (N. Y.) Power Company, then described his methods of keeping security holders' records, reading from an article he contributed to the ELECTRICAL WORLD of Oct. 22, 1921. Richard Mueller, Commonwealth Edison Company, Chicago, touched upon the problem of making immediate deliveries of certificates to purchasers after their final payments. In his organization 15,000 accounts in ten series requiring the services of four bookkeepers present a question of some difficulty from this standpoint. The advisability of using diplomacy in calling delinquents' attention to lagging payments was also emphasized in the discussion.

Purchasing

An unusually interesting and instructive report was presented by the purchasing and storeroom accounting committee, W. F. Stevens chairman. The subjects of warehousing of poles, code numbers for stock items, classifications of stock accounts and centralization of salvage works are treated in detail in separate parts of the report. The yard for the storage of poles should be carefully designed, not only as to location with reference to market and transportation, but as regards railroad sidings, skids, roadways, equipment, etc., each of which is discussed in detail. An ideal design for a system of yards is also given with appropriate diagrams.

E. S. Brock, Public Service Electric Company, Newark, N. J., said that in twenty-nine decentralized stock rooms a three months' turnover is obtained. Continuous inventories were favored by W. J. Hart, Philadelphia; W. A. Jones, New York; C. Marden, Chicago, and Chairman W. F. Stevens, Boston. L. A. Coleman, United Electric Light & Power Company, New York, and other speakers were strongly in favor of salvaging equipment and supplies through a committee, holding this to be beyond the competence of an individual in most cases.

ACCOUNTING WORK GROWING BROADER

That the central-station industry has lost many millions of dollars through inadequate fixed-capital records, now happily being established by the more progressive companies, was the striking feature of the third and final session of the National Accounting Section on Thursday afternoon under Chairman E. J. Fowler. The desire to act as a clearing house for accounting discussions during the year was expressed by the committee on accounting service to member companies. Practice in developing security holders' records was outlined by the committee of that name, the importance of prompt delivery to purchasers being stressed. Regular inventories, preferably by successive monthly adjustments of stock accounts, were favored by the committee on purchasing and storeroom accounting and by the delegates present.

Schmidt New Section Chairman

William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company, Baltimore, was elected chairman of the accounting section for the coming year. The vice-chairmen elected were: W. E. Long, Philadelphia Electric Company; W. A. Jones, Henry L. Doherty & Company, New York, and W. Paxton Little, Niagara Falls (N. Y.) Power Company. Members-at-large elected were H. M. Edwards, New York; A. R. Patterson, Boston; R. M. MacLetchie, Birmingham, and George B. Thomas, Salt Lake City. In accepting the chiarmanship Mr. Schmidt said that the biggest problem ahead is securing the adoption of the uniform classification of accounts by state commissions.

Public Relations Sessions

GROWING interest in the work of the Public Relations National Section was evident in the session Wednesday afternoon, the industry having been attracted by the need of better popular understanding of its purposes and problems and by vigorous efforts to organize effective programs to bring this about. In his opening address Chairman Insull stressed the competitive aspects of central-station service, pointing out that such a utility should treat the public even better than it would if it were possible for customers to secure their desired service next door.

Program

WEDNESDAY, MAY 17

Address of chairman, M. J. Insull.
Appointment of nominating committee.
Report of committee on women's public information, Olive A. Bursiel.
Report of committee on employee relations with the public, H. C. Blackwell.
Report of committee on manufacturers' advertising, P. L. Thomson.
Report of committee on public speaking, H. C. Couch.
Report of committee on relations with bankers, M. S. Sloan.
Report of committee on state organization of public information, H. T. Sands.
Report of committee on uniformity of state regulatory laws, W. W. Freeman.
Announcements.
Report of committee on upbuilding the industry, F. R. Coates.
Report of nominating committee.
Election of officers.

THURSDAY, MAY 18
(With music)
Report of public policy committee, Sidney Z. Mitchell.
Addresses (speakers of national prominence invited).

Publicity

For the first time the viewpoint of the women of the industry has been recognized through the report of the women's public information committee, Miss O. A. Bursiel chairman. Starting with the purpose of educating the women of the industry in its economic fundamentals, this committee prepared four lectures to be given before the woman employees of electric light and power companies. The titles are, respectively, "Public Relations, Facts, Figures, Investments and the Busines as a Whole," "The Home Electrified," "Electric Cooking," and "Relations of Employees to the Public—Courtesy and Good Will," the first three have been printed and distributed. The report said that these lectures wherever given have been well received.

Chairman Insull then called attention to the importance of stronger executive support of the work of the committee on employee relations with the public. No report was presented.

A statement of the amount of advertising donated by the manufacturers for the promotion of good will was given by the manufacturers' advertising committee, P. L. Thomson chairman. For business reasons this advertising has not been so extensive as it was in the year previous. The quality, however, has remained high. Attention was directed to the publicity secured from certain national magazines and banking houses. In conclusion, the committee pointed out that the responsibility for getting the manufacturers to see why they should carry a share of the work of securing better public relations rests on the electric light and power companies.

Commenting on the report, Vice-President F. W. Smith said that the work of the Public Relations National Section bids fair to develop into one of the most important activities of the N. E. L. A. The speaker paid a glowing tribute to the constructive efforts of Chairman Insull in this section.

Little had been accomplished by the public-speaking committee, H. C. Couch chairman, during the first year of its existence beyond procuring approval of plans for a speakers' handbook and suggesting to utility managers that they "exchange pulpits."

The committee on state organization of public information, H. T. Sands chairman, reported seventeen committees operating in twenty-four states, or fourteen states more than a year ago. Preliminary meetings looking toward similar committees in other states were reported. In every state where these committees have been at work, the committee stated, there is already a noticeable disposition on the part of the press to approach the problems of the public utility industry in a saner way than heretofore. The committee was of the opinion that a strong, permanent organization would result if the interest of the outstanding men in each of the four branches of the utility industry were first secured.

Regulation and Finance

For the guidance of state legislatures and utility companies a draft of a so-called model public regulation act will be made soon under N. E. L. A. auspices, declared W. W. Freeman, chairman of the committee on regulatory laws. Conferences in the committee have resulted in substantial agreement, and when the N. E. L. A. act is drafted it will then be submitted to various other national utility bodies for consideration. In view of the diversified interests of many of the N. E. L. A. members, it is thought that no serious difficulty will arise in obtaining in due course an agreement upon a detailed statute draft. The N. E. L. A., the speaker said, has no patent upon the idea of a uniform act and will co-operate actively in its furtherance. The speaker paid a well-deserved tribute to the committee members whose legal talents and experience have been so freely placed at its disposal.

In view of the recent return from Europe of Chairman F. R. Coates of the committee on upbuilding the industry, the report on this subject was postponed.

H. T. Sands, president of the Haverhill (Mass.) Electric Company and an officer in other Tenney companies, Boston, was elected chairman of the section for the ensuing year. Vice-chairmen elected were F. R. Coates, W. H. McGrath and E. A. Barrows. Members-at-large until 1925 elected were A. C. Marshall, J. F. Gilchrist and T. W. Martin.

State Public Utility Information Bureau Directors Meet

ANIMATED and constructive discussion of the most successful ways and means of getting the utility story to the people marked the first meeting of the directors of public utility information bureaus on Tuesday. J. B. Mullaney, director of the Illinois committee, acting as chairman, directed the discussion of the papers in a masterly manner and every vital point was dwelt upon. Four papers were read and discussed during the afternoon.

Four salient points are to be remembered if a public utility information bureau is to be a success, H. M. Lytle, associate director of the Illinois committee, declared in his paper, "The Newspaper Relationship." These points are; (1) There must be constant thought

F. R. COATES
President and General Manager
Toledo Railways & Light Co.

W. W. FREEMAN
President
The Union Gas & Electric Co.

MISS OLIVE A. BURSIEL
Secretary New England Division,
N. E. L. A.

H. C. BLACKWELL
Kansas City Light & Power Co.

P. L. THOMSON
Advertising Manager
Western Electric Co.

H. C. COUCH
President and General Manager
Arkansas Light & Power Co.

M. S. SLOAN
President
Brooklyn Edison Co.

H. T. SANDS
Charles H. Tenney & Co.

Chairmen of public relations committees who presented reports at Atlantic City Convention, and committees over which they presided during the past year: Mr. Coates, committee on upbuilding the industry; Mr. Freeman, committee on uniformity of state regulatory laws; Miss Bursiel, committee on women's public information; Mr. Blackwell, committee on employee relations with the public; Mr. Thomson, committee on manufacturers' advertising; Mr. Couch, committee on public speaking; Mr. Sloan, committee on relations with bankers; Mr. Sands, committee on state organization of public information.

and effort. (2) The so-called press-agent type of publicity man has proved to be a flash in the pan. (3) Information must be collected and collaborated from every branch of the industry, for at best the individual knows only his own department. (4) More progress in educating utility employees in their business has been made in the past three years than in all the previous years combined, but this in reality is only a step. It was pointed out that few utility companies have even as yet organized themselves in a publicity, advertising or public relations way. Many continue to buy expensive space in advertising columns and then fill it with badly written matter which creates no good impression except upon the man who wrote it. Definite technique is required to do this, and it takes a skilled workman to tell a story in an advertisement successfully.

SPEAKERS' BUREAU OF VITAL IMPORTANCE

Operation of a speakers' bureau in connection with state committees on public utility information is so vital, said Benjamin E. Ling, director of the Ohio committee, in his paper, "Public Addresses as Good-Will Builders," that it is doubtful whether this great co-operative effort at gaining good will for the public utility can be successful without it. The messages about the public utility industry which these public speakers have been able to "put across" in Ohio have had most pleasing results, and he thought that these results can be duplicated in every other state.

Excellent results were pointed to as a result of personal letters from the bureau directors when editorials and articles appeared in the press which showed misinformation on the part of the editor. Copies of such letters—which naturally treat only of the general utility situation and not of any local problem—are sent to utility executives in the city where the newspaper is published, so that, if advisable, information as to the local aspects may be added to the general information.

In his paper, "Possibilities in Public Utility Conventions," Alfred Fischer, director of the Michigan committee, dwelt on the possibilities of making the utility convention a great public mass meeting. He pointed out the desirability of throwing open the doors of the convention to the public and particularly emphasized the value of making the power plant available for public inspection. Mr. Fischer brought out the fact that the most successful means of reaching the public has been to leave discussion of utility problems out of the picture until the agricultural, industrial and civic dependence of a community upon electric power has been explained. Then the relation of the utility development to the communities growth will naturally follow and be understood by the public.

The enormous value of imbuing engineering students with proper ideas of utility problems was emphasized by Horace M. Davis of Lincoln, Neb., who cited several specific cases where direct benefit had resulted from holding state conventions at the state universities and colleges. Participation in the convention programs by the engineering faculty has been found to be highly advisable as it brings out an unusually instructive interchange of viewpoints.

In discussing this phase of public utility information the good moral support of the manufacturers was commended, and it was held that the value of the publicity efforts made by these manufacturers in the past cannot be overestimated. It was pointed out, however, by Howard T. Sands of Boston that it is now the duty of the utilities themselves to bear all the expense of this publicity.

Nothing can be so important as education relative to the utility industry, for it is its cornerstone, declared E. E. Lincoln, head of the chair of public utilities of Harvard University, at the second meeting. In Harvard University this is considered one of the most important subjects. There is the most profound ignorance relative to all public utility affairs. There is nothing too elementary to explain. For thirty years men in the utility business have gone on assuming a situation—assuming that the public knew about their business—and the public has known nothing.

"I agree with every word the chairman (Bernard J. Mullaney) has said relative to municipal ownership," said Professor Lincoln. "The way to attack it is merely to give the public the facts relative to the industry. The public will make up its mind as to the facts, but any intensive move throughout the country against municipal ownership might have a disastrous effect."

John C. Mellett, director of the Indiana Committee on Public Utility Information, told of the co-operative effort under way in that state with the public schools, particularly high schools and colleges. A series of pamphlets, duplicating those published by the Illinois committee, has been sent to those schools requesting such pamphlets. These requests are brought through letters sent to the school superintendents advising them of the committee's work in preparing such informative matter.

H. M. Lytle, for the Illinois committee, said that it first had dealt with 356 high schools, but that since then the list had been expanded to 887 high schools and thirty colleges and universities of the state.

CLOSE CO-OPERATION URGED

Joseph B. Groce, director New England Bureau of Public Service Information, declared that there is a necessity for the closest c-operation between the various state committees and the national associations. He said the big work before the committees and the national associations is to sell to America the knowledge that the utility industry is second only to farming as the nation's greatest enterprise and that it is a great industry whose essential character is such that unless it progresses and prospers the nation cannot prosper.

Labert St. Clair, publicity manager of the American Electric Railway Association, and Charles W. Person, secretary advertising section, American Gas Association, who were present, volunteered the closest co-operation with the state committees. Mr. St. Clair said that the state committees were close to the ground and could localize publicity and educational effort in a way that would get actual results which such effort directed from a centralized source could not hope to accomplish.

H. T. Sands, chairman public relations committee, N. E. L. A., said that the work of the committees must be carried out on state lines, that there must not be too much organization between the various state committees, and that they must continue their policy of hammering home the truths relative to the industry and staying out of controversies.

To work out a clear-cut program of co-operation between the state committees and the national associations, it was resolved to appoint a committee from the state directors to meet with the secretaries of the three national associations.

Breaker Rating and Automatic Substation Attract Special Attention

Electrical Apparatus Committee of N. E. L. A. Also Dwells on Transformer Standardization, Interchangeability of Oils, Closed-Circuit Ventilation, Excitation, Service Voltages, Power Factor, Motor-Starting Current and Radio

RATING of oil circuit breakers and the progress which has been made recently in applying automatic substations to various kinds of service received considerable attention this year in the report of the electrical apparatus committee of the National Electric Light Association, of which A. H. Lawton is chairman. Special consideration was also devoted to the trend in providing excitation, the progress in standardizing transformers and the oil used in them, the basis for performance guarantees, and the status of radio as it bears on central-station operation. Service voltages, power factor, motor-starting currents and the alternating-current elevator motor also came in for discussion, along with other things.

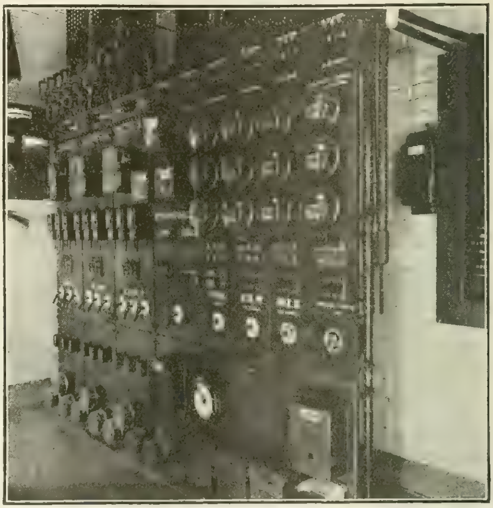
This year the efforts of the committee have been directed toward harmonizing the circuit-breaker requirements specified by operating companies. So many differences were found to exist that it was necessary to redefine "duty cycle," "condition after duty cycle" and "interrupting rating."

As a result it has been decided that duty cycle is the specified number of times at stated intervals that a breaker interrupts a circuit. It begins with the breaker in the closed position and is completed when the breaker is in the final open position. There is a possibility that two duty cycles must be recognized—one starting with the breaker closed and the other with the breaker open.

It was further decided that the breaker shall be substantially in the same mechanical condition at the end as at the beginning of the specified duty cycle and shall not have emitted flame. Furthermore, the breaker shall be capable of carrying rated current at the rated frequency and voltage. It is not to be inferred, however, that the breaker may be reclosed without inspection and making repairs if necessary.

The "interrupting rating" is based on the root-mean-square current at normal voltage which the breaker can interrupt under the specified duty cycle.

To cover the majority of existing conditions the committee recommends five duty-cycle standards, as follows: (A) One interruption (one shot) heavy overload duty; (B) two shots with two-minute interval; (C) four shots with thirty-second intervals; (D) four shots with one-half second interval, and (E) 300 shots with fifteen-minute intervals. The first duty seems desirable as a basis for checking safety factor of old breakers and also for new breakers where the duty imposed never exceeds that specified. Most breakers are now rated on the two-shot basis (B), which is comparable with the requirements on underground circuits. The three-shot, thirty-second interval duty (C) seems best for overhead circuits, while the modified three-shot duty (D) seems best for automatic substation service. Duty E is intended for service where many interruptions occur per day.



CONTROL BOARD OF AUTOMATIC ALTERNATING-CURRENT FEEDER SUBSTATION AT ST. LOUIS, MO.

According to an analysis of circuit-breaker performances, twenty out of twenty-nine breakers failed or were damaged in performing interrupting duty. Five successfully ruptured the circuit, and four were examples of failures due to other causes than interrupting duty. One of the five successful performances was reported as rupturing two and one-half times the rated capacity. Of the twenty units which failed, ten did so while interrupting more than rated current and nine while interrupting less than rated current. One could not be classified because of lack of data.

Substantial progress is reported in the development of control devices for automatic substations, and several recently installed stations of this type, both direct current and alternating-current, are described.

The high cost of control equipment required to convert existing manually operated direct-current substations for automatic operation is no doubt the reason for the few changes which have been considered. Where new substations are contemplated, particularly the standard stepdown transformer substation with feeder regulators connected to an alternating-current distribution system, designs for automatic operation should receive careful consideration. For this class of substation, according to the committee, it can be confidently stated that successful operation will result. It is likewise probably true that in most cases of alternating current substations, the annual charges—*i.e.*, investment and operating charges—are less than for a substation where attendants are required. The use of automatic substations permits the greatest flexibility and economies in the design of the distribution system. In addition, the automatic control devices give a character of service superior to the highest-grade of service delivered from manually operated substations. This follows from the accuracy with which these devices respond to the settings for which they are adjusted. This fact further prompts the suggestion that service from manned substations can be improved by the installation of automatic-control devices.

Considerable progress has been made in actual installations of automatic alternating-current substation equipment during the year. The power supply for actuating the oil circuit breakers is arranged somewhat differently in the several cases. In two instances the oil circuit breakers are operated individually by solenoids and motors, the operating power being furnished by control storage batteries. In one installation the circuit breakers are operated by individual alternating-current solenoids, the operating power being supplied by control transformers. In one substation gang operation of all oil circuit breakers has been provided, one alternating-current motor operating a cam which in turn operates a separate cam for each circuit breaker.

Some difference in practice exists in the substations described with regard to (1) the number of reclosures of oil circuit breakers provided by the control equipment; (2) the interval between reclosures, and (3) the question of reclosure at all under certain conditions of short circuit.

Suitable devices are now obtainable to permit automatic operation in accordance with any of the following basic schemes:

Scheme 1.—Under this scheme provision is made when the circuit breaker is opened as a result of overload conditions for three reclosures at very short intervals regardless of the nature of the overload. After three reclosures the circuit breaker will open and remain open if a short circuit persists. The merit of this arrangement is that it tends to prevent loss of load.

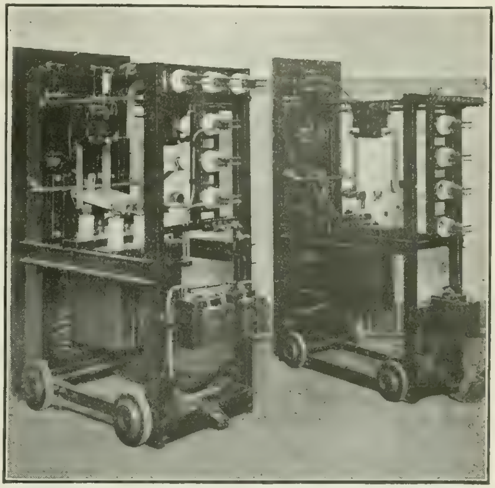
Scheme 2.—Under this scheme a motor-driven periodic relay or timer is employed. This timer can be made to reclose the circuit breaker at definite intervals varying from a few seconds to two minutes, depending upon the gearing used with the timer. The total number of reclosures depends upon the number of contacts on the drum of the timer. The customary number is three.

Scheme 3.—This scheme is a combination of the first and second schemes. It differentiates between a short circuit and an overload less than 50 per cent of short-circuit current value. Should a short circuit occur, a motor-driven timer will be placed in operation and function as outlined in Scheme 2. Should the overload current be less than 50 per cent of short-circuit current value, a service-restoring relay will function as outlined in Scheme 1.

Scheme 4.—The fourth scheme provides for periodic reclosing as in the second scheme by using a motor-driven timer, but with selective action to permit reclosure of only one circuit at a time on account of the limited capacity of the control storage battery. The selective action is secured by means of a motor-driven master controller which is caused to rotate by the opening of a circuit breaker. The release coils of the timers on the several circuits are connected to this controller. Once the master controller releases the timers, the three reclosures for each circuit are governed by the operation of its individual timer.

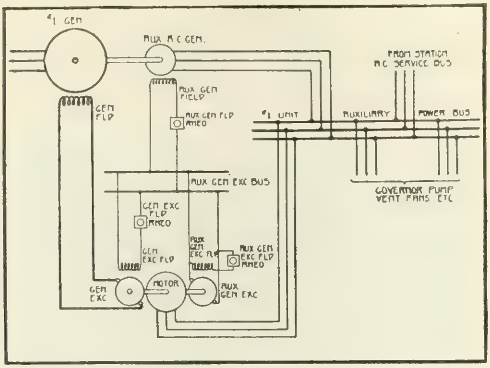
TRANSFORMER STANDARDIZATION

The standardization of transformer sizes, voltages and taps has been carried forward and extended to include accessories and name-plate markings. Recommendations are made to extend the present standards to include 33,000-volt single and three-phase distribution transformers, and also to include distribution transformers with 2,300 volts low-tension rating in certain sizes. For power service the committee recommends the extension of present standardized ratings to cover transformers taking power from standard system voltages of 44,000 volts and above and supplying nominal 6,600-volt, 11,000-volt and 13,200-volt secondary distribution. Certain voltage ratings and sizes have been designated as preferred in both distribution and power transformers with the hope of directing the trend of future transformer development into the fewer sizes, thus making possible lower factory costs and hence reduced purchase prices.


TRIPLE-POLE AND SINGLE-POLE TRUCK-TYPE SWITCHBOARDS USED IN LOUISVILLE (KY.) SUBSTATION

Interchangeability of oil for transformers has been agreed upon by the two largest manufacturers of transformers, and the standard oil of either manufacturer has been accepted by most of the smaller manufacturers for replacement use in the latter's transformers. Recommendations have been made covering performance guarantees of all standard transformers for lighting and power service in order to clarify the wording of the present pamphlet on transformer standards. Experience is reported with regard to drying oil by means of the centrifugal separator and a method is described for drying out large power transformers.

Three actual installations of closed-circuit ventilation for generators have been reported to the committee, in all of which cooling is accomplished by passage of the air through water spray. These have been designed to obtain the advantages of cleaner windings, decreased liability of internal fires, and in one case to conserve the heat from generator losses. In this case the cooling water is taken from the city mains and pumped into the boiler feed-water heaters.



COMBINATION AUXILIARY AND EXCITATION SUPPLY SUGGESTED FOR LARGE HYDRO-ELECTRIC UNITS

Several instances have been reported during the year of generator fires being quickly extinguished by steam. Only one fire in a generator equipped with water-spray equipment has been reported, and this was quickly extinguished, but with considerable damage. The use of inert gases to stifle combustion has been suggested, one plant now being equipped with carbon-dioxide nozzles.

Considerable variation seems to exist in the current settings of differential relays, ranging from 15 to 125 per cent of full-load current. The high setting is provided to avoid unnecessary disconnection, abnormal conditions being indicated at much lower current by an alarm.

The advantages of separation of the control from the exciter system so as to make it entirely independent have led the engineers of one company to provide two separate control systems in a very large station recently placed in operation. Two oil circuit breakers are provided in series on each circuit and are connected to different control systems. Both are automatic, so that in case the first switch should fail to function, the second would surely do so, even should the control supply to the former be interrupted.

Use of individual exciters for generators has increased considerably, some being turbine-driven, some electrically driven, and others having a combination of the two drives. At Keokuk fifteen generators with individual motor-driven exciters have been operated successfully for many years without any provision for emergency except spare parts. At the Hell Gate station, New York, generators with directly connected exciters are provided without any alternative supply of excitation. With the individual excitation scheme it is practically possible to eliminate the losses in the generator-field rheostats by operating the exciter throughout its stable voltage range and using the generator-field rheostat only for lower voltages.

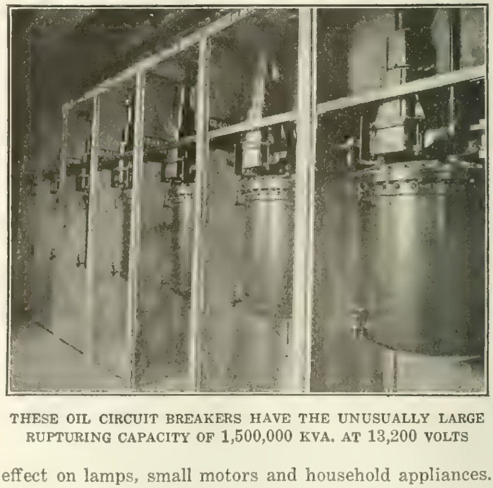
Greatly increased use of electrically driven auxiliaries is reported, 2,300-volt motors being used in some cases wherever the rating is over 40 hp. and in other cases where it is over 100 hp.

The development of the alternating-current motor to replace satisfactorily the direct-current motor for variable-speed service is progressing, but it still continues to be a serious problem. In this connection it can be reported that the experience with the brush-shifting motors installed in the fall of 1920 in the Springdale station has been quite satisfactory. The boiler forced-draft fans in the Hell Gate station are driven by 350-hp. motors of the brush-shifting type.

Grounding of the neutral of three-phase generators in order to limit the voltage stresses to ground throughout the system has practically become standard practice for both 25-cycle and 60-cycle systems. On most systems it has been found desirable to make the ground connection through a current-limiting resistor, in order to limit these ground currents. However, on a few of the larger underground systems, notably at Baltimore and Detroit, neutrals of all the generators are tied together and solidly grounded, thus limiting the voltage stresses, though involving heavy ground currents.

The motor rules have received consideration, and it is recommended that no charges be made this year. An interesting digest is given of the factors entering into the consideration of motor starting currents, and a description of new developments in motor starters is included. The improvement of motor power factor and system power factor are given brief mention. Particular attention has been paid to alternating-current elevator motors.

The tentative recommendations of last year on standardization of service voltage are discussed as to their effect on lamps, small motors and household appliances. The committee recommends that the report remain in tentative form for another year.



THESE OIL CIRCUIT BREAKERS HAVE THE UNUSUALLY LARGE RUPTURING CAPACITY OF 1,500,000 KVA. AT 13,200 VOLTS

A general review of the radio situation and an outline of electrical developments in the textile, steel, paper, moving-picture, oil and break-making industries conclude the report.

Some large motor-driven centrifugal gas compressors are described, and data are given relative to a new line of synchronous motors recently developed for power-factor correction.

Adopt Inductive Interference Principles

Second Report of the General Joint Committee Includes Principles for Governing Future Work — Public Interest Is Recognized as the Paramount Factor in Arriving at a Solution of the Problem

IN ADDITION to the regular committee report, the second report of the general joint committee of the National Electric Light Association and the Bell Telephone System on joint relations between supply and signal systems was presented at the inductive-interference committee meeting at Atlantic City this week. The first report, made on March 7, 1922, was a statement of agreement on the use of the National Electrical Safety Code for crossings and conflicts and a statement of the position of both interests on the inductive-interference problem and of the existing status of the subjects of joint pole occupancy and parallel construction. A recommended plan of procedure was also included. The second report represents the actual working out of the fundamental principles on which detailed rules and the development work of the future will be based. They are important as representing a definite step in the joint committee work and the first attempt to make a statement of principles in which public interest to service is the governing factor. Not only will the future joint work be governed by this code of principles, but they are now in form to put to practical use in situations where inductive-interference rules of some character must be adopted before detailed rules are agreed on. The complete code of principles is as follows:

SCOPE

These principles and practices are intended to apply to all new installations, extensions and reconstructions and to the maintenance, operation and changes of all signal and supply systems where inductive co-ordination may be required now or later to prevent interference with the rendering or providing of supply or signal service.

PRINCIPLES

Duty of Co-ordination.—(a) In order to meet the reasonable service needs of the public, all supply and signal circuits with their associated apparatus should be located, constructed, operated and maintained in conformity with general co-ordinated methods which maintain due regard to the prevention of interference with the rendering of either service. These methods should include limiting the inductive influence of the supply circuits, or the inductive susceptiveness of the signal circuits, or the inductive coupling between circuits, or a combination of these, in the most convenient and economical manner.

(b) Where general co-ordinated methods will be insufficient, such specific co-ordinated methods suited to the situation should be applied to the systems of either or both kinds as will most conveniently and economically prevent interference, the methods to be based on the knowledge of the art.

Co-operation.—In order that full benefit may be derived from these principles and in order to facilitate their proper application, all utilities between whose facilities inductive co-ordination may now or later be necessary should adequately co-operate along the following lines:

(a) Each utility should give to other utilities in the same general territory advance notice of any construction or change in construction or in operating conditions of its facilities concerned, or likely to be concerned, in situations of proximity.

(b) If it appears to any utility concerned that further consideration is necessary, the utilities should confer and co-operate to secure inductive co-ordination in accordance with the principles set forth herein.

(c) To assist in promoting conformity with these principles, an arrangement should be set up between all utilities whose facilities occupy the same general territory providing for the interchange of pertinent data and information, including that relative to proposed and existing construction and changes in operating conditions concerned or likely to be concerned in situations of proximity.

Choice Between Specific Methods.—When specific co-ordinated methods are necessary and there is a choice between specific methods, those which provide the best engineering solution should be adopted.

(a) The specific methods selected should be such as to meet the service requirements of both systems in the most convenient and economical manner without regard to whether they apply to supply systems or signal systems or both.

(b) In determining what specific methods are most convenient and economical in any situation for preventing interference, all factors for all facilities concerned should be taken into consideration, including present factors and those which can be reasonably foreseen.

(c) In determining whether specific methods, where necessary, shall be wholly by separation or partly by methods based on less separation, the choice should be such as to secure the greatest present and future economy and convenience in the rendering of both services.

Inductive Co-ordination for Existing Construction.—(a) Utilities operating supply or signal circuits should exercise due diligence in applying co-ordinated methods, as occasion may arise, in accordance with these principles, to existing construction.

(b) When supply or signal circuits are generally reconstructed or when associated apparatus is rearranged or added, or when any change is made in the arrangement or characteristics of circuits, the new or changed parts should be brought into conformity with these principles.

Co-ordinated Locations for Lines. — Utilization of the highways is essential to the economical and efficient extension, operation and maintenance of supply and signal facilities. To avoid unduly increasing the number or difficulty of situations of inductive or other exposure incident to the use of the same highway by two different kinds of facilities, all lines should, in general, be located as follows:

(a) General Location.—(1) Where the conditions and character of the circuits permit, joint use of poles by signal and supply circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience, and presuming satisfactory agreement between the parties concerned as to terms and conditions.

(2) Where signal circuits and supply circuits on the same highway are not to occupy joint poles or where either kind of circuit is alone on a highway, all signal circuits should be placed on one side of the highway and all supply circuits should be placed on the other side, so that, as far as practicable, one side of any section of a highway will be available as the signal side and one side as the supply side.

(3) Unnecessary crossings from side to side of the highway should be avoided.

(b) Detailed Location.—(1) Local Signal Lines: Where to be located on the same highway with local supply lines, joint use is generally preferable to separate lines, except sometimes in rural districts and except where the character of circuits involved makes separate lines on opposite sides of the highway more desirable. Where to be located on the same highway with transmission lines, separate lines on opposite sides of the highway are generally preferable unless a large number of service wire crossings would be involved, in which case, joint use or other arrangements may be preferable.

(2) Toll or Through Signal Lines: Where to be located on the same highway with local supply lines or lower-voltage transmission supply lines, separate lines on opposite sides of the highway are generally preferable, unless a large number of service wire crossings would be involved, in which case, joint use or other arrangements may be preferable. Where proposed for location on the same highway or to follow the same general direction with higher-voltage transmission supply lines, co-operative consideration should determine whether such locations should be used, and if so, what specific co-ordinated methods are necessary. Where to be located on the same highway with higher-voltage transmission supply lines, separate lines on opposite sides of the highway are preferable.

(3) Local Supply Lines: Where to be located on the same highway with local signal lines, joint use is generally preferable to separate lines except sometimes in rural districts and except where the character of circuits involved makes separate lines on opposite sides of the highway more desirable. Where to be located on the same highway with toll or through signal lines, separate lines on opposite sides of the highway are generally preferable, unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable.

(4) Transmission Supply Lines: Where to be located on the same highway with local signal lines or shorter toll or shorter trunk signal lines, separate lines on opposite sides of the highway are generally preferable unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable. Where proposed for location on the same highway or to follow the same general direction with longer toll or through signal lines, co-operative consideration should determine whether such locations should be used, and if so, what specific co-ordinated methods are necessary. Where to be located on the same highway with longer toll or through signal lines, separate lines on opposite sides of the highway are preferable.

(5) Avoidance of Overbuilding: Overbuilding of one line by another should be avoided, where practicable. Where necessary for the two kinds of lines to occupy the same side of a highway, joint use is generally preferable to overbuilding.

(c) Other Rights-of-Way.—The foregoing principles, although specifically mentioning highways, should also, when applicable, govern situations involving private rights-of-way near to each other or to highways.

Deferred General Co-ordination.—While signal or supply lines when alone should conform to general co-ordinated methods, such lines, pending the incoming or development of the other kinds of lines, may, if deemed economically advantageous, occupy locations or use types of facilities, construction and operating methods other than those conforming to general co-ordinated methods. However, the location and character of such facilities should be altered when and as necessary to conform to these methods upon the incoming or development of another kind of facility conforming to general co-ordinated methods.

Special Location and Types.—When co-ordination of supply and signal lines of particular types cannot be technically and economically established under the methods of co-ordination covered by these principles, special co-operative consideration should be given to determining what location and type of construction should be established for each line of such type.

Definitions.—For the purpose of these principles and practices, the following terms are used with meanings as defined below:

Inductive co-ordination: The location, design, construction, operation and maintenance of supply and signal systems in conformity with harmoniously adjusted methods which will prevent inductive interference.

General co-ordinated methods: Those methods reasonably available for general application to supply or signal systems which contribute to inductive co-ordination without specific consideration to the requirements for individual inductive exposures.

Specific co-ordinated methods: Those additional methods applicable to specific situations where general co-ordinated methods are inadequate.

Inductive interference: An effect arising from the characteristics and inductive relations of supply and signal systems of such character and magnitude as would prevent the signal circuits from rendering service satisfactorily and economically if methods of inductive co-ordination were not applied.

Inductive exposure: A situation of proximity between supply and signal circuits under such conditions that inductive interference must be considered.

Inductive susceptiveness: Those characteristics of a signal circuit with its associated apparatus which determine, so far as such characteristics can determine, the extent to which it is capable of being adversely affected in giving service by a given inductive field.

Inductive influence: Those characteristics of a supply circuit with its associated apparatus that determine the character and intensity of the inductive field which it produces.

Inductive coupling: The inter-relation of neighboring supply and signal circuits by electric or magnetic induction or both.

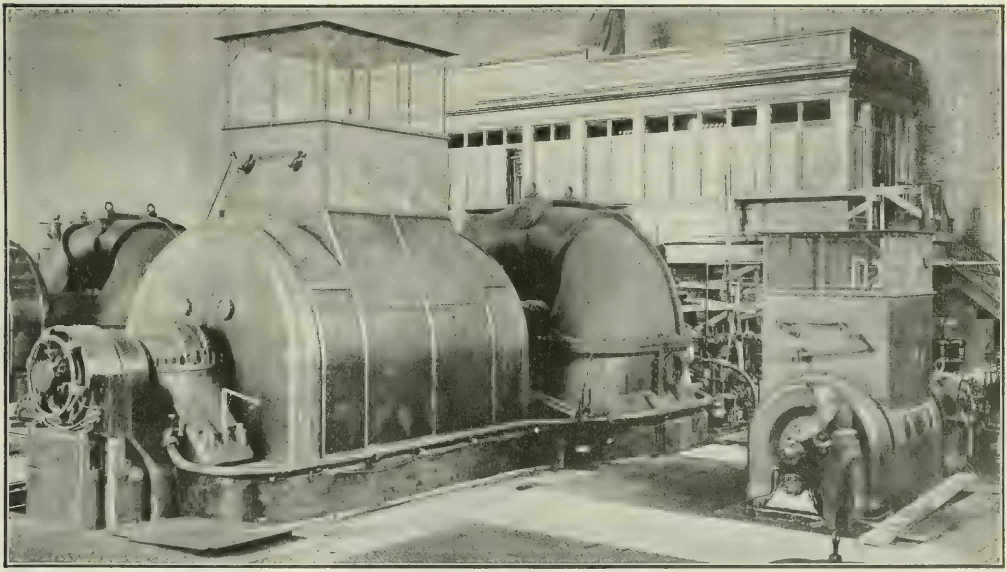
Lessons Learned from Forty Electrical Fatalities

UNDER the above heading E. S. Whiting of the Liberty Mutual Insurance Company has written a paper in which he considers hazards from low-voltage as well as from high-voltage circuits, asserting that a remarkable number of low-voltage shocks—that is, shocks where the voltage was under 600 and even as low as 110—have proved fatal. The safety engineer, says Mr. Whiting, is interested in the medical question of how electricity kills only as a possible clue to determine what maximum flow of electricity through the body is safe, but this value would be of little actual use if it was known. It is necessary to measure the electrical hazard in terms of voltage since the shock current which flows in case of accident can never be known. It is undoubtedly the amount of current sent through the body and the time it flows that causes the death, but there is no way of tying the voltage and current together quantitatively in shock cases. This is because the other element in the case, the resistance of the shock circuit, is widely variable. This resistance depends on what manner of body contacts are made with the circuit, and these contacts range all the way from a light finger contact with foot contact through dry shoes (thus giving extremely high resistance in the shock circuit) down to a heavy grip of the hand on a switch blade with feet soaking wet in a pool of water (thus giving the other extreme of low resistance in the shock circuit).

The way to prevent low-voltage accidents, Mr. Whiting holds, lies in inclosing all current-carrying equipment to a height of 7 ft. at least above the floor, boxing in all fuse cut-outs, getting rid of bare motor terminals by boxing in or by thorough insulation, replacing open-knife switches by inclosed switches, keeping open wiring out of reach, avoiding the use of drop cords and using safe types of lamp sockets. If extension lamp cords are necessary, the highest grade of reinforced cord with the lamps mounted on wooden handles with porcelain sockets and lamp cages should be employed. In addition, all dead-metal parts of low-tension equipment should be permanently grounded.

Performance of Equipment and Trends in Station Practice

Analysis of Turbine Outages and Operating Data for Powdered-Fuel, Diesel and Oil Plants Constitutes an Important Part of the Report of the N.E.L.A. Committee on Prime Movers This Year



MARKED DEPARTURES FROM CONVENTIONAL PRACTICE WERE MADE IN THE STATION OF WHICH THIS GENERATOR IS A PART

The turbine room is next to the river, enabling condensers to draw circulating water through short intakes; practically all the auxiliaries are electrically driven; feed-water is heated by exhaust from house turbines and in emergency by bleeding main units; heat balance is controlled from the balcony overlooking the turbine room; ashes are removed by a hydraulic sluice; flexible facilities are provided for coal handling, and all important steam valves are electrically operated.

DATA on the performance of seventy-eight large turbines, the characteristics of furnace refractories, and experience had with several Diesel-engine, powdered-fuel and oil-fired boiler plants constitute this year an important part of the report of the prime movers committee of the National Electric Light Association, of which H. P. Liversidge is chairman. In addition, however, considerable information of value is given regarding improvement in turbine details, maintaining heat balance, tendency in steam pressures and superheats, prevention of clinker adhesion, water softening and lubrication. In general, the committee points out that station equipment has become virtually standardized except in details.

The data on performance of turbines, which are presented in chart form on another page, were obtained from twenty-seven plants and cover units rated at 20,000 kw. to 45,000 kw. The data give a complete history of each unit from the date of installation, as indicated on the accompanying chart. The weighted performance of the units in these three classes is given in the original report.

The committee states that 100 per cent availability of generating equipment is essential from a service standpoint, but that existing units do not approach this figure and that, generally, it is better to invest money in improving the reliability of existing units than to purchase reserve units.

Improvements in turbines may be noted during the year in two respects: (1) Short-range emergency governors have been placed on the turbines; (2) rotor, disk and blade design features have been improved by the use of better materials and through research work on vibrational stresses.

A decided trend toward feed-water heating from house turbines or from steam bled from the main units is noticeable, and the practice of installing feed-water heating tubes in the main-unit condensers has been discontinued. The other methods offer operating advantages in maintaining a heat balance.

Large boilers are favored in generating-station practice, according to data collected during the last year. The largest boiler installed is in the Congress Street heating plant of the Detroit Edison Company and has a normal rating of 2,982 hp.

There is a continued tendency toward higher pressures, the present maximum being 350 lb. gage with a steam temperature of 700 deg. Fahr. Thirty-six stations now operate at pressures between 225 lb. and 260 lb.; sixteen at between 250 lb. and 275 lb.; six at between 275 lb. and 300 lb. During the year, at Runcorn, England, and at Edinburgh, Scotland, installations were made that operate with steam pressures of 270 lb. and 300 lb. respectively and a total steam temperature of around 700 deg. Fahr.

The A. S. M. E. Boiler Code has now been accepted in whole or in part by seventeen states and eleven cities, according to the chairman of the Uniform Boiler Law Society, and an organization has been formed to bring about uniform methods of boiler inspection.

The high temperatures found in the combustion chamber have necessitated the intensive study of refractories as regards both temperature effects and mechanical strength. The characteristics of some refractories are given in the report.

COST OF OPERATION OF TEN DIESEL ENGINE PLANTS 1921
(Fixed charges, insurance, taxes, etc., not included)

	Power Plant		Fuel		Labor		Lubricating Oil					
Plant	No. of Engines	Total Hp. of Stations	Quantity in Gallons	Cost	No. of Men	Cost	Quantity in Gallons	Cost	Repairs, Etc.	Total Cost	Kw.-hr.	Cost per Kw.-hr.
A	2	340	60,529	$3,389.62	3	$4,742 50	630	$441.00	$164.88	$8,738.00	$563,685	$0.0155
B	2	530	89,408	6,180.28	3	5,065.00	922	645.40 Price assumed at $0.70 gal.	500.00 Incl. extra parts not yet used	13,319.29 Incl. some misc. expenses not shown	778,310	0.0171
C	3	980	158,823	6,688.50	4	3,950.00 No. mgr. incl.	2,250	1,680.00	4,016.67 Incl. rep. and supplies, overhaul expense and water	16,230.17	1,514,862	0.0107
D	3	330	35,040	4,242.08	2	5,064.00	989	575.45	121.68 Includes waste	10,003.21	317,442	0.0315
E (6 yrs. results	2	240	. .	13,084.36		15,242.60	.	2,158.24	6,609.62 Includes repairs to buildings and elec. equipment	37,094.82	1,348,903	0.0275
F	3	1,500	528,020	28,186.07	11	14,549.17	251,832	2,012.31	25,927.51	74,189.08 Includes $368.53 for water and $3,145.49 miscellaneous	5,833,230	0.0127
G	1	165	67,490	3,978.34		1,639.51		1,974.77 Also incl. supplies	. .	8,305.62 Incl. $713.80 for maintenance	680 293	0.0122
H	4	2,000	606,522	57,080.37		9,225 79	7,046	5,464.41	16,577.88	88,618.09 Includes $269.64 miscellaneous	6,331,937	0.0139
I	....	... .		9,922 31		10,808.02		1,783.50	1,744.27 (Supplies and expenses)	24,258.10	1,898,620	0.0127
J	3	1,500	413,479	20,501.41		8,959.00		4,973.23	118,773 81 (Maintenance)	253,814.99 Includes $407.54 miscellaneous	3,959,033	0 0136
											Arithmetical average	0.0167
											Weighted average	0.0144

On the whole, the committee commends the specifications of the Panama Canal Commission for firebrick and calls attention to the tests of the American Society for Testing Materials.

Clinker adhesion is commonly prevented by using perforated firebrick along the clinker line through which air is forced from the stoker air duct. Results are generally satisfactory, but slag may stop the holes in the blocks. Perforated cast-iron side-wall air boxes also have given good satisfaction.

The treatment of feed water is a very important question with most companies, and the committee favors the use of a softening plant in preference to the use of compounds. The use of evaporators solves the feed-water problem, but much corrosion ensues, especially in steel-tube economizers, due to the presence of oxygen in the water.

The past year has been marked by increased attention to auxiliary drive, with particular reference to the type of drive and source of power as affecting heat balance. Reliability of operation is still the first essential in choosing auxiliaries, and where electric drive is used provision must be made for starting the station under emergency conditions. Duplicate equipments are still essential, with auxiliary drive for main units. The house turbine continues to gain in favor as a source for generating electric power and for obtaining all the steam needed for feed-water heating. Variations noted in the installations are: (1) They may be employed in conjunction with other steam auxiliaries; (2) the normal supply may be by electric drive from the house turbine with emergency supply from the main units; (3) part of the drive may be supplied by main units and steam for heating be bled from these units. Theoretically the greatest economy is gained from multiple-stage bleeding of the main unit, but practical operation has limited all the bleeding points to two.

Control of all auxiliaries should, in the opinion of the committee, be placed in the hands of one man, and he should be responsible for maintaining a heat balance at all times.

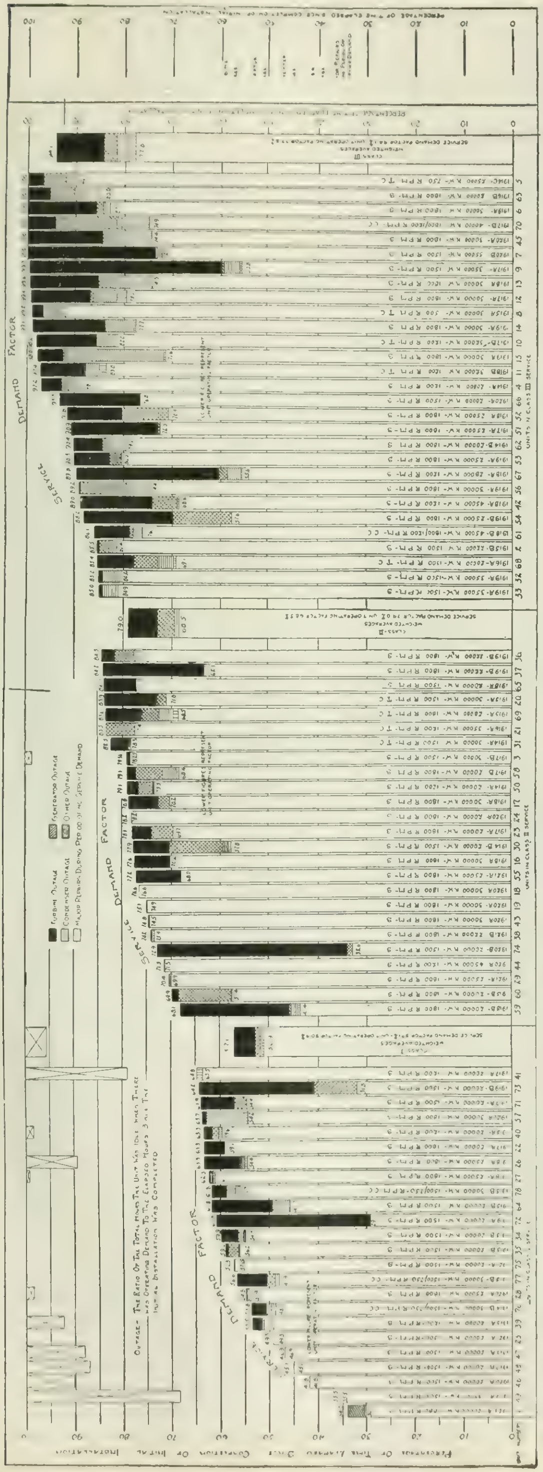
The problem of ash handling and quenching is still solved by the individual plants in various ways. Submerged ash hoppers, railroad-car conveyors and hydraulic sluicing are among the methods adopted.

Under the auspices of the committee an elaborate series of tests was made on electrically operated gate valves.

All of the valves under test closed satisfactorily from the standpoint of emergency operation, although some showed more damage to the seat and disk ring than others.

The use of meters for recording data necessary to efficient operation is warranted by the experience of most operating companies. Most of the apparatus which is now on the market has been operated satisfactorily and many new types have been developed during the year.

The aggregate horsepower of Diesel engines is 374,000, with an average horsepower per engine of about 225. The high price of fuel oil leads the committee to say



SERVICE RECORD SINCE COMPLETION OF INITIAL INSTALLATION—SEVENTY-EIGHT TURBINE-GENERATING UNITS, 20,000-KW. TO 45,000-KW. RATING

that Diesel engines must be adapted to the use of low-grade fuel oil to make much progress in power work. The consensus of opinion is that Diesel engines are reliable, have a thermal efficiency as high as 34 per cent and are reasonably quick to pick up load, but that they need care and that maintenance may be high after several years of operation. In ten instances the operating cost runs from $0.0107 to $0.0315 per kilowatt-hour without including taxes, fixed charges, etc. In five instances the cost of maintenance per kilowatt-hour runs from $0.004 to $0.019.

FUEL SITUATION UNCHANGED

Greater use of low-grade coal, fuel oil, pulverized fuel, gas and other alternatives has been strongly advocated, but no marked departures have been made in practice. Isolated tests have been made with lignite with very good results under special conditions. The pulverized-fuel situation is unchanged, although the experience obtained shows it to be practicable for power purposes. The year has seen marked improvements in regard to ash discharge, furnace design and burner design and arrangement. Therefore pulverized coal may be accepted as a practical fire for power-boiler operation. In the United States more than 13,000,000 tons of coal per year is now used in pulverized form under boilers.

With pulverized fuel the subject of byproducts is usually associated from the standpoint of conservation. The general situation is that the extraction of byproducts from coal may become a profitable enterprise where the market value of the byproducts is great enough to offset the cost of processing the coal. Some investigations are under way to determine the best method of producing the byproducts and to ascertain the cost of the process.

Lubrication has been a vital element in operation, and much study has resulted in some definite improvements in methods and in lubricants.

A standard specification for turbine lubricating oil is recommended by the committee, and a tentative outline is submitted.

A noticeable trend toward pressures of around 350 lb. with total steam temperatures of from 800 deg. to 850 deg. Fahr., and even 1,300 deg. Fahr., is contemplated for the future in Europe.

Single-shaft turbine units are available up to 50,000 kw., and a complete design has been made for a 100,000-kw. unit. Closed-circuit cooling is favored in Europe, for the generator, and surface condensers are used in preference to the jet types.

A large number of European engineers favor turbine bleeding for feed-water heating, but three-point bleeding is the maximum used at the present time. For the large plants the economizer and air heater are used in conjunction with the bleeding. The subject of by-product plants is an economic problem which must be solved for European conditions, and great progress is being made.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Swedish Engineers' Opinion on Lightning Protection

To the Editors of the Electrical World:

After reading the A. I. E. E. midwinter convention reports on lightning arresters I could not help feeling quite astonished at the almost unanimous vote for electrolytic and oxide-film arresters. Leading men here in Sweden believe that lightning arresters for 55-kv. systems and higher voltages are rather superfluous. There is not a single arrester of the aluminum-cell or oxide-film type in use anywhere here, although there are a few private enterprises which use horn gaps with carborundum resistances. I believe most of the big power plants are owned by the state, and in none of these are any lightning arresters used. In fact, in the Trollhättan plants (55 kv., 135,000 kw.) there is a whole shack full of old aluminum cells which were installed about 1910 and thrown out of service soon after, when the people got tired of repairing them.

When the Alukarleby plant was built (1914-15) a whole story with big rooms was reserved for lightning arresters to be installed later. At that time several systems for surge protection were investigated, among others the Campos arrangement, consisting of two choke coils, with a condenser between them grounded through a resistance. While this arrangement was excellent theoretically, it proved too expensive to install. It was finally decided to leave out all arresters and instead provide better insulation on the transformers, particularly on the first few coils. The space reserved for lightning arresters was converted into a high-tension laboratory.

However, choke coils are often used on outgoing lines and a great number of oil breakers are provided with precharging contacts, with appropriate series resistors. Furthermore, all current transformers are protected by 5-ohm "Silit" resistors shunted across their primaries. When designing the insulation the principle of grading was followed, as described in the Electrical World for Nov. 13, 1920. The line insulators, power transformers and current transformers, being most difficult to repair, are strongly insulated. The busbar insulators form the weakest spot in the system. A surge entering the station will thus discharge over such an insulator, which is very easily replaced.

It is contended that if horn gaps are to be used they must, in order to respond to all dangerous surges, be adjusted for an arc-over voltage much lower than that of the weakest insulation. If so, however, they pick up a lot of smaller surges which would ordinarily cause no disturbance and the horns thus would virtually increase the yearly interruption hours rather than diminish them.

Edy Velander.

Vattenfallsstyrelsen, Stockholm, Sweden.

Forty-Degree Versus Fifty-Degree Rating from an Industrial Engineer's Viewpoint

To the Editors of the Electrical World:

Your editorial headed "A Machine Rating Should Express a Definite Limitation," in the March 18 number of the Electrical World, was a great surprise to me as it seemed a decided departure from your usual impartial statement of fact and clear-sighted comment. The extremely unwarrantable use of the Power Club's indorsement of the 50-degree motor as an argument for its use certainly demands a protest. You must be sufficiently acquainted with the Power Club to know that a substantial part of its membership has consistently opposed the 50-degree motor, but that, driven by inexorable competition into its manufacture, the club has finally been obliged to indorse it.

The use of "single rating" as applied to the 50-degree motor is merely a euphemism. I feel certain that there would be little objection to making the 40-degree motor one of single rating provided the temperature rise of the motor at full load was 40 deg. rather than 50 deg. The real point of the discussion is not whether a motor shall have a single or a double rating, but whether at full-load continuous operation its temperature rise shall be 40 deg. or 50 deg. C. above the ambient temperature.

The 50-degree rating sprang from three figures fixed by the American Institute of Electrical Engineers in its laudable efforts toward standardization—40 deg. to be taken as the "ambient" or room temperature, 15 deg. as a correction factor expressing the difference between the motor temperature taken by thermometer and the "hot-spot" temperature, and 105 deg. as the maximum safe temperature for impregnated cotton insulation. These are all arbitrary figures. On the maximum safe temperature in particular there was no unanimity of opinion nor does the figure selected represent any physically definite point. Rather, it is a compromised figure to represent a broad section of the curve of temperature and rate of deterioration. The 50-degree rise used as a rating is, of course, the difference between the 40-degree ambient temperature and the 90-degree maximum allowable observed temperature.

There are, however, a great many engineers who feel that for general-utility motors (and these comprise probably 85 per cent of the motors sold) conditions under which the motor will operate are so indeterminate and so variable that a factor of safety should be used between rated motor temperature and the ultimate safe temperature. Factors of safety are used in all other branches of engineering where uncertain limits or indeterminate conditions occur, and their omission in the temperature rating of motors seems most unwarrantable. The 10-degree difference between the 40-degree and 50-degree ratings, together with the factor of safety which the manufacturer must necessarily use to insure his being within his rating, compose the factor of safety implicitly proposed by the 40-degree rating.

In what way, then, does the rating of a 50-degree motor any more express a "definite limitation," or any more uphold "conceptions of genuine standardization," or any less comprise a "subordination of principles of accurate measurement to considerations of commercial expediency," than does that of the 40-degree motor?

Philip Chapin Jones,
Electrical Engineer.

Goodyear Tire & Rubber Company,
Akron, Ohio.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Remarks on the Rupturing Speed of Oil Circuit Breakers.—G. LONGUE.—The author describes a simple method to determine the mechanical speed with which an oil circuit breaker opens its contacts. A cylindrical drum upon which a time curve is drawn by the pointer of an electrically operated tuning fork is fastened to the main shaft of the breaker. If such a timing device is not available, the metallic registering drum may be covered with a wet strip of blueprint paper, an iron stylus used as pointer, and between the drum and the pointer an alternating current of known frequency and about 30 volts potential applied. This arrangement will, if the drum is rotated quickly, produce blue dashes, separated by blank spaces. Knowing the radius of the registering drum, the length of the operating lever and the frequency of the tuning fork or the alternating current, it is easy to calculate the average speed of the breaker mechanism. A curve may then be plotted between time and speed which will give the speed of the switch at each desired point. The author claims that the usual design of spark-breaking auxiliary contacts is unsuitable, because their shape causes such a rapid displacement of oil as to form a momentary vacuum, which is likely to reignite the arc. Such contacts should be tapered to an upper point or edge, so as to cause the smallest possible amount of eddying in the oil, instead of having the more or less ball-shaped form which is given to them in most switch designs.—*Revue Générale de l'Electricité,* March 11, 1922.

Lamps and Lighting

Flashlamps and Flashlight Batteries.—EUGENE H. MATHEWS.—The development of the flashlamp, first manufactured twenty years ago, is discussed. At the present time there are four classes of flashlamps in use. These are tubular, lantern-type, vest-pocket, spotlight or projection flashlamps. The development of the spotlight type is treated at length. Two factors made possible the economical use of the flashlamp—first, the introduction of the tungsten filament and, second, the development of the flashlight battery cell. Statistics are presented comparing the sales of flashlamps and flashlight batteries in the last year with those of other standard electrical appliances and specialties.—*Transactions of Illuminating Engineering Society,* March, 1922.

Remote Switch Control for Street Lamps.—L. MAAS.—It is feasible and permissible to increase momentarily the gas pressure in the pipe lines of illuminating-gas systems. This principle has been actually used to light and to extinguish street lamps from the gas plant. On the same principle can be based a remote control of electric street lamps. It is only necessary to provide for certain groups of lights a switch box which contains a funnel-shaped casting, connected to the gas line and covered with an elastic membrane. An increased gas pressure will cause this membrane to bulge out, and this motion will operate a mercury-tube contact, which in turn closes or opens the street-lighting circuit. A ratchet motion may be introduced between the membrane and the contactor to make the mechanism selective, so that half-night or full-night lamps may be switched on and off at will. A gas-electric remote-control system of this description is in successful operation in Nürnberg, Bavaria.—*Elektrotechnische Zeitschrift,* April 6, 1922.

Generation, Transmission and Distribution

Interconnection of Small Hydro-Electric Plants.—A. SOULIER.—Frequently small mills not more than 6 miles from one another along the same river have individual electric plants. In times of low water or accident no emergency supply from the adjoining plant is possible. For such plants the author suggests a novel system using 500-volt direct-current generators with two slip rings from which alternating current may be derived at the same time. The plants would be connected with a double-wire 500-volt direct-current line. The local illumination would be supplied from an auto-transformer, fed from the two slip rings, and the motive power would be taken from one generator brush and the middle of this auto-transformer at 250 volts.—*Revue Générale de l'Electricité,* Feb. 11, 1922.

Synchronous Operation of Alternators Through Capacitance.—T. NISHI.—The author of this article discusses the phenomenon of the mutual synchronizing action of two circuits which are in close parallel. The theory of this action is clearly explained and the conclusion is drawn that of two arrangements of two transmission circuits in physical parallel that one is the better in which the conductors of the same phase do not occupy the same relative position on the towers but rather diametrically opposite positions.—*General Electric Review,* March, 1922.

Traction

Rotary Converters, with Special Reference to Railway Electrification.—F. P. WHITAKER.—The author takes up the limiting factors that affect the design of converters. The most important of these is the maximum voltage that can exist between adjacent commutator segments. The author describes a machine so constructed that upon short-circuit and resulting flash it cannot draw the flame in between the armature and field coils.—*Electrician* (*London*), March 3, 1922.

Italian Single-Phase Road in the Brembana Valley.—C. BRODBECK.—This electric road has been in operation since 1907, but owing to a great increase in traffic a number of more powerful locomotives of the B-B type have recently been put in service. The line is 30 km. long, with standard gage. It is operated from its own power station, which has an equipment rated at 1,500 kva., single-phase, and 6,000 volts, with a frequency of 25 cycles. The new locomotives are rated at 400 hp. and are driven by two single-phase, series-commutator motors of 200 hp., operating at 550 r.m.p., with gear and horizontal-rod drive. The locomotive transformer is of the dry type with forced-air cooling. Carbon-filament lamps are used to illuminate the trains, and they give satisfactory light at 25 cycles.—*Brown-Boveri Mitteilungen*, March, 1922.

Installations, Systems and Appliances

Electric Motor Starters.—J. ANDERSON.—The author deals with the development of an electric motor starter from the basic principles, defining what is meant by starting, accelerating and using torques and referring to the lack of data regarding starting conditions. After giving a means of estimating the accelerating time and torque, he considers the application of these facts to step-by-step starters.—*Electrician* (*London*), March 24, 1922.

Method of Selecting Gearing for Motor-Driven Cargo Hoists and Winches.—J. A. JACKSON.—In determining the gearing for motor-driven hoists and winches it is best practice to base calculations on the average load to be handled, making the rope speed for this load the maximum that is consistent with safety and accurate control. The speed at rated load and overload will then depend upon the speed characteristics of the motor. The author shows how to calculate the proper gearing for hoists and winches when driven by constant-speed and variable-speed motors.—*General Electric Review*, March, 1922.

Electrophysics and Magnetism

Contact Difference of Potential and Thermionic Emission.—O. W. RICHARDSON and F. S. ROBERTSON.—In this theoretical discussion the authors confirm the relation that exists between the contact potential between two surfaces at a given absolute temperature and their thermionic electron saturation currents per unit area at the same temperature. The experiments carried out were made with a thoriated tungsten filament.—*Philosophical Magazine* (*London*), March, 1922.

Cracking in Condenser Tubes.—H. MOORE and S. BECKINSALE.—The paper gives the result of investigations of low-temperature annealing applied to condenser tubes. This work consisted in the examination of split condenser tubes, the determination of the properties of condenser tubes made by various manufacturers, experiments on condenser tubes purposely made by methods having high internal stress, a study of the rate of reduction of stresses in condenser-tube brass during low-temperature annealing, and the determination of the effect of heat treatment, in a range from 200 deg. to 325 deg. C., on the properties of brass condenser-tube composition.—*Engineering* (*London*), March 17, 1922.

Electrochemistry and Batteries

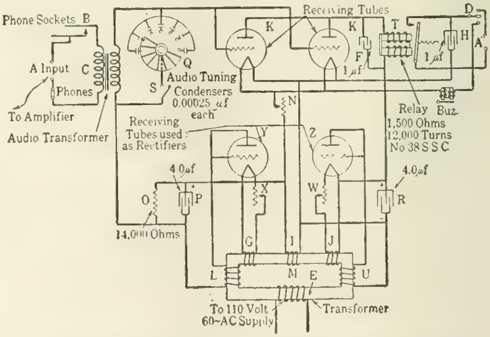
Effects of Impurities on Electrolytic Zinc.—G. D. SCHOLL.—Investigations were carried out to determine the effects of impurities on the cathodes in commercial cells used in the production of electrolytic zinc. These tests were made after the addition to the electrolyte of one or two parts per million of arsenic, antimony, cobalt, copper, nickel and glue. The results brought out the fact that, as a general rule, impurities within reasonable limit do not attack the zinc deposit very vigorously during the first fifteen or twenty hours of deposition. Although it has been shown that the action of cobalt is catalytic, it appears from the test that either there is likewise preliminary concentration before the catalytic action starts or the impurity is changed into another state before the corrosion begins. Thirty-eight photographs are included, showing the effect of the impurities.—*Chemical and Metallurgical Engineering*, March 29, 1922.

Units, Measurements and Instruments

Standard Practice in the Testing of Line Insulators.—C. L. KASSON.—This article explains the methods used both in the laboratory and in the field for testing insulators before acceptance and while in service. Among the methods of testing are the flashover, electrostatic capacity and stress distribution tests.—*Electrical Record*, April, 1922.

Units, Measurements and Instruments

A Relay Recorder for Remote Control by Radio.—F. W. DUNMORE.—This paper describes the development and the operating principles of a type of relay recorder which is designed to operate from the output terminals of a radio receiving set and which may also be operated by any other source of audio-frequency signal. By its use any electrically controlled mechanism may be operated. Two types are described. One receives its energy from batteries, and the other, a diagram of which is shown in the accompanying illustration, from any 60-cycle, 110-volt lighting circuit. This feature makes this type simple and inexpensive to operate, durable and practical. Curves and diagrams are shown illustrating the principles of operation—*Journal of the A. I. E. E.*, April, 1922.



ALTERNATING-CURRENT RELAY RECORDER OPERATED BY RADIO

Low-Voltage Rectifier Design.—R. D. DUNCAN.—An article on the theoretical and practical aspects of low-voltage rectifier design when employing the three-electrode vacuum tube. The author considers the percentage amplitude or "ripple" voltage overload resistance, determination of the voltage consumed by the rectifier tube, voltage regulation and the current and power delivered by transformer secondary.—*Radio Review*, March, 1922.

Miscellaneous

Reinforced Concrete in Power-Station Construction.—A description of the use of reinforced concrete in building power houses, transformer houses and cooling towers as applied to central-station design in England. This type of construction is one of the solutions for the problems involved in the increasing size of foundations required with modern electrical equipment.—*Electrical Times*, Feb. 9, 1922.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **PROF. VLADIMIR KARAPETOFF**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

OVENS, ELECTRIC, AUTOMATICALLY REGULATED.

A series of observations on two different types of incubating, drying and sterilizing ovens has been in progress for some months to determine (1) variation in temperature with time at any given point and (2) temperature distribution in the oven at any particular time. The ovens are electrically heated and automatically regulated. A valuable byproduct of the study has been the information obtained on electric thermoregulators, particularly on the behavior of contacts which operate very slowly. As a result of the work the designs of the ventilating system of the oven and of the wiring arrangements have been so improved that closer approach to temperature uniformity, both in time and location, seems impossible without forced ventilation.—*Paul E. Klopsteg, Central Scientific Company, Chicago.*

CIRCUIT BREAKER, SELF-RECLOSING.

A European manufacturing company has developed a simple automatic arrangement for reclosing an oil circuit breaker. It consists of a raised weight acting upon the handle of the circuit breaker and held by a simple mechanical lock. When the circuit breaker trips, the lock is released after about thirty seconds and the falling weight closes the breaker again. Should the short circuit still exist, the breaker opens again, this time without being reclosed. On branches without attendance this device saves many long interruptions in service due to transient disturbances.

OIL SWITCHES, TESTING OF CONTACTS.

A large current is sent through the switch by means of a current transformer. If the pointer of a voltmeter, connected across the switch, moves rapidly to a high reading, an imperfect switch contact is indicated. A low reading gives assurance of the proper functioning of the contacts and thus saves an expensive dismantling and inspection.—*Charles Miller, Rochester, N. Y.*

MAGNETIC MEASUREMENTS ON SMALL SAMPLES.

To reduce the expense incurred in research requiring magnetic measurements of materials, new apparatus has been constructed by means of which it is possible to make reliable measurements on smaller samples (10 cm. long and 6 cm. in diameter). This work is not yet complete but already the results are very satisfactory.—*Bureau of Standards, Washington, D. C.*

CABLES, OPERATING TEMPERATURE OF.

An arrangement has been made with the Massachusetts Institute of Technology to conduct tests on the maximum possible operating temperature for paper-insulated, lead-covered cables. The institute furnishes the laboratory facilities, the supervision and instruments, while the committee pays the salary of research assistants and also furnishes the necessary samples of cable. Sufficient funds have been appropriated to insure the success of the plan.—*Underground Systems Committee of the N. E. L. A.*

ALTERNATORS, PROTECTION OF.

The committee has brought up to date the subjects of temperature indicators on generators, fire protection for generators, recirculation of air for cooling and differential relay protection. Consideration has also been given to control systems, excitation systems, stability of exciters and generators, grounding of generator neutrals, electrically driven auxiliaries and high-voltage testing sets.—*Generating Stations Committee of N. E. L. A.*

MOTOR, INCLOSED, WITH AXIAL VENTILATION.

A line of completely inclosed induction motors has been developed, with ventilating openings in the stator, parallel to the shaft. The air draft is created by a fan with a labyrinth packing which absolutely prevents dust or dirt from entering the space occupied by the windings. In this manner the advantages of a completely inclosed motor are combined with small size and weight due to forced ventilation.—*George Lewinnek, Berlin, Germany.*

CORROSION OF CAST IRON.

Two cells were so constructed as to provide two pieces of cast iron not in contact with each other, but both in contact with moist soils, the anode being in contact with lining silt and the cathode in contact with a clay soil, both soils being kept moist. The results show that some soils, when in contact with iron, can of themselves set up an appreciable emf., like that of a primary battery, amply sufficient to decompose the iron.—*W. Nelson Smith, Winnipeg Electric Railway, Winnipeg, Canada.*

HEAT, DISSIPATION OF, FROM PLAIN AND BLACKENED BRASS SURFACES

The heat dissipated in still air from plain brass and blackened brass surfaces has been determined for various temperature excesses up to 140 deg. C. Curves were plotted showing the total losses for each surface. Relationships have also been derived showing the loss due to radiation and convection respectively.—*T. S. Taylor, East Pittsburgh, Pa.*

STEEL, MAGNETIC TEST OF MECHANICAL PROPERTIES OF.

The material used in tire chains must have a hard outside shell to resist wear and also a tough central core to stand severe shocks. Mechanical tests and a microscopic examination of the break are slow and unsatisfactory. A successful magnetic test has been devised in which a 60-cycle inductance bridge is used. The sample under test serves as the core of one of the inductances under comparison, and, with a proper setting, the galvanometer deflection is an indication of the mechanical properties to be expected of the sample.—*A. V. de Forest, Bridgeport, Conn.*

TELEGRAPH RELAY, HIGH-SPEED.

The tongue of the relay is composed of a stiff spring with a soft-iron armature on its end. The natural period can be made considerably above that of the succession of impulses whose record is sought. The tongue is permanently magnetized—by a magnet or local current—and is normally held in a distorted position. The line impulse releases the tongue. The local circuit is closed through a moving chemical strip which records the instant of contact. This relay has been tested as an element of a telegraph receiver which prints in roman characters. For a speed of transmission of 600 words a minute over a 400-mile line each relay has a natural period of about 190 cycles, which is much higher than is needed. The speed of transmission is entirely controlled by the characteristics of the line and is in no way limited by the terminal apparatus.—*Carl Kinsley, Ithaca, N. Y.*

PHOTOMETER, SPHERE, FOR MEASUREMENT OF REFLECTION AND TRANSMISSION FACTORS.

A new method has been developed of using the sphere (or Ulbricht) photometer for measuring the reflection factor of surfaces. It consists in a combination of the sphere with the Martens polarization photometer, which enables a direct comparison to be made between the brightness of the sphere wall and that of the test surface which closes an aperture in the sphere.—*Enoch Karrer, Bureau of Standards, Washington, D. C.*

CABLE, SUBMARINE, TELEPHONE, TRANSMISSION CHARACTERISTICS OF.

Considerable uncertainty is introduced into the theory of such a cable because of the contribution of sea water and armor wires to the effective resistance and inductance of the circuit. A mathematical investigation has been made of the influence of sea return, and the results have been checked with experimental data. Means have also been found for diminishing this effect.—*J. R. Carson, American Telephone & Telegraph Company,* and *J. J. Gilbert, Western Electric Company, New York, N. Y.*

Suggestions for Research

CONDENSERS, PAPER FOR.

With the increasing use of static condensers for power-factor correction in motor installations, the question of permanency of such condensers acquires a new importance. The paper used in their insulation sometimes has weak spots which later lead to punctures. It is desired (a) to improve the quality of the paper, (b) to devise a convenient factory test for detection of weak spots, (c) to develop a method for repairing the spots rather than discarding a particular sheet of paper.

FLASH-OVER, EFFECT OF NATURE OF SURFACE UPON.

Systematic laboratory experiments are desired on flashover distances and voltages over plane surfaces of different insulating materials, both clean and covered with soot, dust, moisture, oil, paraffine, etc. The details of the physical nature of the arc should also be determined. The results will be of great value in the design and in the operation of high-tension apparatus.

INSULATORS, EFFECT OF SALT-WATER FOG ON.

In localities exposed to salt-water fog it is necessary to use larger insulators in order to reduce the occurrence of flashovers. It is desired to find a general relationship between the safe voltage rating of insulators in a dry climate and under salt-fog conditions, this relationship to extend from the lowest to the highest voltage in use or proposed.

CORONA ON PORCELAIN, ITS EFFECT ON DUST AND FOG.

In localities subjected to dust or sea fog the lower surface of insulators presents a special problem in that the deposits are not washed off by the rain. It has been suggested that this surface be so designed as to have parts which in normal operation run at a corona voltage, and thus tend to repel the particles of fog or dust.

SUBSTATIONS, AUTOMATIC.

One of the features of operation of revolving machinery in automatic substations, where the current demand frequently drops to a small value, is the corresponding stopping and starting of these machines many times a day. The resulting waste of energy and depreciation of apparatus more than offsets the saving in power while running idle. It is desired to develop a control system which will keep these machines running unless the period of light load is of considerable duration.

INSULATORS, FLASHOVER EFFECT OF FREQUENCY UPON.

It is becoming increasingly common to test power insulators for flashover with high-frequency apparatus. The question has been raised as to whether or not a given insulator would give the same flashover at a low as at a high frequency, and experiments on the effect of frequency are desired.

CURRENT TRANSFORMERS FOR RECORDING TRANSIENTS.

With the ever-increasing experimental study of transient electrical phenomena, particularly in large high-tension transmission systems, the question of reliability of current transformers for such purposes is becoming of considerable importance. It is desired to investigate theoretically and experimentally the errors involved with transient phenomena and to design a special measuring transformer in which such errors are reduced to a minimum.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Young and Swope Succeed Coffin and Rice as General Electric's Executives

A BROADENING of the engineering and research service of the General Electric Company and an increase of its prestige here and abroad are forecast by a number of important changes in the directorate of the company which have just been officially announced.

O. D. YOUNG

Following a meeting of the board of directors held in New York May 16, Charles A. Coffin retired as chairman and was succeeded by Owen D. Young, long associated with the company as vice-president. The position of president was filled by the election of Gerard Swope, president of the International General Electric Company, who succeeds E. W. Rice, Jr. Mr. Rice requested to be relieved of the duties of organization and management and allowed to devote his entire energies to the further upbuilding of the scientific, engineering and technical phases of the company's work in the broadest sense, and he will become honorary chairman of the board of directors. Anson W. Burchard, for many years identified with the company as vice-president, with particular reference to public utilities and foreign investment, was elected vice-chairman of the board. J. R. Lovejoy, vice-president in charge of sales, was elected a director, as was also G. F. Morrison, vice-president.

Particular significance is attached to the action of the board of directors in the creation of the position of honorary chairman, which will be filled by Mr. Rice.

Mr. Coffin, the retiring chairman of the board, will continue, as a director, to give attention to the problems of the company. He has been for forty years a leading influence in the development of the corporation and was founder and creator of the company and its predecessor, the Thomson-Houston Company.

Mr. Young, the new chairman of the board, is a lawyer by profession. He was born in Vanhornesville, N. Y., Oct. 27, 1874. He is a graduate of St. Lawrence University and the Boston University Law School. In addition to his interest in the General Electric Company he is chairman of the board of directors of the Radio Corporation of America and a director of the Electric Bond & Share Corporation, the Bankers' Trust Company and many other organizations.

Mr. Swope, the new president, has both an engineering and a commercial training. He was born in St. Louis, Mo., Dec. 1, 1872, received his elementary education in the local public schools and was graduated from the Massachusetts Institute of Technology in 1895. That fall he entered the employ of the Western Electric Company. Starting from the bottom in the shops at Chicago, where he was first assigned, he worked his way up department by department to an executive position. His first promotion was to the power apparatus engineering department as designing engineer. Next he organized and was first manager of the company's St. Louis house, opened in 1901. Four years later he was called back to Chicago and made manager of the power apparatus department. When in 1908 the company went out of the power apparatus field Mr. Swope was transferred to New York as general sales manager, and in 1913 he was elected vice-president. This connection he severed Jan. 1, 1919, to become president of the International General Electric Company.

GERARD SWOPE

E. W. RICE, JR.

Baekeland Patents Sustained

THE Redmanol Chemical Products Company has made a settlement in the recent action instituted by the General Bakelite Company against the General Insulate Company for infringing on the use of "Redmanol." This action, though brought against its customer, was defended by the Redmanol company. Judge Chatfield rendered a decision sustaining the Baekeland patents, covering broadly the combination of phenol condensation products with fiber and fibrous materials and the simultaneous use of heat and pressure in the manufacture of articles from these products. The Redmanol company has now consented to the decree and has paid heavy damages in liquidation. It will henceforth manufacture under license.

Byllesby to Increase Capacity 32 per Cent

THE 1922 construction plans of the Byllesby Engineering & Management Corporation contemplate additions to its entire electric generating capacities averaging around 32 per cent. These additions will be much greater than in any previous single year in the development of this company. A total of 110,000 hp. in generating equipment will be placed in service or put under construction. Of this total 27,000 hp. will be installed in the new hydro-electric development of the Western States Gas & Electric Company of California. The principal other additions now under construction are as follows: The San Diego Consolidated Gas & Electric Company, San Diego, Cal., is installing a 20,000-hp. unit; the Northern States Power Company, Sioux Falls, N. D., an increase of 4,000 hp.; the Red River Power Company, Grand Forks, N. D., a 2,360-hp. unit, and the Ottumwa (Iowa) Railway & Light Company a 4,000-hp. addition.

The Mobile (Ala.) Electric Company has increased its power capacity by 5,000 hp. since it obtained a long-term lease of the 10,000-hp. plant recently built for the Chickasaw Shipbuilding & Car Company.

Secretary of Federal Power Commission Attacks Ford Offer

FINAL stages are being reached in the House military affairs committee in Washington on the offers of Henry Ford, the Alabama Power Company and others to purchase or to lease and develop the government's Muscle Shoals projects. The Senate committee on agriculture and forestry has adjourned for the time being to prepare for a new group of witnesses, among them William H. Onken, Jr., editor of the ELECTRICAL WORLD, who will be called upon to comment on Senator Norris' own bill for a government owned and operated corporation to complete the water-power projects and produce explosives and fertilizers. The other witnesses in this group are expected to be experts, either for or against, on government ownership and operation.

In the House committee, as this is telegraphed from Washington, a bitter fight is taking place on a motion made by Representative McKenzie of Illinois to reconsider a vote passed last week by the narrow margin of eleven to ten under which approval was given to the idea that in case Congress decided to make a bargain with Mr. Ford it would or might be possible for him to obtain possession of the government's interest in the Gorgas plant of the Alabama Power Company on the Warrior River, provided that Mr. Ford would agree to defend any suits against the government arising from such a situation and pay any damages. Little real progress, however, has been made by the House committee in the past week beyond the adoption of a fertilizer guarantee which it is not believed Mr. Ford will accept; but there are signs that a report will soon be forthcoming from the committee very soon.

In the Senate committee hearings the principal witness was O. C. Merrill, executive secretary of the Federal Power Commission. Mr. Merrill opposed the hundred-year-lease period, asked by Mr. Ford in particular, saying that under the federal water-power policy the fifty-year policy should be adhered to. He criticised Mr. Ford's offer in every respect, characterizing it as an "unconscionable subsidy" not only for fertilizers but for his private operations as an automobile manufacturer.

If Mr. Ford's offer were accepted by Congress, Mr. Merrill said, after using 100,000 hp. for nitrate operations, "there would be left for Mr. Ford's private use 360,000 hp. of the cheapest power in the United States, not excepting Niagara, for the simple reason that Mr. Ford would pay only a part of the cost of that power and the rest of it would be paid for out of the United States Treasury."

Mr. Merrill testified that from every practical standpoint the offer of the Alabama Power Company is more favorable to the United States than any other bid made.

J. E. Aldred Negotiates Purchase of Water Powers in North Italy

BETWEEN $25,000,000 and $50,000,000 will, according to a special dispatch from London to the New York *Times*, confirmed at the New York banking office of J. E. Aldred, be the utlimate investment by American capitalists in well-known water-power and electric light and power companies operating in the industrial areas of northern Italy. Mr. Aldred, who is now on his way back from Italy, has been the chief factor in bringing these companies under American control.

The companies, centering in Milan, Venice and Turin, are among the most important factors in the industrial situation in Italy. They supply electric light and power to these cities and the adjoining territory, and, through the development of large water powers to the north of these districts obtaining their supply of water from the Alps, they command an amount of electrical energy which, applied to industrial operations, may make this section one of the chief industrial areas in Europe.

Mr. Aldred has been intimately concerned with the development of water power in Pennsylvania and in Canada. He is the president of the Shawinigan Water & Power Company of Montreal and chairman of the board of the Pennsylvania Water & Power Company, which has 83,500 kw. installed at Holtwood, on the Susquehanna River. The Consolidated Gas, Electric Light & Power Company of Baltimore, of which also Mr. Aldred is chairman of the board, derives part of its energy supply from Holtwood. Engineering representatives of the Aldred organization are now in Italy working out practical details, while the financing, says the New York *Times* correspondent, is being arranged in New York and London.

A. M. E. S. Plans for Its June Meeting

A PARTICULAR feature of the annual gathering of the Associated Manufacturers of Electrical Supplies, which is to be held at the Essex and Sussex Hotel, Spring Lake Beach, N. J., during the week beginning June 19, will be a special members' meeting for the discussion of such technical and other subjects of common interest as may be presented by the sections or by individual members. The general standards committee will hold an important meeting on Monday afternoon, June 19, in preparation of recommendations to be made to the sections. The section meetings will be held at convenient hours during the week on a schedule to be arranged. The annual meeting proper, postponed from March, will be held on Thursday, June 22.

A. S. M. E. Discusses Boilers, Welding and Fuel at Atlanta Meeting

MANY technical papers of interest to electrical engineers were presented before the spring meeting of the American Society of Mechanical Engineers, held at Atlanta, Ga., on May 8 to May 11. Dr. Johann Stumpf of Charlottenburg, Germany, the inventor of the "Unaflow" engine, contributed, with C. C. Trump, a paper on "Exhaust Energy in Reciprocating Engines" which suggested the use of the residual energy due to incomplete expansion to reduce the counter pressure by the employment of eduction nozzles.

Alfred Cotton's paper, "Accuracy of Boiler Tests," was a plea to give up pretenses to impossible exactness. He held that it was absurd to report the heat-balance figures of a boiler test closer than the nearest tenth of 1 per cent. Arguments were presented to show that the efficiency obtained from a twelve-hour test on a coal-fired boiler might be in error by 3 or 4 per cent.

A paper on the "Reduction of Fuel Wastes in the Steel Industry," by F. G. Cutler, gave a survey, in the form of a heat balance, of the heat required and produced by the various operations in the manufacture of iron and steel.

E. A. Uehling, in his paper on the "Control of Boiler Operation," said that the pound of coal would probably continue to be the commercial fuel unit but was most unsatisfactory as a control unit. The pound of combustible was a more satisfactory unit, but even this allowed of considerable variation in the heat value. After a careful study of the hundreds of analyses published by the government, Mr. Uehling strongly recommended the use of the pound carbon fuel unit as giving a practically constant heat value. He then proceeded to develop a practical system of figuring the percentage of losses and of dividing these losses to show the proportions due to various avoidable causes.

C. W. E. Clark presented a paper on "Boiler-Room Performance and Practice at the Colfax Station of the Duquesne Light Company," and R. H. Heilman one on "Heat Losses from Bare and Covered Wrought-Iron Pipe at Temperatures Up to 800 Deg. Fahr."

There were papers from Charles G. Adsit on "Power Development of the Southeast," by C. A. Mees on the "Economies of Water-Power Development," and by John A. Sirnit on "Hydro-Electric Power-Plant Design." H. B. Reynolds and W. F. Hovey presented by title only a report previously made to the Metropolitan Section upon "Efficiency Tests of a 60,000-kw. Cross-Compound Triple-Cylinder Steam Turbine." Mr. Adsit's paper is noted in another column. Mr. Mees gave a broad outline of the economic and business considerations involved in the financing, construction and operation of complete hydro-electric systems. Mr. Sirnit dealt almost entirely with the use of the backwater suppressor in hydro-electric plants. In many such plants there is a serious loss of head during the flood seasons on account of the rise in the tailwater level. O. G. Thurlow, chief engineer of the Alabama Power Company, conceived the idea of using the water running over the spillway to push back the tailwater and thus reduce the negative head on the discharge of the draft tube. The paper described various preliminary experiments as well as the application of the Thurlow backwater suppressor in connection with the new Mitchell Dam project of the Alabama Power Company.

Under the joint auspices of the boiler code committee and the American Welding Society a symposium on welding was held. R. J. Roark contributed a paper on the "Strength of Electrically Welded Pressure Containers," S. W. Miller one on "Some Principles of the Construction of Unfired Pressure Vessels," F. N. Speller one on "Steel for Forge Welding" and E. A. Fessenden and E. J. Bradford one on "Facts on Welded Cylinders." That the most important considerations in the uniform production of welds of high efficiency are "suitable material, well-trained operators and adequate facilities for control of the work" was the conclusion reached by Mr. Speller.

The committee on nominations reported as the official ticket these nominees, who will be elected by mail ballot and take office after the December meeting in New York City: President (unanimously chosen), John Lyle Harrington of Kansas City, Mo.; vice-presidents, W. S. Finlay, Jr., of New York, William H. Kennerson of Providence, Earl F. Scott of Atlanta, and H. H. Vaughan of Montreal; managers, A. G. Christie of Baltimore, James H. Herron of Cleveland and Roy V. Wright of New York; treasurer, William H. Wiley of New York.

Mr. Adsit Attacks Muscle Shoals as a Source of Power

THE contention that the public has been fooled in regard to the Muscle Shoals development and that the Southeastern States have many undeveloped water-power sites that can be exploited on a commercial basis to much better advantage was made last week by C. G. Adsit of Atlanta, executive engineer of the Georgia Railway & Power Company, who spoke before the power session of the convention of the American Society of Mechanical Engineers, held in the city just named. Mr. Adsit's subject was "Power Development in the Southeast."

"It is a source of considerable regret to engineers who are familiar with the Tennessee River to read in the press of the enormous power allotted to the Muscle Shoals development, usually stated as 1,000,000 hp., and the consequent misleading of the general public on this much discussed subject," he said.

Mr. Adsit brought to the attention of the engineers the fact that hydro-electric power connected to a high-tension transmission line linking together the five Southeastern States represents 17.75 per cent of the total water-power development of the United States.

Another Muscle Shoals Proposal

SENATOR NORRIS of Nebraska has introduced by request a bill for operation of the Muscle Shoals (Ala.) nitrate plant under an incorporated Federal Chemical Corporation, the bill having been prepared by ex-Representative Lloyd of Missouri. The proposed corporation would continue for fifty years and would have seven directors, of whom three would represent the government by selection of the Secretaries of the Treasury, War and Agriculture. Offices of the corporation would be at Muscle Shoals, Ala., and the District of Columbia, and it would have $5,000,000 stock divided into 50,000 shares. The bill provides that the corporation may lease from the government the Muscle Shoals project for fifty years.

Bill to Prohibit Tax Exemption of Securities Strongly Opposed

DESPITE efforts to delay the consideration of legislation to prohibit the tax exemption of securities, the joint resolution favoring such a law recently approved by the ways and means committee will be brought to a vote in the House of Representatives in the near future. It is believed that the resolution will pass, but a hard fight is in prospect. The principal arguments being advanced against the legislation are that it will make it difficult to a prohibitive degree for states and cities to sell their securities and that it will increase the rate of interest that farmers will have to pay for loans. Some members of the House hold that it will virtually preclude municipal operation of public utilities.

On the other hand, those favoring the legislation contend that the stability of the government is being undermined by a system which permits the wealthy to pay a much smaller comparative proportion of the taxes than do those less able to pay. While industry as a whole suffers very seriously because it is denied the use of large sums which can be invested more profitably in tax-free securities, the privately owned public utilities suffer most, friends of the resolution point out, because they cannot compete with publicly owned competitors whose bonds are tax-exempt. A majority of the committee on ways and means voted to recommend the legislation and gave eight reasons why the issuance of tax-exempt securities should be condemned. These reasons are: A large proportion of property escapes taxation, causing a great loss of revenue; it violates the ability principle of taxation and discriminates unfairly between taxpayers; it impedes private financing; it discourages investment in new enterprises; it encourages extravagances of governmental agencies; it grants a private subsidy to certain interests; by withdrawing money from private enterprises it increases the rate of interest required for all enterprises not carried on by the government and thereby adds to the cost of living; it creates social unrest.

Hoover Takes Hand in Coal Strike

CONSUMERS are not to be mulcted in the matter of coal prices if the Washington administration can help it. Statements to that effect were made this week at the White House and in a formal statement issued by Secretary of Commerce Hoover, who said:

"The tendency of coal prices to rise at the mine in certain districts will be checked. In order to devise measures for the protection of consumers, I have called a meeting of representative operators from the different producing fields for consultation, and I have been assured that they will co-operate to prevent speculation and rising prices.

"I have also requested the American Railway Association to consider the creation of a buying committee for railway coal and have made the same request of the public utilities associations. I shall ask that certain other large consuming industries undertake the same measures in order that we may stop their bidding against each other and against the general consumer.

"At the present time the price of coal has risen unduly in certain districts, while in other districts there is an insufficiency of orders to employ the mines full time. There are very large stocks of coal in the country in the possession of consumers, and the problem is one of co-ordination and co-operation. The reports of certain wholesalers that there is a shortage of coal are untrue and designed to further their personal ends."

Radio Equipment and Fire Insurance

CALLING attention to the fact that fire insurance regulations governing the installation of radio apparatus are to be revised, the Bureau of Standards warns owners of such equipment that unless these rules are observed the rates on their properties may be raised or the insurance refused entirely. The new rules are being considered by a committee of the National Board of Fire Underwriters, and the Department of Commerce has prepared a mimeographed circular containing tentative requirements which have been suggested for adoption. This circular (Letter Circular 62) may be had from the Bureau of Standards, Washington, D. C.

Sale of Salt River Power Approved by Congressional Committee

THE House of Representatives' committee on irrigation of arid lands favors the sale of surplus electric power on the Salt River reclamation project in Arizona on leases not to exceed fifty years in duration. The committee inserted a proviso in its bill that the charge for power may be readjusted at the end of five, ten or twenty-year periods after the beginning of any contract for its sale. The committee did not act on the recommendation of the Secretary of the Interior that the fifty-year leasing right be extended to all federal irrigation projects.

It is the desire of the Salt River Valley Water Users' Association to increase its plant so as to be able to deliver about three times more power than is being generated at present. Last year the output of the existing plant was 61,000,000 kw.-hr. With that output there was a profit of 5 per cent on the investment. The output can be tripled with a relatively small increase in the operating expenses and without the construction of additions to the transmission system. The Inspiration Copper Company and the Miami Copper Company are understood to be ready to finance the extension provided that they can make a fifty-year lease. The proposal has the indorsement of the Secretary of the Interior.

A. E. S. Elects New Officers

AT THE successful spring meeting of the American Electrochemical Society held at Baltimore on April 27-29 these officers were elected for the ensuing year: President, C. G. Schluederberg, Westinghouse Electric & Manufacturing Company, Pittsburgh; vice-presidents, H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*, New York; A. H. Hooker and W. S. Landis; managers, A. T. Hinckley, W. M. Corse and William Blum; treasurer, F. A. Lidbury, Niagara Falls; secretary, Colin G. Fink, New York.

Bradley Stoughton, New York, was elected chairman and John A. Mathews vice-chairman of the electrothermic division of the society. It was determined to hold the fall meeting at Montreal on Sept. 21-23.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

University of Florida's Course for Metermen.—Forty-eight men, including twenty-two representatives of electrical business throughout Georgia and Florida, twenty-two students and professors of the university and two salesmen, attended last month the first short course for electrical metermen at the University of Florida.

"Selected Professional and Business Books."—A list of 400 books on accountancy, industrial engineering and related business topics has, under the title quoted, been compiled by Scovell, Wellington & Company of Boston, with the object of indicating to engineers and business men some of the most useful among the thousands of such volumes now in existence. The compilation should be valuable in the selection of books for private or office business libraries.

Seattle Municipal Lighting Plant Establishes Off-Peak Power Rate.—The city of Seattle's municipal lighting plant is about to grant by city ordinance a reduction from the regular advertised power rates now prevailing of 25 per cent on off-peak power for all loads of 21 kw. or more. The peak-load hours are defined as the hours between 4:30 p.m. and 9:30 p.m. All power used during the peak period will be paid for at the present rates. The new rate is to be administered with the aid of graphic wattmeters. This legislation has come about largely as the result of the insistent demand of certain large users of power for a reduction in the rate for power used during the off-peak period.

India's Big Hydro-Electric Power House. — The largest hydro-electric power station in India, the Andhra Valley project, is nearing completion. The storage lake is about 60 miles from Bombay, and after passing through a tunnel 2 miles in length the water will be conveyed to the power house at the foot of the hills through six penstocks. Here six Pelton wheels will drive an equal number of generators, and the latter will deliver energy at 5,000 volts to step-up transformers, from which it will be transmitted at 100,000 volts. One unit, rated at 10,000 kva., will be placed in service probably in June and will relieve the demand for power in Bombay cotton mills. The whole of the plant, designed for an output of 60,000 kva., with room for additions, will be completed about twelve months hence. Incidentally, remarks the Bombay correspondent of the London *Engineer,* an interesting feature of this project is that energy will be delivered to consumers' doors at 20,000 volts and will be converted to 500 volts direct current on the spot.

Automatic Hydro-Electric Plant in Vermont.—Finishing touches are being put upon a new 5,000-kva. automatic hydro-electric plant for the New England Power Company at Searsburg, Vt., one of the largest of this type thus far designed for service in the East. The plant is on the Deerfield River, the plants along which are tied in with hydro-electric stations on the Connecticut River and with numerous steam plants. The Searsburg station delivers energy at 66,000 volts to the main transmission lines of the company near the Hoosac Tunnel, is designed to handle a maximum of 300 sec.-ft. under 210 ft. normal operating head, and has been planned for automatic starting and stopping by means of a time clock, the amount of load which is to be carried being predetermined and set at the governor mechanism. The mushroom-center differential surge tank, designed to prevent spilling of water in case full load is thrown off the generator suddenly or the load instantaneously increased, is illustrated here.

Railway Electrification Discussed at Ottawa.—Electrification of steam railroads as an issue to be faced in the near future was brought up in the Canadian Parliament recently by the member for St. Mary's, Quebec, who dwelt on its relation to the fuel problem and to the destruction from forest fires. The speaker made the assertion that for an identical trip under the same load occupying the same time the cost of the motive power for an electric locomotive is as 88 to 200 compared with that for a steam locomotive and that the maintenance costs are as 8 to 18. He wished to know why the railroad built in the valley of the St. Maurice, where 800,000 hp. is available, should not be electrified. In view of his understanding that the Canadian Pacific Railway two years ago almost concluded a contract for the electrification of its line from Montreal to Quebec, he asked why the government lines in the neighborhood of Montreal had not been converted to electric operation. The Minister of Railways said that his department was keenly alive to the situation and would do its part as soon as financial conditions warranted a heavy capital expenditure.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

Association of Municipal Electrical Utilities of Ontario.—The summer convention of this association is scheduled to be held at Niagara Falls, Ontario, on June 22, 23 and 24.

Field Day at Philadelphia. — The "entire electrical industry of the city of Philadelphia and surrounding territory" is to have an outing at McCall Field on Saturday, June 3, under the auspices of the Electric Club of that city.

American Society for Testing Materials.—At the twenty-fifth annual meeting of this society, to be held at Atlantic City, N. J., on June 26-30, there will be reports from the committees on copper wire, coal, magnetic properties, magnetic analysis and electrical insulating materials. Papers of special interest to electrical men will be: "Electrical and Magnetic Weld Testing as Applied to Butt-Welded Steel Plates," by T. Spooner and I. F. Kinnard; "Forms of Specifications for Purchasing Coal," by Hubb Bell; "A Rational Basis for Coal Purchase Specifications," by E. B. Ricketts, and "The Problem of Durability Tests for Transformer Oils," by T. G. Delbridge.

Coming Meetings of Electrical and Other Technical Societies

Electrical Supply Jobbers' Association—Hot Springs, Va., May 24-26.

A. I. E. E. Section Meetings—Atlanta, May 25; Utah, May 26; Vancouver, B. C., June 2.

N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.

American Association of Engineers—Salt Lake City, June 5-7.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

Society for the Promotion of Engineering Education—Urbana, Ill., June 20-23.

American Society of Civil Engineers—Portsmouth, N. H., June 21-22.

American Association for the Advancement of Science—Salt Lake City, June 22-24.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30. (For program see issue of May 13, page 968.)

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council of Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of May 13, page 972.)

A. I. E. E., Pacific Coast Convention—Vancouver, B. C.—Aug. 8-11.

International Association of Municipal Electricians—New Bedford, Mass. Aug. 22-25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Taxpayer and Customer Not Allowed to Intervene in Suit Between City and Utility.—The city of Grand Rapids, Mich., sued the Consumers' Power Company to enforce lower rates. On an ex parte order one Perry Schurtz was allowed to intervene as a taxpayer and a customer of the company using light in his office, home and garage. He claimed to be more interested in having service from the defendant than in the rates charged and asserted that the suit brought by the city, was "absolutely without foundation" and "should be dismissed." The Michigan Supreme Court held that he was without right to intervene in a suit by the city to enforce rates, either as a taxpayer or as a consumer, the interest of a consumer being held to be remote and conjectural. (185 N. W. 852.)[*]

Value of Franchise Excluded in Fixing Rates—Federal Income Tax.—In Georgia Railway & Power Company vs. Railroad Commission of Georgia, the United States Court for the North District of Georgia held that in a valuation for rate-fixing purposes the value of a franchise held by a public utility should not figure, as it is neither taken nor impaired, but its use required according to the original contract. Nor is failure to earn a fair return in past years a factor to be considered either by adding the deficiency to capital investment or amortizing it in future rates. The federal income tax, the court declared, reversing the commission, is not allowable as an expense of business. To permit law-controlled business to pass this tax to the customer, except as it may come to be reflected in generally higher returns obtained by invested capital, would be to subvert the policy of the law that imposes it, and, instead of placing these businesses on an equal footing with other investments of capital of similar security and permanency, would be to give them an advantage. (278 Fed. 242.)

Instruction to Jury Concerning Danger from Electric Wires When Their Presence Was Not Shown Erroneous.—In Duncan vs. Iowa Railroad & Light Company damages were awarded by the trial jury because of injury from steam sustained by a boy casually employed to clean a furnace in an electric power house. The Supreme Court of Iowa has reversed the judgment and remanded the case because of erroneous instructions by the trial judge, who in his charge set out the allegations of the petition concerning failure to furnish a safe place to work. These allegations referred to the presence of electric machinery and wires and of gas fumes, but no evidence was introduced of there being either electrical apparatus or fumes where the boy worked, and it was not alleged that he suffered injury except from steam. The fact that the boy was under sixteen years of age did not, the Supreme Court held, warrant an instruction that his employment in a dangerous task was illegal and negligence *per se* in the absence of an explicit instruction to the jury as to what constitutes such negligence. (187 N. W. 486.)

Commission Upheld in Basing Valuation on Company's Books.—The Supreme Court of New York, Appellate Division, has held, in People ex rel. Adirondack Power & Light Corporation vs. Public Service Commission, that the commission did not act arbitrarily in disregarding estimated reproduction cost new less depreciation, and in accepting the books of the corporation as much better proof of the capital actually expended and the present fair value of the property. Nothing, the court determined, should be allowed for the going value except to cover losses during the lean years while business was being developed and the corporation was not receiving a fair return. An allowance of working capital sufficient to pay expenses for one and a half months was not so small as to justify sending the case back to the commission. In allowing for continued high cost of materials and labor the corporation ought not to be required to run chances on the market nor ought consumers to be charged for a period of time at rates fixed on excessively high prices if such prices are transient. (193 N. Y. S. 186.)

Los Angeles Contract with Central-Station Companies Sustained.—In Los Angeles Gas & Electric Corporation vs. City of Los Angeles, a suit brought by the plaintiff as a taxpayer to enjoin the carrying out of a contract between the city of Los Angeles on the one part and the Southern California Edison Company and the Pacific Light & Power Corporation on the other for distribution of energy developed in city plants, the Supreme Court of California, sustaining the defendant, held that such a sale was not a "sale at wholesale of electric power," which would be contrary to the city's charter; that the contract was not invalid because city officials in executing it did certain things contrary to provisions of the charter and of the contract; that the sale and distribution of electrical energy manufactured by a city is a municipal affair and one over which the Legislature of the state has no control; that the contract was not a "lending of credit" within the constitutional prohibition; that "surplus power" could legally be sold by the city at wholesale, and that the contract did not come within a charter provision requiring letting to lowest bidder. (205 Pac. 125.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Schedules Effective Through Error.—Increased rate schedules for electrical energy distributed by the St. Joseph Transmission Company which had been allowed to become effective because of an error made by the electrical department of the Missouri Public Service Commission were ordered by the commission to be stricken from the files, with leave to the company to refile the schedules with the necessary modifications.

Service Charge Permitted in Massachusetts.—A petition was filed with the Massachusetts Department of Public Utilities by the Worcester County Gas Company to place in effect a service charge of 50 cents per meter. It was found that the establishing of the proposed charge, under the rates assented to by the company, would not impose an additional burden on any consumer who uses during a month 1,000 cu.ft. of gas and would effect a reduction to those using in excess of that quantity. The commission was of opinion that the plan was worth a test and therefore permitted the charge.

Merchandise and Jobbing Business and Central-Station Expenses.—An electric company should not charge to operating expenses expenditures incurred in its merchandise and jobbing business, said the New Hampshire Public Service Commission in fixing rates for the Plymouth Electric Light Company, and the fact that the salaries of the treasurer and the manager of an electric company were very much in excess of what other electric utilities paid for similar services was accepted as evidence that their salaries should be apportioned between the utility business and the merchandise and jobbing department.

Three Different Charges in Rural-Service Bill Forbidden.—In adjusting the electric rates of the Apple River Milling Company the Wisconsin Railroad Commission said: "The rural rate suggested by the applicant in its petition provides for a connected load charge, a transformer service charge and an energy charge. This schedule necessitates three separate computations in determining the bill of each rural consumer. We can see in it no particular advantage over the plan of rate presented by the Wisconsin Electrical Association, which has been approved and placed in effect by the commission in the majority of cases involving rural rates. In order that the type of rural rate shall be generally uniform we shall order that the applicant apply this standard form to its rural consumers."

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Ralph Rainsford has been appointed chief engineer of the Philadelphia Company, Pittsburgh, Pa. The requirements for this position are unusual because the company controls the Duquesne Light Company, the Equitable Gas Company and the Pittsburgh Railway Company, besides numerous subsidiaries connected with the controlling company's manifold interests. In Mr. Rainsford it is believed that the Philadelphia Company has obtained the services of an engineer who has the executive and business training necessary to fill the position successfully. Mr. Rainsford was graduated from Harvard University in the class of 1902. After two years of construction work in the West he became connected with the Guggenheim interests, with which he was associated for four years. Later he represented a New York banking group with wide interests. For this group he was manager and engineer of properties in the West for six years, being then transferred, at the request of the bankers, to the General Motors Company, in which they were heavily interested. When the group he represented withdrew from its connection with the General Motors Company Mr. Rainsford joined the J. G. White organization as an engineer. He served in the war, having joined the first business men's regiment at Plattsburg in 1915 and 1916, and in 1917 was commissioned as a captain in the aviation section of the Signal Corps. After the war he resumed his connection with the J. G. White organization and was also for a time a consulting engineer, opening an office in New York City in this connection.

RALPH RAINSFORD

Charles E. Cansfield, formerly with the Toronto & Niagara Power Company, has opened an office in Toronto for the practice of electrical engineering.

H. J. Pettengill, Jr., has been appointed sales manager of the gas and electric division of the Stone & Webster properties at Pawtucket and Woonsocket, R. I.

Robert O. Sweezey, a well-known consulting engineer on forestry, hydro-electric and pulp and paper problems, has become a member of the newly organized investment banking firm of Newman, Sweezey & Company, Montreal, Canada. Mr. Sweezey, although giving considerable time to the new financial concern, will continue the practice of his profession.

Robert W. Adams, Rhode Island manager for the General Electric Company, has been elected chairman of the Providence Section of the American Institute of Electrical Engineers. Mr. Adams is a past-president of the Providence Engineering Society and is widely known in central-station and industrial circles.

Col. Samuel W. Fleming, Jr., of the firm of Gannett, Seelye & Fleming, engineers, Harrisburg, Pa., will sail on the Paris from New York May 24, with the Pennsylvania French and Belgian Battlefield Commission, of which he is a member. The commission will make a thorough study of the battlefields in France and Belgium where Pennsylvania troops were in action.

Elbert G. Allen has been appointed chief engineer of the Philadelphia Rapid Transit Company and will co-ordinate all of the engineering activities of the company. He was born in East Bridgewater, Mass., in 1879 and was graduated from the Massachusetts Institute of Technology in 1900 with the degree of S. B. in mechanical engineering. In 1901 he received the degree of S. M. for completion of the course of electrical engineering and for advanced work. In the same year he entered the employ of Stone & Webster, remaining with this concern continuously for twenty years, during which time he had exceptional opportunities for wide experience in both office and field work. In September, 1921, Mr. Allen entered the employ of the Mitten Management, Inc., of Philadelphia, and after spending several months on power work for the International Railway at Buffalo, he entered the Philadelphia office of the Mitten Management. In April of this year he took up his new duties with the Philadelphia Rapid Transit Company.

Mitsuichi Oshhima, hydraulic engineer of the Shinyetsu Electrical Power Company of Tokyo, Japan, is making a tour of the United States in the interest of his company. He is visiting every large power plant and machinery manufacturing concern for the purpose of seeking American ideas.

Thomas J. Kelly, superintendent of distribution of the Northern Indiana Gas & Electric Company, has been transferred from Fort Wayne, Ind., to Lafayette, Ind., where he will take up the duties of engineer of gas, electric and water operation. Mr. Kelly is a graduate of Purdue University. He has been with the Northern Indiana company since 1914. His place at Fort Wayne will be taken by **J. P. Darrat** of Janesville, Wis. Mr. Darrat has been in the distribution department of the Janesville Gas Company.

Joseph G. Swallow, superintendent of installation and inspection department of the United Electric Light & Power Company, was tendered a testimonial dinner at the New York Athletic Club by the staff council of the company on Wednesday evening, May 10. Frank W. Smith, vice-president and general manager of the company, outlined Mr. Swallow's thirty-one years of loyal service with the company, and appreciative remarks were also made by other executives and heads of departments.

J. G. SWALLOW

O. E. Wasser, formerly auditor of the New York State Gas & Electric Corporation, has been elected secretary-treasurer of that company.

Roy R. Burnham has been elected chairman of the New England Section of the Illuminating Engineering Society. Mr. Burnham has been active in Boston consulting engineering circles for some years, having been identified with the electrical design and construction of the Victory destroyer plant at Squantum and the Boston army base, and later engaging in general electrical engineering practice, in which connection industrial illumination problems have occupied much of his attention. Mr. Burnham recently moved his offices to 119 Water Street, Boston.

Nelson J. Darling, who was recently appointed manager of the River Works of the General Electric Company at Lynn, Mass., succeeding the late Richard H. Rice, was born at Toronto, Can., in 1884 and was graduated in 1907 from Cornell University with the degree of mechanical-electrical engineer. He entered the testing department of the General Electric Company at Schenectady soon afterward and remained there until the spring of 1909. For about six months he was engaged in electrical construction work on the Panama Canal under Messrs. Dodge & Day, returning for a few more months' service at Schenectady. Mr. Darling then was transferred to the gas-engine engineering department at the Schenectady and Erie (Pa.) works, and for about two years prior to the outbreak of the world war was attached to the company's gas-electric motor-car sales organization with headquarters at Erie. During the war he served successively as executive in charge of the manufacture of English and Russian high-explosive shells at Erie, engineer in foundry work and executive in charge of the manufacture of steam turbines for destroyers at Erie. In 1918 and 1919 he was production manager of the Erie works and then assistant manager. From Erie he was transferred to Lynn.

N. J. DARLING

S. B. Overton is now connected with the sales organization of the Elliott Company in the Philadelphia office.

W. E. Widau, formerly of the Cleveland district office of the Elliott Company, manufacturer of power accessories, has been made assistant general sales manager for the company, with headquarters at Jeannette, Pa.

M. C. Morrow, who has recently been promoted to assistant to manager of the merchandising sales department of the Westinghouse Electric & Manufacturing Company, entered the employ of that company in 1900 as an office boy at East Pittsburgh. A year later he was transferred to the sales department, and in 1902 he went to the Philadelphia office as correspondent. Four years later he was promoted to the position of traveling salesman in the supply department, Philadelphia office. In 1912 he left the Westinghouse company, but returned three years later and was placed in charge of the promotion of electric heating apparatus sales campaigns throughout the United States. In 1913 he was promoted to the managership of the appliance section of the supply department and later was made assistant to the manager of the supply department. In 1920 he was made manager of the merchandising show in New York and also assistant to the sales manager of the Westinghouse Electric Products Company, holding this position until his present promotion.

W. O. Renkin, formerly engineer in charge of the pulverized-fuel department of the Quigley Furnace Specialties Company, is now managing engineer for that company's successor, the Quigley Fuel Systems, Inc., New York. Mr. Renkin has had considerable experience in this field, having made a special study of the application of pulverized fuel to industrial furnaces and boilers while with the A. M. Byers Company, Pittsburgh. Before becoming connected with that company he spent several years in British India in charge of pioneer construction for the Tata Iron & Steel Company works at Jamshadpore, Bengal. Mr. Renkin received his engineering education at Cornell University, finishing in 1895, and is a member of the American Society of Mechanical Engineers and also of the Engineers' Society of Western Pennsylvania.

Harry W. Bliven has been appointed vice-president of Harvey Hubbell, Inc., Bridgeport, Conn. For more than twenty years Mr. Bliven has been general sales manager of the company. As vice-president he will continue to have charge of sales. He was born and educated in Connecticut and gained his first electrical experience as salesman for the Western Electric Company. This position he held for eight years, resigning in 1904 to make his present connection.

H. W. BLIVEN

Harrison P. Reed, for many years electrical engineer in and more recently head of the elevator department of the Cutler-Hammer Manufacturing Company, Milwaukee, has been appointed general manager of the A. Kieckhefer Elevator Company, Milwaukee. Mr. Reed is a graduate of the electrical engineering department of Cornell University, class of 1909, and has been a frequent contributor to engineering publications. He recently read a paper on "Electric Power Application to Passenger and Freight Elevators" before the American Institute of Electrical Engineers, of which he is a fellow. Mr. Reed has also been chairman of the Milwaukee Section of the A. I. E. E. He is a member of the Engineers' Society of Milwaukee. He assumed his new duties May 1.

H. P. REED

R. K. Williams has been appointed a salesman in the Cleveland office of the Elliott Company.

W. T. Bickel has been added to the sales force of the Elliott Company with headquarters at the company's Pittsburgh office.

J. R. Lemon has joined the sales force of the Elliott Company, Jeannette, Pa., with headquarters at the Philadelphia office of the company.

W. Ross Hilton has been appointed representative of the Betts & Betts Corporation, New York, in Quebec, New Brunswick, Nova Scotia and Ontario territory. He will make his headquarters in Montreal.

Obituary

Charles C. Michael, for twenty-six years superintendent of the Bristol & Plainville (Conn.) Electric Company, died recently at Edgewood, Conn. Mr. Michael was born at Red Wing, Minn., in 1868 and in his early life was active in field construction work, in power-plant developments and electric fountain displays.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Orders for Refractories Gaining, with Prices Firm

BOTH new business and production of fireclay brick have been gaining recently, according to the report of the Refractories Manufacturers' Association for March, the latest month on which figures have been published. New orders, expressed in percentage of the monthly economical producing capacity, amounted to approximately 55 per cent, while production totaled around 52 per cent. Other figures give shipments as about 48 per cent, stocks about 188 per cent and unfilled orders about 40 per cent.

Business, according to several manufacturers, is good as compared with last year, though the figures quoted above show it to be considerably below the normal average for the years immediately preceding 1921. It is reported that the iron and steel industry, though operating closer to capacity than at any time for the past twelve months, is still somewhat conservative in buying for future needs. The end of the coal strike should see this condition changed. Central-station companies are buying more generously, however. Prices are firm, and there are rumors of an advance, but buyers are evidently of the opinion that the market is not strong enough to permit this and are not making any effort to get under cover.

Improved Trade in Electrical Porcelain

THERE has been noticeable improvement in recent weeks in the low-tension or dry-process electrical porcelain industry, particularly in the demand and distribution of standard items, regularly stocked and sold by the jobbing trade. These products enter directly into the construction of a building, and the marked increase in certain lines of the construction industry has had its effect on standard electrical porcelain commodities. The extent of this improvement is pointed out in a statement to the ELECTRICAL WORLD by a prominent manufacturer, setting forth that the aggregate value of standard porcelain shipped during the month of March, 1922, was 67.5 per cent of the total for the corresponding month a year ago, but as the price level is 55 per cent lower than that in the previous year, the increase in volume is approximately 50 per cent.

This manufacturer views the outlook as most favorable. As standard electrical porcelain products are being sold today, it is said, at less than the actual cost of manufacture, it is held that prices will stiffen materially just as soon as building operations have reached a sufficient point to intensify the demand.

In the special porcelain field, or the other branch of the dry-process porcelain industry covering built-up wiring devices and the like, improvement has not been noticed to the same extent. The informant of the ELECTRICAL WORLD points out that plants in this field are running at from 25 to 45 per cent of capacity, with signs of early increase.

With prices about 100 per cent above the level of 1915, the average buyer, it is set forth, finds it hard to understand why special electrical porcelain prices should not reach pre-war figures, as have some other commodities. The reason is found in the fact that flint, feldspar and imported clays are now costing about 100 per cent more, and American clays and coal 150 per cent more, while labor, which is one-half the cost of production, ranges from 100 to 300 per cent higher than in 1915. As practically all of the cost of pottery materials is based on labor, fuel and transportation, it is easy to understand that further liquidation in these items, and primarily in wages, is necessary before any further reduction in the cost of production can be had.

The opinion of this manufacturer, shared by other leading electrical porcelain producers, is that a gradual but constant and healthy betterment in the situation can be expected.

Radio Broadcasting Stations Increase 50 per Cent in Month

FIGURES showing the expansion of interest in radio telephony appear in a survey of the merchandising and advertising possibilities of the art prepared by the bureau of research and information of the National Retail Dry Goods Association. Broadcasting stations of the 360-meter length, according to these figures, number now well over 100, an increase of more than 50 per cent in less than one month. Department-store broadcasting stations of this class throughout the United States have increased 100 per cent within the one-month period and constitute nearly 13 per cent of the total number. There are listed in the report 202 manufacturers of radio apparatus, including thirty-four plants producing complete receiving sets, eighty-five manufacturers of accessories and special units for receiving sets, twenty-three manufacturers of raw materials and parts used in construction of radio apparatus, and thirty-four manufacturers of A and B batteries and battery-recharging devices.

Metal Market Situation

COPPER is still holding firmly to its 13⅛-cent level, and some producers have even gone so far as to ask 13¼ cents per pound for electrolytic, delivered. However, this means that they are more or less out of the market, for there is plenty of the metal on the market at the lower price. Domestic demand is still very good, and this, coupled with the decrease in the surplus stocks, may soon bring another advance. Domestic buying is quite evenly distributed. One large agency reports that virtually all of its regular consumers, both wire and brass, have bought on this present movement. Buying is still mainly for May and June, with July commitments increasing, but with little inquiry yet for August. Foreign buying is still good.

Following the unusual demand of a few weeks ago, the lead market has become more quiet. Consumers seem to feel that the upward movement has been halted and that they need not hurry to provide for future requirements. Lead is freely offered at 5.25 cents, New York.

NEW YORK METAL MARKET PRICES

Copper:	May 9, 1922	May 16, 1922
London, standard spot	£ s. d. 60 5 0	£ s. d. 60 10 0
	Cents per Pound	Cents per Pound
Prime Lake	13.00 –13.25	13.25
Electrolytic	13.00	13.00-13.12
Casting	12.62½	12.62½
Wire base	14.62 –14.87½	14.62½–14.87½
Lead, Am. S. & R. price	5.25	5.35
Antimony	5.37½–5.50	5.37½–5.50
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.40	5.50
Tin, straits	30.62½	30.75
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.00 –11.25	11.25 –11.37½
Brass, heavy	5.25 – 5.50	5.25 – 5.50
Brass, light	4.87½– 5.12½	4.87½– 5.12½
Lead, heavy	4.50 – 4.62½	4.50 – 4.62½
Zinc, old scrap	2.75 – 3.00	2.75 – 3.00

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

If no sudden spurt in industrial activity is reported from any section of the nation, neither is there any setback in the gradual movement toward better times. The prevailing tone is one of encouragement and confidence. The busiest spot in the electrical field continues, of course, to be that which is filled by radio equipment, where supply is still vainly trying to get within hailing distance of demand. Chicago, however, reports a slight slump in orders for this apparatus, which is attributed to warm weather. The same increase of temperature has started fans moving in the Middle West. New York reports wiring supplies fairly brisk and the jobbers' outlook promising. Building operations maintain or surpass their previous good record all over the country. Woolen mills are active in New England, though the textile strike still hampers cotton manufacture. Agriculture promises splendidly in the Middle West, but has been retarded by bad weather in some parts of the Southeast. Better buying is, none the less, reported from Atlanta.

On the Pacific Coast an improvement in the employment situation is announced. In some parts of California rainfall has been subnormal, but in general crop reports are good. The business revival lags in the Intermountain States, but the gradual resumption of mining will help the return to prosperity, and fewer men are reported out of work.

NEW YORK

The movement of wiring supplies continues at a fairly brisk rate, and the strong tone of trade in electrical circles indicates further improvement. Jobbers who predicted that business would open up this spring are beginning to realize on their optimism and do not look for any serious reaction during the summer and fall months. While hand-to-mouth buying has almost disappeared, purchases are being made on a conservative basis and dealers are inclined to build up stocks only gradually. There seems, however, to be no immediate need for increasing stocks as those in the hands of jobbers are in very fair condition and the manufacturers are making prompt shipments.

Building operations continue to increase rapidly in both the Metropolitan district and outlying sections. Jobbers are feeling the effect of this in the increased size and number of orders from their customers. Collections, if anything, show a slight improvement, but the average continues to be around sixty days. The advent of radio business has somewhat improved the average collections because of the increase in cash sales. On the other hand, with the greater number of new dealers, credit men have to be careful.

Rigid Conduit.—Demand is fairly active and most jobbers are quoting the new schedule of prices on pipe. Some small stocks which were bought at the old price are still in jobbers' hands, and small quantities can be purchased on that basis. On carload lots the new price is being quoted. Under the above conditions prices ranged as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1 000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Sales have been good with prices steady. Stocks in jobbers' hands are ample to meet the demands. Quotations on No. 14, rubber-covered, single-braid, in 5,000-ft. lots are from $6.15 to $6.25 per 1,000 ft.

Flexible Armored Conductor.—The volume of sales holds up well, and stocks in jobbers' hands are fair. No. 14, two-wire, single-strip, sells for $43 to $45 per 1,000 ft., and double-strip is quoted at $45 to $47 per 1,000 ft.

Loom.—There exists only a moderate demand for this material, and stocks are kept pretty low. The 7/32-in. and ¼-in. sizes listing at $5.50 and $6 per 100 ft. are quoted at 70 and 10 per cent off list in 1,000-ft. lots.

Fans.—Sales have continued to hold up remarkably well considering the cool weather. Jobbers report that a considerable number of fans are being sold at this time for commercial uses, mostly new restaurants and small stores.

Tape.—Both friction and rubber tape are quoted at 36 cents a pound in quantities of 25 lb. and over.

Radio.—Dealers continue to clamor for wireless apparatus, and jobbers have booked orders considerably in advance of deliveries.

CHICAGO

The electrical trade situation appears to have changed very little during the week. While the business momentum of the past month has been sustained, the upward trend has been slow and is visible only from a time prospective of several weeks. The building of the long-needed apartment houses and private residences is progressing at a favorable rate for electrical contractors. A slightly improved market is shown by the fact that the individual orders are increasing in size. All the wiring materials are maintaining their previous steady movement. Dealers in washing machines and vacuum cleaners are reporting better action and enthusiasm in these lines. The warm weather of the past week has started a healthy movement of fans. The radio demand has also felt this warm weather in the form of a slight slump, and prices are improving because of more frequent shipments.

Wire.—A steady demand for this material, with considerable price variation, was the chief important event of the week. The rubber-covered No. 14 is selling around $6 per 1,000 ft. in 5,000-ft. lots, and in a few cases better prices than this have been quoted. The building activity is still continuing its upward limit, and jobbers report that this is the reason for the improved market.

Conduit.—Action on conduit is also going well and, according to most jobbers, in lots of increased size. The ½-in. black pipe sells for $43 per 1,000 ft. in 5,000-ft. lots and stocks are good.

Flexible Armored Conductor.—The movement on armored conductor has followed along the increase in building so that most jobbers are selling larger-sized lots than formerly. The No. 14 two-wire, single-strip, is quoted in 5,000-ft. lots from $42 to $44 per 1,000 ft. Stocks fair.

High-Tension Equipment.—Orders have been received by one manufacturer for outdoor substations with ratings of 600 kva. and 900 kva. at 22,000 volts, 450 kva. at 45,000 volts and 5,000 kva. at 66,000 volts. Another concern reports that inquiries are improving and that fifty busbar supports were shipped to a utility in New York State.

Washers and Cleaners.—While marketing efforts are still strong, the value of this work is indicated by the improved sales on washing machines and vacuum cleaners. Dealers say that market is improving encouragingly.

Lamp Cord.—The call for lamp cord has fallen off along with the demand for portable lamps. The No. 18 twisted cotton, 1/64-in., is quoted at $15 per 1,000 ft., while the same size with silk covering sells for $25.50 per 1,000 ft.

Lighting Fixtures.—Dealers report an improved market for house-lighting fixtures because of the active increase in residential building. Stocks are good. The call for industrial fixtures is also improving.

Radio.—A slight slump in the demand for this equipment, together with better shipments from manufacturers, has improved prices. Head telephones are better distributed, but vacuum tubes are still behind on orders.

BOSTON

Activity in both wholesale and retail circles is well sustained. The underlying gradual improvement in New England business continues, with some irregularities. Building operations still gain in striking fashion. Contracts awarded in New England for the week ended May 9, 1922, totaled $10,079,700, compared with $5,230,100 for the same week last year. This record is far ahead of any similar week in twenty years with the exception of 1920, which slightly exceeded the above figure. Trade in staple electrical appliances is moving along nicely, on the whole. Wiring devices are a little quiet this week and prices are holding fairly firm with the exception of materials changing hands under acute competition. Miniature-lamp schedules are now distributed on a lower price basis as of May 1. In the textile field woolen mills are active, while cotton mills are hampered in some localities by the long-continued strike. Better labor conditions are noted in the leather industry and paper mills are busy. Metal-working establishments are doing better. Nothing seems able to affect the tremendous demand for radio apparatus.

Safety Switches.—Business is looking better, and one New England producer reports a fifteen-thousand-dollar order in progress, with growing interest in this type of equipment. Sales are being made largely on a quality basis, price being less important in the eyes of the purchaser.

Lamps.—List prices on certain miniature tungsten lamps have been reduced from 10 to 25 per cent, depending on the lamp number. The demand for lamps in general holds up well, and motion-picture lamps are moving with some spirit. Portables are doing better than might be expected at this season, and the consumption of the "bread-and-butter" types continues excellent.

Radio Equipment.—Vacuum tubes are scarce and the shortage of telephone receivers shows little improvement. Wire for aërials is now more plentiful. A leading jobber's price on No. 14 seven-strand, tin-clad bare copper is 75 cents per 100 ft. in 100-ft. lots and on No. 14 copper-clad steel wire in the same quantity 50 cents per 100 ft.

"Nail-it" Knobs.—Stocks are easily meeting current demand, and prices are quiet, with a normal quotation of $15.50 per 1,000 in barrel lots.

Wire.—Rubber-covered wire is less active for the moment, and on Saturday one large jobber had nearly 500,000 ft. of No. 14 in stock. In 1,000-ft. lots this size and type is moving around $6.25 per 1,000 ft. Weatherproof wire is moving quietly around 17 cents base in small quantities to 15½ cents in larger amounts. Transmission-line construction contemplated soon in central New England will quicken the movement of bare copper wire and insulators, if arrangements now pending go through along lines desired by one of the larger hydro-electric utilities.

Flexible Armored Conductor.—Recent activity in this material is well sustained, and No. 14 single-strip is moving around $42 net per 1,000 ft. in 1,000-ft. lots.

Potheads.—Prices have been reduced on some designs. One house is offering a three-conductor pothead formerly selling at $27 net at $22.50 with a sealed top bushing and at $21 net in the side-screw type bushing.

ATLANTA

The business outlook continues to brighten with the advent of real spring weather, the week just past being the first seasonable week for some time. The inclement weather has given a slight setback to farming operations. Crops in general are late, and the planting of cotton in the northern part of Georgia is very light. The southern part of the state, however, is in fine shape agriculturally. The citrus crop in Florida has shown improvement and conditions as a whole are reported good. Eastern markets are absorbing all the fruit produced at increased prices, and this is reflected in the very optimistic feeling throughout the citrus section.

Retail merchants as a whole report conditions improved, with an increased tendency on the part of the public to buy a little more liberally, and collections show a slow but steady improvement. A number of state banks which failed last year in the smaller towns are being reopened and are assisting materially in bettering business conditions.

Building in the twenty-three largest towns in the Southeast for the month of March shows a total of 3,223 permits with a valuation of $6,850,452, an increase of $2,212,725 over the same period of 1921. Only six of the towns in question show a decrease, these being Mobile, Pensacola, Tampa, Augusta, Meridian and Chattanooga. As a result of this condition the general market for electrical building supplies is showing a satisfactory activity and jobbers report that they are swamped with orders for radio equipment.

Farm-Lighting Outfits.—Sales of this specialty have slowed down somewhat in the past few weeks, owing probably not to a lack of interest but to the fact that money is required for financing agricultural operations. Stocks are in good condition with shipments satisfactory. No recent price changes are reported.

Safety Switches.—This line continues active, particularly in the more popular sizes of from 30 amp. to 200 amp. in both the two-pole and three-pole types. All jobbers report satisfactory stocks with prices steady.

Oil Switches.—A slight increase in the movement of this line is reported, due in all probability to the increased activity in the industrial plants in the section. Sales activities by the larger companies will create an even brisker market in the future. Local stocks are fair to good.

Insulators.—Glass telephone insulators continue in fair demand, but the porcelain types are somewhat slow, except in the larger centers where the central-station companies are pushing line extension work. Stocks of both varieties are ample.

Schedule Material.—This line is quite active, the heavy building program throughout the section having caused a very brisk demand for all classes of wiring specialties, particularly sockets and snap switches. Jobbers have plentiful stocks on hand with no prospects of immediate price changes.

Battery-Charging Outfits.—Little movement in this line is as yet apparent, though increased activity in the automobile business is sure to stimulate the sales of this specialty in the near future. Jobbers' stocks are reported good to heavy.

Ranges.—High prices continue to hold down the volume of sales in this line, though some increase is to be noted, resulting from campaigns by various dealers. Jobbers' stocks are in good shape.

ST. LOUIS

The week closed with comparative dullness in the electrical jobbing field, but on the whole business was good. The prospects in future business continue to grow more promising. The agricultural conditions indicate a bounteous yield this year, commercial activity is increasing, and virtually every line of manufacture shows improvement. Construction work, especially of residences, is expanding rapidly throughout the entire territory. Industrial plants in many instances are taking advantage of the present low prices on wire, conduit and motors to make improvements which have been deferred for months. The central-station companies are making preparations for substantial increases in their loads.

The effect of these conditions is noted in the increased sales of electric goods of virtually all kinds. In radio equipment the demand is, of course, feverish. Power generating equipment, substations, transformers, meters, wire, conduit, etc., are moving in entirely satisfactory volume. Warm weather is being experienced, and with it the fan business has opened. A warm spring such as this usually results in a good fan season. Stocks everywhere are in good condition and inventories have been liquidated.

Wire.—Prices are firm, with stocks amply large to meet the increasing demand. Representative prices on rubber-covered per 1,000 ft., in 5,000-ft. lots, are as follows: No.

14, $6.25; No. 12, $8.50; No. 10, $11.25; No. 8, $15.05. The base price on bare is 17 cents per pound, and the base on weatherproof is 15.5 cents to 16 cents per pound. The power companies are in the market for sizable quantities of weatherproof.

Porcelain.—The demand is steady, with some indication of improvement, and stocks have been reduced to a conservative basis. "Nail-it" knobs are being generally sold at $15 per 1,000 in barrel lots, and likewise 5½-in. split knobs are sold at $10.70 per 1,000 in barrel lots. The prices per 1,000 of other items are: Two-wire or three-wire unglazed cleats, $10.70; $\frac{5}{16}$-in. x 2½-in. porcelain tubes, $3.75; $\frac{5}{16}$-in. x 3-in. tubes, $4.50.

Dry Cells.—A strong demand continues, and the four-cell battery is growing in favor. Stocks are excellent, and prices are: Regular, $32.50 per 100 in lots of 100 and $31 per 100 in barrel lots; igniter, $33.50 per 100 in lots of 100 and $32 per 100 in barrel lots; four-cell, $1.70 each in lots of 24.

Fuses.—The demand shows improvement as the industrial plants increase their operations and, in the case of plug fuses, as new buildings are completed. Non-renewable cartridge fuses, 250-volt, in standard-package lots, are priced as follows: 0-amp. to 30-amp., $4.60 per 100; 35-amp to 60-amp., $6.90 per 100; 65-amp. to 100-amp., $20.70 per 100; 110-amp. to 200-amp., $46 per 100; 225-amp. to 400-amp., $82.80 per 100; 450-amp. to 600-amp., $126.50. Renewable fuses, 0-amp. to 30-amp., 250 volts, are quoted at $29 per 100 in standard packages, and the 31-amp. to 60-amp. fuses at $58 per 100. In the clear-window plug fuses prices range from $2.75 per 100 to $3.65 per 100 in lots of 1,000.

Weatherproof Sockets.—Except for some demand from the packing houses, the call is extremely light. Stocks are correspondingly low. Representative prices are found to be: Mica, $11 per 100; composition, $12 per 100; porcelain, $9 per 100.

Radio.—Back orders continue to pile up, notwithstanding the mass of low-priced equipment being sold by department stores and the ten-cent stores.

PORTLAND—SEATTLE

Construction of state highways is now in full swing. Reports from employment agencies show that men who are really seeking work can now find jobs. Few are idle. Farm labor is in good demand, with wages tending upward. Lumber production for the week ended May 6 was 2 per cent above normal, the highest it has been in over two years. New business for the same week was 13 per cent above production, with shipments practically equaling production. Building continues very active. The cities of Seattle and Tacoma have entered into a mutual agreement for the interchange of power. Power will be exchanged over a tie line having a capacity of 15,000 kw. The line will be about 40 miles long and will cost approximately $150,000.

Among electrical jobbers business continues on the up grade and is generally quite satisfactory. Prices on the whole are quite stable, although there was a 7 per cent advance in the price of conduit in Portland in the past week. The Portland Railway, Light & Power Company has recently placed an order for a large amount of copper in connection with a line to its new Oak Grove project.

Rubber-Covered Wire.—There is a good demand for this material, with the size of orders increasing. Stocks are ample. No. 14 is quoted at from $6.48 to $6.70 per 1,000 ft. in 5,000-ft. lots. No. 12 in similar quantities is quoted at $9.10.

Weatherproof Wire.—Sales of weatherproof wire are picking up with the coming of good weather, prices are steady. No. 6 triple-braid is quoted at from $20.50 to $21 per 100 lb. in coil lots.

Lamp Cord.—Lamp cord is in good demand. No. 18 twisted cotton is quoted at $13.30 per 1,000 ft. in coil lots.

Sockets.—The movement in sockets is particularly good. Heavy stocks are carried which easily meet the demand. The following approximate prices are maintained per 100 for standard carton lots: Pull, $25; key, $24.75; keyless, $22.50.

SAN FRANCISCO

The large increase in building in which all leading California cities are participating is very encouraging and has done a great deal to silence those who have predicted depressing conditions. At the same time a very slow collection rate is noted, affecting not only dealers but their customers also, and severe checking has been found necessary by the retailers. Light rains have been beneficial as the soil has been reported hard. Some of the richest districts, such as the central San Joaquin valley and the lower Sacramento valley, have had a subnormal rainfall, but in general the crops will be fair to good. These ripening crops are reflected in better orders.

Pole-Line Hardware.—Several excellent stocks are now carried on the Coast, and the recent settlement of boat service from the East has cut freight charges. As an example of local costs the following figures, which are pretty generally quoted for 1,000-piece orders of galvanized material, with from 5 to 10 per cent additional charge for 100-piece assorted lots, are interesting: Double-arm bolts, ⅝-in. x 18-in., $17.50 per 100; machine bolts, ⅝-in. x 18-in., $12.50 per 100; carriage bolts, ⅜-in. x 4-in., $1.75 per 100; lag screws, ½-in. x 4-in., $2.35 per 100; square washers, 2¼-in., $17.50 per 1,000; round washers, 1-in., $2.50 per 1,000.

Household Material.—It is very evident that radio interest has reacted upon the purchases of the larger household appliances. This is also evidenced by the larger commissions paid the outside crews for door-to-door soliciting. The figures for vacuum sweepers, for instance, have crept up in some cases from 15 per cent to a new mark of 25 per cent. Dealers are so much interested in the radio inquiries, for which just now very little sales effort is required, that they are prone to neglect household appliances, with the result that it is difficult to get a purchase order unless some guarantee method of selling goes along with the purchase. However, this field of sale is being clarified, and before the end of the year experts believe that a standardized selling method will have evolved out of present disorganization.

Small Motors.—Considerable missionary work is being done by manufacturers of such small household service motors as cream whippers, mayonnaise mixers and the like. There is a big field for their sale, but the buying public is unaware of their advantage. Good local stocks are carried, but so far most dealers feel that the present returns are not worth the increased sales effort.

SALT LAKE CITY—DENVER

Business recovery throughout the Intermountain country continues at a slow but perceptible rate. The revival here lags, according to salesmen who make all the large jobbing centers. With the gradual resumption of mining, however, the strides toward normal conditions will be decidedly more marked. Collections show improvement from month to month and credit is easier. As the demand for building materials increases prices show a stiffening tendency. Sporadic labor troubles are reported from the coal fields, with production proceeding at a good rate in the non-union mines. The employment situation is much improved, with the prospect of a job for every idle man by the first of June. The carrying out of the Moffat railway project, to connect Salt Lake City and Denver by a shorter route, is now definitely assured. The Colorado Legislature has appropriated $6,000,000 toward its construction. Road improvements to the extent of $3,000,000 have been approved for Idaho.

Radio continues to hold the spotlight of interest. Jobbers are swamped with orders, with no assurance of immediate relief in the way of ample stocks.

Wiring Supplies. Business is picking up as building activities get under way. Cottage building has brought back better times to contractor-dealers. Stocks are ample to meet requirements.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Allis-Chalmers Billings at Yearly Rate of $18,600,000

The Allis-Chalmers Manufacturing Company, Milwaukee, for the first quarter of the current year reports sales billed totaling $4,671,602, while net profits for the quarter, after providing for federal taxes, amounted to $278,733. Sales billed in the first quarter last year amounted to $7,656,218. Unfilled orders on hand at the close of the first quarter of 1922 were $8,011,463, as compared with $12,943,633 on March 31, 1921. Unfilled orders, however, show an increase over those on hand Dec. 31, 1921, which were $7,300,574. Bookings are said to be running in excess of billing and to be increasing steadily. March bookings were well over $2,000,000, while January bookings were considerably below $1,500,000. Good orders are being received for cement machinery, principally for road building.

Credit Now Needs Broad Vision and Exceptional Judgment

One whose province it is to deal with foreign credit should bring vision and understanding to his work, not permitting himself to be bound by a too narrowly restricted consideration of the problem before him, declared L. R. Browne, credit manager of the International Western Electric Company, who addressed the ninth foreign trade convention at Philadelphia last week. "The aim of the credit manager," said Mr. Browne, "should be to build a foundation for future business that will endure. He should be actuated by larger motives than a desire invariably and above all things to play safe, no matter what may befall."

Mr. Browne went on to describe in detail the ideal credit manager, picturing him as one knowing as much about other countries and the lives and habits of other people as he does concerning those of the country in which he lives and whose language he speaks.

Charles M. Muchnic, vice-president of the Locomotive Sales Corporation, explained why our export trade is decreasing, giving as a main reason lack of foreign purchasing power. Lower transportation cost was the subject of a talk by W. H. Stevenson, president of the Lake Erie & Ohio River Canal Board of Pennsylvania. James S. Martin, publicity manager of the foreign department of the Remington Typewriter Company, asserted that the reduction of selling cost was the paramount problem of business.

F. de St. Phalle, vice-president of the Baldwin Locomotive Works in charge of foreign sales, told the delegates that while South Americans do trade with Germany they have experienced many disappointments arising from late deliveries, inferior material and, recently, invoice increases of accepted prices. He declared that the future holds out bright prospects for trade between South America and the United States. South America is expected to develop at an increasing rate because it is the most attractive and richest of the accessible thinly populated districts of the world. A larger proportion of this development must be financed and carried out with the assistance of the United States. With the general recovery of trade, Mr. de St. Phalle said, South American rates of exchange may be expected to rise. Some have already done so materially.

Stanley G. Flagg, Jr., an exporter of Philadelphia, said that the larger exporters who have been operating abroad for years are not curtailing their efforts to promote business, because they have experience behind them which leads them to believe that renewed and continuous efforts will in the long run produce business and repay their efforts.

Stockholders Suggest Plan for Habirshaw Reorganization

Stockholders of the Habirshaw Electric Cable Company have suggested a plan of reorganization for that company calling for an assessment on common and preferred stockholders. The plan is being carefully considered by the creditors' committee. It calls for an assessment of $2 a share on the common and $25 a share on preferred stockholders. They would receive in return one share either of common or of preferred stock for each share turned in; also the equivalent of the assessed amount in a second-mortgage bond to run probably twenty years.

The Habirshaw Electric Cable Company has outstanding $2,000,000 consolidated 7 per cent bonds, due March 1, 1935; 132,945 shares of no-par common, and 9,630 shares of 8 per cent cumulative preferred stock, par $100. It has 3,000 shares of a subsidiary pledged with the government for advances. A first mortgage bond, covering this obligation, may be tendered the government if the plan meets with the approval of the creditors' committee. No decision is expected until after the middle of May. Owing to expansion in building construction, the company has considerable business on its books, but at low prices.

General Electric Is Recalling Employees at Fort Wayne

"From the present outlook we will recall at least 200 employees in the next ten days or two weeks," said W. F. Melching, in charge of employment at the Fort Wayne (Ind.) plant of the General Electric Company. "We are much in need of machine operators. Efforts are being made to get in touch with our old employees who are able to do this work. A real shortage of female help exists at our plant."

It is officially stated that the transformer department has greatly increased its production during the past few weeks, and the taking on of more men has proceeded at an almost constantly increasing rate. The small-motor section of the plant also is experiencing a great increase in orders.

"Of course," said Mr. Melching, "we cannot foresee everything that may come up, but we are reasonably sure that this increase in business is permanent."

Radio Manufacturer Incorporates and Expands Production

A million-dollar corporation has just been organized in Salt Lake City and a factory site purchased at Holliday, a suburb of that city, for the manufacture on a large scale of the Baldwin radio receiving sets. Many prominent business men of Utah, it is said, are interested in the corporation, which will be headed by David A. Smith, Lester D. Freed and Joseph F. Nibley.

For several years Nathaniel Baldwin has manufactured at 3474 South Twenty-third East Street, Salt Lake City, the Baldwin mica-diaphragm telephones. With the development of the radio telephone and the sudden spread of demand there developed a call for the Baldwin receivers which Mr. Baldwin has been unable to meet, owing to limited capacity. The capacity of the new plant will be between 1,000 and 3,000 receivers per day.

Mr. Baldwin holds the basic patents not only to the instrument but to the machinery which he has created for its manufacture. The present plans of the new corporation include the immediate construction of the first unit of its manufacturing plant, which is expected to develop into one of the largest industries in the West. All the stock in the new corporation has been subscribed for by Utah people.

Illinois Testing Laboratories Increase Facilities

In order to obtain more manufacturing space for electrical instruments and pyrometers, the Illinois Testing Laboratories, Chicago, have moved from 340 South Green Street to 141-143 Austin Avenue. The new location affords the laboratories a floor space double the size of their old quarters. J. A. Osermaier, the chief engineer, speaking with a representative of the ELECTRICAL WORLD, said that more testing equipment had been added to maintain better testing service.

Record of Electrical Patents

Notes on United States Patents

(Issued April 25, 1922)

1,413,678. Electric Furnace; Frederick W. Moffat, Weston, Ontario, Canada. App. filed March 9, 1921. Resistance type, for use as enamelling oven.

1,413,685. Polyphase Choking Coils for Rectifier; Béla B. Schafer, Baden, Switzerland. App. filed July 11, 1920. Coils for each phase on same iron core.

1,413,708. Signaling Circuits for Toll Lines; John Davidson, Jr., Montclair, N. J. App. filed Dec. 12, 1918. By using intermittently operating distributor for sending code signals.

1,413,725. Wrapping Machine; Martin B. Grout, Chicago, Ill. App. filed Nov. 15, 1920. Applying reinforcing wrapping to object spirally.

1,413,732. Electric Discharge Apparatus; Raymond A. Heising, East Orange, N. J. App. filed Oct. 2, 1916. Aëroplane wireless set.

1,413,747. Means for Starting and Operating Motor Generators; John C. Lincoln, Cleveland, Ohio. App. filed May 29, 1917. All windings connected in series while starting.

1,413,748. Signaling Apparatus; Dimmitt R. Lovejoy, Freneau, N. J. App. filed June 26, 1918. Of the non-interfering successive type.

1,413,753. Receiving Device for Signaling Systems; William H. Martin, New York, N. Y. App. filed Jan. 17, 1920. Vacuum-tube amplifier on ocean cables.

1,413,776. Tire-Wrapping Machine; George W. Prouty, Milton, Mass. App. filed May 27, 1920. For spiral wrapping of tires.

1,413,782. Telephone System; Alexander C. Reid, Genoa, Ill. App. filed Oct. 31, 1918. Vibratory rectifier for constant charging of supply batteries.

1,413,785. Artificial Corundum and Process of Making Same; Harold A. Richmond and Robert MacDonald, Jr., Niagara Falls, N. Y. App. filed Jan 7, 1921.

1,413,817. Mercury Motor Meter; Otis White, Springfield, Ill. App. filed July 5, 1921. Constructed to prevent spilling of the mercury.

1,413,887. Incubator; Franz Baba, Irvington, N. J. App. filed May 13, 1919. Automatic temperature control.

1,413,932. Furnace; Paul L. Pfanenschmidt, Dewsbury, England. App. filed Jan. 2, 1915. Produces articles made from quartz, silica sand or crystals.

1,413,939. Resistance Unit for Electric Heaters and Regulating Resistances; Willy Schulz, Frankfort-on-the-Main, Germany. App. filed June 17, 1916. Constructed in shapes to prevent short circuits.

1,414,007. Pressing Element; William H. Berwick, Syracuse, N. Y. App. filed April 7, 1920. Iron with fluid chamber heated by electric element.

1,414,018. Telemotor; Albert H. Heyroth, Duluth, Minn. App. filed Feb. 25, 1921. Electric time-switch circuit system.

1,414,059. Method and Apparatus for Producing Alkaline Hypochlorites; LaFayette D. Vorce, Windsor, Ontario, Canada. App. filed May 28, 1920. Electrolyte cell for producing caustic and chlorine.

1,414,079. Apparatus for Dehydrating Oil; Samuel A. Giebner, Bakersfield, Cal. App. filed May 12, 1919. By discharge of heavy current in emulsions.

1,414,105. Telephone Receiver; John S. Timmons, New York, N. Y. App. filed July 17, 1918. Ring-shaped permanent magnet.

1,414,127. Hanger; Byron L. Heater, Forest Park, Ill. App. filed Aug. 30, 1920. Clamps trolley wire securely.

1,414,170. Magnetic Separating Process and Apparatus; J. P. Bethke and R. H. Stearns, Milwaukee, Wis. App. filed June 11, 1919. Uses alternating current to separate magnetic and non-magnetic materials.

1,414,179. Cable System; Louis Cohen, Washington, D. C. App. filed Dec. 28, 1918. Balancing in duplex-bridge cable signaling.

1,414,226. Electric Heating Apparatus; Wijtse B. Smits, Dilmen, Netherlands. App. filed March 1, 1920.

1,414,232. Method of Receiving Radio Signals with the Compound Heterodyne; Albert H. Taylor, Grand Forks, N. D. App. filed Aug. 12, 1919. For high-power work.

1,414,248. Voltage Regulation; James C. Armor, Pittsburgh, Pa. App. filed May 26, 1920. Maintains constant voltage on one of two circuits connected together.

1,414,259. Purification of Tin; Jerome J. Collins, Southport, England. App. filed April 6, 1921. By dehydrating, fusing and electrolyzing stannous chloride.

1,414,274. Trolley Guard; Rephael E. Harlowe, Los Angeles, Cal. App. filed Nov. 11, 1920. Arrangement to prevent dislodgment.

1,414,298. Indicator; Juan C. Montero, Washington, D. C. App. filed Sept. 18, 1918. Float-type electric indicator for gasoline tanks.

1,414,301. Trolley Harp; Charles W. Oldenquist, West Lynn, Mass. App. filed Sept. 29, 1919. Spindle for turning movement.

(Issued May 2, 1922)

1,414,362. Electric Furnace; Arthur Jones, Belleville, Ill. App. filed May 13, 1920. Rotates electrodes.

1,414,369. Station Indicator; Samuel Mitchell, Detroit, Mich. App. filed June 30, 1920. Automatic street indicator for trolley cars.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CONCORD, N. H.—The Utilities Power Company, recently organized, will build a hydro-electric power plant on the Pemigewaset River, to cost about $1,000,000.

BOSTON, MASS.—A power plant, refrigerating plant, electric pumping station, etc., will be installed in the twelve-story building to be erected at Federal and Congress Streets by the Chamber of Commerce Realty Trust, 177 Milk Street, to cost about $5,000,000. Parker, Thomas & Rice, 110 State Street, are architects.

WATERTOWN, MASS.—The Edison Electric Illuminating Company, Boston, has acquired property on Spring Street for proposed plant extensions.

THOMPSONVILLE, CONN.—The Northern Connecticut Light & Power Company has filed notice of increase in capital stock from $700,000 to $1,000,000.

Middle Atlantic States

BUFFALO, N. Y.—The Larkin Company, 663 Seneca Street, is preparing plans for a new power house at its soap factory. Griggs & Myers, 347 Fifth Avenue, New York, are engineers.

BUFFALO, N. Y.—The Council has approved of a three-year lighting contract with the Buffalo General Electric Company, all gas lights to be replaced with electric lamps during this period.

BUFFALO, N. Y.—The Buffalo General Electric Company will soon call for bids for a two-story service building at Niagara Street and Front Avenue, 115 ft. x 120 ft. and 151 ft. x 165 ft. Plans are being prepared for the construction of a new outdoor switching station at Tonawanda.

NEW YORK, N. Y.—S. B. Wight, agent for the New York Central Railroad Company and affiliated companies, will take bids until May 24 for incandescent lamps for the railroads for a period of one year from June 1, 1922, aggregating $300,000.

OLEAN, N. Y.—The installation of a municipal electric light plant is under consideration by the City Council.

WARSAW, N. Y.—Plans have been completed by the Warsaw Gas & Electric Company for the erection of a one-story power plant, 80 ft. x 105 ft.

ATLANTIC CITY, N. J.—The Atlantic City Electric Company has been granted permission by the Board of Public Utilities to issue $300,000 in capital stock, part of the proceeds to be used for extensions and improvements.

ALLENTOWN, PA.—The Lehigh Navigation Electric Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

KEATING, PA.—The Keystone Power Corporation, Ridgway, has acquired property at Keating for a hydro-electric plant.

LEBANON, PA.—The Lower Milford-Lehigh Power Company is being organized to install and operate a power plant in Lower Milford Township. S. P. Light represents the company.

McCONNELLSBURG, PA.—The lighting committee is raising a fund of $30,000 for the installation of an electric lighting system.

PITTSBURGH, PA.—The Board of Public Works will install a new lighting system on East Ohio Street, Northside.

PITTSBURGH, PA.—The Duquesne Light Company has applied to the Public Service Commission for permission to erect a transmission line in Plum Township.

POTTSTOWN, PA.—The Reading Transit & Light Company has been ordered by the Public Service Commission to make extensions and improvements to its system in this section.

READING, PA.—The Metropolitan Edison Company has issued $1,805,830 in capital stock, part of the proceeds to be used for extensions and improvements.

WILMINGTON, DEL.—The Street and Sewer Department will install ornamental lamps on King Street, between Front and Tenth Streets, replacing all arc and gas lamps.

BALTIMORE, MD.—Electrical and mechanical equipment will be installed in the grain elevator addition of the Pennsylvania Railroad Company at Canton, near Baltimore, to cost about $750,000.

BALTIMORE, MD.—The Susquehanna Water Power Company has been granted permission by the Public Service Commission to issue about $700,000 in capital stock, the proceeds to be used in connection with preliminary work for a hydro-electric plant on the Susquehanna River, near McCall's Ferry. The ultimate cost is estimated at about $15,000,000. Luther M. R. Willis, 213 Courtland Building, represents the company.

BALTIMORE, MD.—The Board of Estimates is arranging appropriations of $50,000 for the installation of improved electric lighting equipment in the public schools, as well as $169,000 for new power equipment.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company will build a new substation at 700-704 West Pratt Street.

CHARLESTON, W. VA.—The West Virginia Water & Electric Company has issued $3,300,000 in bonds, part of the proceeds to be used for extensions and improvements. A. C. Babson is vice-president and general manager.

CLARKSBURG, W. VA.—The Council contemplates the installation of a fire-alarm and police-signal system, to cost about $88,000.

HUNTINGTON, W. VA.—The Union Gas & Electric Company, Cincinnati, contemplates the construction of an electric plant for mining service in this vicinity to cost about $1,500,000, including transmission system. W. W. Freeman is president.

KINGWOOD, W. VA.—The West Penn Power Company, Pittsburgh, contemplates the construction of a new transmission line in this section. A new substation will be erected at Grafton.

MERIDEN, W. VA.—The Rock Island Coal & Coke Company contemplates the installation of a 300-kw. generator set, transformers, motors, etc., at its properties.

WHEELING, W. VA.—Work will soon begin on extensions to the plant of the Beech Bottom (W. Va.) Power Company, including the installation of two complete generating units. The company is controlled by the American Gas & Electric Company, 30 Church Street, New York City.

CLIFTON FORGE, VA.—Plans are being prepared by the Virginia-Western Power Company for extension to its plant at Ronceverte, to cost with equipment and line extensions about $500,000.

WASHINGTON, D. C.—Bids will be called at an early date by the Bureau of Yards and Docks, Navy Department, for alternators and auxiliary equipment for use at the Yorktown, Va., navy yard. (Specification 1612.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 31 for electrical generator equipments for the navy yards at Newport News, Va., and Camden, N. J. (Schedule 9644.)

WASHINGTON, D. C.—Bids will be received at the Office of the Chief Signal Officer, United States Army, until May 31, for 1,300 ft. switchboard cable, 20-pair with reels; 1,300 ft. switchboard cable, 50-pair with reels; 800 ft. switchboard cable, 100-pair with reels, and thirty-six condensers. (Circular PR 7200A-429 CP.) Also, until May 31, for 110 insulators, 75 mast-top insulators, 100 strain insulators and 300 insulators. (Circular 10813-19 CP.) Also, until May 29, for 400 voltammeters and ten voltmeters. (Circular PR 11130-1 CP.)

WASHINGTON, D. C.—Bids will be received at the office of the chief air service, United States Army, until May 24, for 17,000 ft. electrical airplane wire, covered. (Circular ASA 77.)

North Central States

DETROIT, MICH.—The Detroit Sand Lime Brick Company, Vinton Building, will erect a power house in connection with its proposed plant at River Rouge.

EATON RAPIDS, MICH.—The Council is considering a proposal from the Eaton Rapids Power Company for light and power service for a period of ten years.

SWANSON, MICH.—The White Rapids Paper Company has applied to the Federal Power Commission for permission to build a 10,000-hp. hydro-electric plant on the Menominee River.

UNION CITY, MICH.—The Council has awarded a contract to the Benjamin Douglass Construction Company, Ann Arbor, for the construction of a hydro-electric power plant on the St. Joseph River, to cost $150,000.

LANCASTER, OHIO.—A power plant will be constructed in connection with the proposed new window-glass manufacturing plant of the Fairfield Glass Company, to cost about $2,500,000. Leopold Hambourg is general manager.

LOUISVILLE, KY.—The Field Packing Company will build a one-story addition to its power house and a new cold-storage plant.

LA SALLE, ILL.—The Citizens' Lighting Company has made application to the Publica Service Commission for permission to issue $350,000 in bonds and $88,000 in capital stock, part of the proceeds to be used for extensions and improvements.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company will build a 22-mile transmission line for service at Mikana, Campia and Birchwood, to cost about $40,000.

PARK FALLS, WIS.—The Flambeau Paper Company has plans under way for extensions to its works calling for an expenditure of $500,000 for buildings and about the same amount for equipment, which will cover a period of three years. Contract has been awarded for a three-story, 75-ft. x 150-ft. concrete pulp mill to the C. R. Meyer & Sons Construction Company, Oshkosh. The pulp mill at Pixley will be converted into a hydro-electric generating plant when the new pulp mill is completed.

PORTWING, WIS.—The Northern Wisconsin Hydro-Electric Company contemplates the construction of a new hydro-electric power plant. The Jacobson Engineering Company, Metropolitan Bank Building, Minneapolis, is engineer.

AUSTIN, MINN.—Plans are being prepared for the rebuilding of the municipal electric plant, to cost about $100,000. The C. L. Pillsbury Company, 1,200 Second Avenue, South Minneapolis, is engineer.

DETROIT, MINN.—The City Council has engaged L. P. Wolff, engineer, Guardian Life Building, St. Paul, to prepare plans for extensions to the municipal electric light plant, to cost about $40,000.

WINONA, MINN.—The Chicago & Northwestern Railroad Company, 226 West Jackson Boulevard, Chicago, will build a power house in connection with its new local shops, to cost about $500,000.

OSKALOOSA, IOWA.—A special election will be held June 3 to vote on the proposal to issue $300,000 in bonds for the construction of a municipal hydro-electric plant on the Des Moines River. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

BUNCETON, MO.—F. T. Porter, California, has been granted a franchise to install an electric light and power system in Bunceton.

KANSAS CITY, MO.—The Cavanal Coal Company, Ridge Building, is in the market for equipment for an electric light and power plant at its property at Shady Point, Okla.

KANSAS CITY, MO.—The Kansas City Power & Light Company is installing a 30,000-kva. turbine, and four 1,370-hp. boilers. H. H. Kuhn is assistant chief engineer.

OSCEOLA, MO.—The Council has authorized estimates of cost made for extensions and improvements to the municipal electric plant. A. L. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

PARIS, MO.—The Council is considering an issue of $75,000 in bonds for extensions to the municipal electric lighting system. W. B. Rollins & Company, Railway Exchange Building, Kansas City, are engineers.

DOUGLAS, NEB.—The City Council has authorized plans drawn for a transmission line, about 6 miles in length, and distributing system, to cost about $12,000. The Hollister Engineering Company, Bankers' Life Building, Lincoln, is engineer.

Southern States

GREENSBORO, N. C.—Bids will soon be asked by the City Council for the following work: Installing certain hydro-electric equipment, to cost $20,000; erecting six filtering units of 1,000,000 gal. capacity each, $90,000; construction of Reedy Fork dam, $80,000. J. L. Ludlow, Winston-Salem, is engineer.

SAVANNAH, GA.—The Savannah Electric & Power Company has issued $1,300,000 in bonds, part of the proceeds to be used for extensions and improvements.

GERMANTOWN, TENN.—Plans are being prepared for a municipal electric plant. J. A. Arthur is engineer.

LAWRENCEBURG, TENN.—Plans are under consideration by the City Commission for extensions to the municipal electric plant, including the installation of water-wheels, generator and auxiliaries, to cost about $50,000.

CHARLESTON, ARK.—A company is being organized by E. C. Lichty, Fort Smith, to install and operate an electric plant and system at Charleston.

RISON, ARK.—The Rison Light & Water Company contemplates improvements to its plant, including a new power house.

BATON ROUGE, LA.—The Baton Rouge Electric Company contemplates extensions and improvements to its systems, to cost about $250,000. The work will include an addition to the power plant, line extensions, etc.

MONROE, LA.—The Southwest Pulp & Paper Company, 206 Broadway, Norwich, Conn., it is reported, will open bids early in June for its proposed new pulp and paper mill in Monroe. The plans include a power house and bids for the equipment, and other machinery will be called for early in July. The cost of the plant is estimated at about $250,000. Joseph G. Mayo is president and manager.

BURBANK, OKLA.—The installation of a municipal electric light plant, to cost about $27,000, is under consideration.

PAWNEE, OKLA.—The Council has engaged the Benham Engineering Company, Gimbel Building, Kansas City, Mo., to prepare plans for extensions and improvements to the municipal electric plant and system, to cost about $65,000.

ABILENE, TEX.—The American Public Service Company will build a transmission line to Albany, Sylvester, Buffalo Gap, McCaully and Ovalo. The cost will be financed by residents at the different places requesting service. A line will also be erected from Merkel to Trent.

CARTHAGE, TEX.—The property of the Carthage Ice & Light Company has been purchased by the Central Texas Power Company, San Antonio. A high-tension transmission line will be erected from the Central Texas Company's plant at Center to supply electricity in Carthage.

CLERMONT, TEX.—Extensions to the municipal electric plant, including the installation of new equipment, have been authorized by the Council.

DALLAS, TEX.—Plans for improvements to be made by the Dallas Power & Light Company, involving an expenditure of $205,400, have been approved by the City Commission. The work includes the erection of a large cable from the main power plant on Trinity River to the Jackson Street substation, to cost $53,000; the installation of a motor-generator set in the East Dallas power station, $41,500, and the erection of a transmission line to Trinity Heights to connect with the lines of the Texas Power & Light Company, $110,900

LIVINGSTON, TEX.—A bond issue of $30,000 for the installation of a municipal electric light plant has been approved by the voters.

TEXLINE, TEX.—Work will begin at once on the construction of a municipal electric light and power plant. E. W. Baker, Oklahoma City, is engineer. H. H. Tate is city manager.

Pacific and Mountain States

SEATTLE, WASH.—The Council is considering the installation of an ornamental lighting system in the University district.

TACOMA, WASH.—The Lighting Department has advertised for bids for equipment for an 9,000-kva. auxiliary steam plant to be operated in conjunction with the hydro-electric plant on the Nisqually River. The plant will be located on Dock Street at the plant of the Consumers' Central Heating Company. The equipment will include two turbo-generator units. Llewllyn R. Evans is superintendent of the municipal electric plant.

RIDDLE, ORE.—D. S. Riddle has applied to the State Engineer for permission to appropriate water rights on the South Umpqua River for the development of 250 hp. to supply electricity for lamps and motors in the town of Riddle and vicinity.

BANNING, CAL.—The Southern Sierras Power Company, Riverside, is planning to construct a hydro-electric plant on Snow Creek, about 15 miles from Banning, with initial capacity of 4,200 hp.

LOS ANGELES, CAL.—Plans have been completed by the Municipal Electric Bureau for a power house to be erected at Harbor Boulevard and Regan Street, to cost about $300,000, of which about $150,000 will be expended for equipment.

LOS ANGELES, CAL.—The Board of Works has approved plans for an ornamental lighting system on Figueroa Street, comprising sixty standards and 250-cp. lamps.

MADERA, CAL.—The Madera Irrigation District has applied to the State Water Commission for water rights on the San Joaquin River for the construction of a hydro-electric plant to develop about 100,000 hp.

MODESTO, CAL.—The Council contemplates the installation of an ornamental lighting system on Sycamore Avenue, from Needham to Stoddard Street.

REEDLEY, CAL.—A power house will be constructed in connection with the new group of high school buildings, to cost $450,000. Norman F. Marsh, Broadway Central Building, Los Angeles, is architect.

SAN FRANCISCO, CAL.—Plans are being prepared by the Pacific Gas & Electric Company for the erection of substations at Turlock, Riverbank, O'Banion Corners and Hughson, to cost about $75,000 each.

SAN FRANCISCO, CAL.—The Kaweah Molybdenum Mines Company has applied to the State Water Commission for water rights on the Keweah River, Tulare County, for a hydro-electric plant, for use at its properties in this section.

SAN FRANCISCO, CAL.—Roy H. Elliott, 1213 Hobart Building, and associates have been granted permission by the State Water Commission to construct and operate a series of hydro-electric power plants, to be located on the Middle Fork of the Yuba River, Milton Creek, Sardine Creek and other streams in Sierra and Nevada Counties, to develop about 60,500 hp., at a cost of about $2,700,000.

WATERMAN, CAL.—The Preston School of Industry has been granted permission by the State Water Commission to construct a hydro-electric plant on Sutter Creek, to cost about $75,000.

GRIMES PASS, IDAHO.—The power plant of the Boston-Idaho Gold Mine Company on the Payette River at Grimes Pass was recently destroyed by fire, causing a loss of between $75,000 and $100,000.

COLUMBIA FALLS, MONT.—The Cyanide Gold Mining Company contemplates the construction of a power plant in connection with a new mill and cyanide plant.

Canada

VERNON, B. C.—The construction of a hydro-electric plant at Shuswap Falls, to cost about $25,000, is under consideration by the Town Council.

WINDSOR, N. S.—Bids will soon be asked by the Avon Power Company for the construction of a power plant on Avon River to develop 3,000 hp. The work will include a canal 2,000 ft. long and 16 ft. wide, concrete dam, etc., to cost about $250,000. Further information may be obtained from R. A. Jodrey, Wolfville, or T. B. Akin, Windsor.

EMERSON, ONT.—The installation of an electric lighting plant, to cost about $10,000. is under consideration by the Town Council L. H. Ashby is clerk.

Electrical World

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New York, Saturday, May 27, 1922

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For Greater Expectations

GRADUALLY the thought is sinking in that the great movement for business development, formally launched at the Atlantic City convention, must set new standards for electrical men in commercial plans and policies. Here is a project which embraces all branches of the industry, but in the end the individual must do the work and it is a bigger work than he has ever taken on before.

Any great success can only be made possible by a broader vision, a larger expectation and a more impulsive effort than we have been accustomed to in recent years.

ONE day last November, for example, in an Eastern city, we talked to the manager of a central-station electric shop. Masses of small reflector-type radiators were on display. The winter campaign was on. He was enthusiastic. Ten men were ringing doorbells on commission and together selling 400 radiators a month. They were "doing a fine business," he said.

But—consider this. The radiator drive could last, we'll say, four months, and make some 1,600 sales. Yet 450,000 people live in that town, and there are 30,000 households using electric service. In every one of them a radiator could have been sold unless that home possessed one or two already. Therefore 100 men could have made 4,000 sales each month as easily and profitably as ten could make 400. And 16,000 radiators could have been added to the load in that one town last winter if this man had had a vision of the greatness of his opportunity.

We are so new at all of this. We think so much in terms of former years. Yet in 1921 alone 1,100,000 new residence consumers came into our market in America. And it is estimated that 3,500,000 more new and old houses will be wired within the next five years. There are already 7,500,000 connected homes to sell to in the land. Each one of them needs and wants everything electrical. And still we are content to sell by tens where we could sell by hundreds.

Central-station sales departments, therefore, must be re-established and the local co-operative plan conceived upon a bigger basis than we have ever sensed before. And there must be also broader vision, larger expectation and a will to work—not in the war-time way—but with a more intense creative spirit and constructive force.

TO DO the job for which the industry is organizing will need an ample and well-oiled machinery, setting up a working balance of all the classes of electrical men. But more even than organization it needs inspiration and a recognition by the individual of the scope of the steadily expanding common opportunity.

Frank Baldwin Jewett

President-elect of the A. I. E. E., who for the past fifteen years has been actively associated with all important telephone developments.

ATHOUGH just reaching the prime of life, Frank B. Jewett, president-elect of the American Institute of Electrical Engineers, has long since been recognized both at home and abroad as one of the foremost telephone engineers of our time. With all of the remarkable developments in the telephone art which have taken place in the last fifteen years, and which include the establishment of the transcontinental telephone line and talking for the first time by radio across the Atlantic, Dr. Jewett has been actively associated. Because of his scientific skill and administrative abilities his contributions to these and many other notable achievements have been of the first order.

He was born in 1879 at Pasadena, Cal. In 1898 he was graduated from the Throop Polytechnic Institute, now the California Institute of Technology. From the University of Chicago, where he spent some years as research assistant to Prof. A. A. Michelson, he received the degree of Ph.D. Later he was instructor in physics and electrical engineering at the Massachusetts Institute of Technology, and in 1904 he joined the staff of the American Telephone & Telegraph Company. In this position he worked in a field in which his brilliant attainments and fundamental scientific training qualified him admirably for the practical engineering work and scientific development and research which he was called upon to do.

In 1912 Dr. Jewett became assistant chief engineer of the Western Electric Company, and in 1916 he was made chief engineer having charge of the research laboratories of that company, which carry out the experimental work for the Bell Telephone System. Under his charge also was all the engineering work required in connection with the manufacturing activities of the Western Electric Company. He is now vice-president of the Western Electric Company, and his duties have been extended to include the supervision of all the manufacturing operations of that company in America, together with the direction of its sales and the distribution of its manufactured product.

At the outbreak of the war Dr. Jewett was commissioned as major in the Signal Corps and had charge of the development of numerous scientific devices for the use of that branch of the service. Prominent among these was the radio telephone for use in connection with aircraft. He served as a member of the anti-submarine board of the United States Navy and took a notable part in the development of methods and apparatus for combating the submarine activities of the enemy. He was promoted to the grade of lieutenant-colonel, and for his service in the army and his other war activities he received from the United States government the distinguished service medal.

Dr. Jewett is the author of numerous scientific and engineering papers and is one of the foremost among those who have contributed largely to advance electrical engineering to its present high standing among the learned professions. He is a director of the Western Electric Company, Inc., and of the International Western Electric Company, Inc.; vice-president of the Manufacturers' Junction Railway and past-president of the New York Telephone Society. He is a member of numerous scientific societies, including the National Academy of Sciences, the National Research Council, the American Physical Society and the American Association for the Advancement of Science; a trustee of the Engineering Foundation Board and vice-chairman of the Engineering Foundation.

Editorial Comment

Electrical World, May 27, 1922
Volume 79
Number 21

Prosperity Again with Us

BUSINESS in electrical materials and supplies is on the upgrade—not feverishly as in 1919, but as the honest outcome of good hard sales effort. Billings are for the most part far in excess of those in 1913 and 1914, and as a result employment in electrical manufacturing plants is increasing. Much of the reckless price cutting of a few months ago has disappeared, and in a few lines prices are actually advancing.

Better still, however, is the outlook. The electric light and power companies, the largest single market for electrical products, are ordering quantities of generating equipment, transformers and line material. Prime-mover orders are again piling up. There is hardly a large city in the country that is not installing, or that has not placed contracts for, prime movers. It was shown in the issue of May 13 that at least $400,000,000 will be spent in 1922 by new and existing companies. These new units, substations and lines must all be loaded. The investment must be put on a paying basis as soon as possible. This means the purchase of energy-using equipment—wires, transformers, lamps, meters, electrical supplies, etc.

The other important market—the industrial market—is beginning to pick up as the result of generally better conditions. Many factory heads are anticipating more strenuous times by putting their motor equipment in order. The mining industry, with the exception of the coal mines, and the oil industry are getting into stride. One of the most promising markets, however, is that afforded by the electrification of railroad lines and terminals. Millions will be spent in equipping the Chicago terminal of the Illinois Central. An announcement that one or more of the large Eastern roads are ready to start main-line electrification may be given out any day. Other roads are known to be figuring on the cost.

Stimulating these demands will be the business development campaign of the electrical industry fostered by the National Electric Light Association. Just in proportion to the effort put forth locally will this movement result in supply sales.

The Voice of That Small Group

IN A GREAT auditorium a large audience was gathered. The ventilation was bad. There was much grumbling. Suddenly eight men in an upper box began to yell in unison: "We want air!" The manager heard, fans were started, ventilators were opened. Such is the power of the organized co-operation of a few men. It was not necessary for everybody in the theater to shout, but the voices of one small group working together accomplished what individuals could not.

This is the same kind of opportunity that awaits the organized effort of the small group of electrical men in every community in the land. The message of electricity must be carried out to all the people. Individual murmurings and individual eagerness are not enough. The voice of that small group must be raised in unison if the common purpose is to be achieved and if our industry is to forge ahead with the full recognition that will only come when it is won.

Satisfied Curiosity Begets Confidence

A FEW conspicuous examples remain of the type of public utility official who objects to releasing information on plant economy and operating expenses, fearing that some politician will use part of it against the company. No fear is expressed that the data will react against the company if used in their entirety. The reasons for making such data public are so obvious that the logical thing would be to call on the opponents of publicity to tell why, in their opinion, they should *not* be made public. A tremendous amount of effort has been expended to educate the public to the facts that underlie the operation of public utilities, to tell it that the utility is established for the purpose of rendering service, to encourage it to consider the utility as a thing of intimate direct concern with itself, and to induce it to sustain the utility by investing in its securities.

A particular example of the fallacy of unwillingness to publish pertinent facts arose recently in California. In this case it was urgently requested by officials of several power companies that data of the operating results of their companies be not made public, for the reason that the advocates of the California water and power act might seize upon them and use them to the disadvantage of the existing utilities. For three reasons these requests seemed puerile: The operations of the California companies will stand comparison with those of any plants operating under similar conditions; the figures could all have been obtained by appeal to the California Railroad Commission, with which they are filed, and, most pertinent of all, the proponents of this act do not have recourse to either facts or figures in their statements but rely on imaginative "spellbinding."

Of the principal factors that sustain the life of the utility that of public confidence is one of the greatest. Curiosity satisfied begets confidence. If the facts regarding a utility are concealed or shrouded in mystery, the consumers and the public will become suspicious and clamor for an investigation. How often we have seen such investigations begun by public officials, only to have them abruptly stopped when the facts became known! There is nothing in the operation of a central-station company that needs to be concealed, and the sooner the few remaining objectors to broadcast dissemination of utility expenses are converted, the better it will be for the industry as a whole.

Consideration of Human Element Essential to Best Public Relations

MUCH of the public-relations effort being expended in the utility field is wasted because the developments in the field are treated as having worth without reference to their human environment. Human beings have lived in the world for untold centuries. At the bottom human nature is the same today as it has always been. It has its likes and dislikes, its fears and hopes. Out of these all development springs because they are the elemental forces that drive humanity to do things that minister to physical needs and the real or fancied wants of the individual. If public relations work of any character is to be a success, it must be based on a clear recognition of this fact and the industry must be presented as a factor in community development. Mere claims that the industry must have money to give service are utter folly. Efforts to show the place of the industry in the scheme of community welfare, and that to assume this place, which none other can fill, it must have financial support and a fair deal as well as give the public a fair deal, are only common sense.

Astonishing Claims for New Lead Battery

A NEW lead storage battery for which astonishing claims are made is announced from England. It is the lead-hydrate battery, first proposed a number of years ago and now appearing in developed form as a commercial offering. It differs from other present well-known types of lead battery only in the active material, which, however, permits the use of fewer and thicker plates.

Exemption from practically all of the troubles to which the commonly used lead cells are liable is claimed for the new cell. Sulphation is absent because the active material can be obtained in purer form. Buckling and disintegration are avoided because the volume of the active material does not vary under any conditions of charge or discharge. High capacity at low rate is obtained because more active material can be used and because it is very porous, permitting the electrolyte to penetrate freely. As a consequence, for a given weight of cell the plates can be made thicker and fewer in number, improving the mechanical structure. Claims made for the battery are a capacity 300 to 800 per cent greater than for any other; that it is rechargeable at any rate, reducing the charging interval to as little as fifteen minutes; a longer life than any other battery, and the possibility of standing for an indefinite time in any state of charge or discharge without deterioration. Some interesting test data under severe demand conditions are given in a recent number of the London *Electrical Review*. It is also asserted that a large company is being formed for the manufacture of the cell in this country.

In the light of the character and authority of the evidence presented, it is perhaps unwise to express skepticism. It must be remembered, however, that it is possible to construct a battery for exceedingly large values of capacity if provision does not have to be made for long life. Moreover, extravagant claims which have not been substantiated have often been made for batteries of new design. While the present battery does not appear to be in the latter class, conservative engineers will await comparative tests, as regards both capacity and life per unit of weight, between this battery and those of reliable types now in use. The announcement referred to is noticeably silent on the question of such comparative tests.

Co-ordinating Plant Operation for Highest System Economy

THE operation of a complex system fed by hydro-electric and steam plants so as to attain maximum economy is a task of details rather than fixed principles. The most that one can do in an orderly attack upon the problem is to correlate his facts and be guided by them. How this is done in the great Southern California Edison system was explained in our May 13 issue by J. W. Andree.

The first step is to know the actual operating conditions of each plant and the run of demand on the whole. Then one may divide the hydro-electric plants broadly into two classes—the base-load plants which must keep running to let through water for irrigation and those which can store water, either day by day or for long periods, over the whole season. The plants giving daily storage can advantageously be worked for carrying daily peaks or held in reserve up to the time when further storage would waste water.

It is a fundamental of hydro-electric operation that water never should run off save through the wheels if this can be avoided. Where several plants on the same stream are concerned the storage can be utilized successively so as to make the best use of the water. Then if the load rises beyond the generating capacity of the hydro-electric plants the most economical steam plant is put into service, followed by the next best and so on; meanwhile, if it is flood season, the great reservoir for carrying through the dry season is filling, never drawn upon unless unavoidable. Usually it is cheaper to use steam to permit storage during times of good flow than to be caught with heavy demand for it later in the season.

It takes no small skill in finesse to work a complicated system like this in an orderly and efficient manner, but close study of the data enables it to be done as Mr. Andree indicates. A study of his system in connection with the maps will give a very clear idea of the general methods which must govern a particularly detailed knowledge of load and flow.

Corona Discharge as a Relief to Line Surges

THE question of the value of lightning arresters on high-voltage lines has been often discussed and received new comment in the report of the electrical apparatus committee of the National Electric Light Association last week. Replies which have been received from a questionnaire indicate a wide opinion that bus arresters ordinarily furnish sufficient protection to the equipment connected close to the bus, and that arresters are not required for individual lines connecting with the bus. It is claimed that the corona effect of a 120-kv. line is an effective lightning arrester. Some engineers seem to think that even the bus arrester is unnecessary, it being felt that the maintenance of arresters of this high voltage amounts to more than the damage experienced by good equipment, particularly if a little more money is put into the insulation. Arresters have been omitted entirely from some systems in the West ranging from 60 kv. to 110 kv. It is to be regretted that data on this subject are not more numerous. Experimental observation on some of the existing lines would be of very great value.

The use of the corona as a protective feature requires mechanical design for corona discharge at a voltage only slightly in excess of normal operating voltage. Few existing lines meet this condition. Most of them are designed for corona voltage far in excess of operating voltage in order to avoid energy losses. It should be noted, however, that it is possible to equip an existing line with discharge points which may be so designed as to give a corona discharge curve practically equivalent to that corresponding to the true corona discharge. Some interesting experiences on a line so equipped have been reported from Germany, and they show a decided protective value for the device. The corona is undoubtedly an ideal form of lightning protection, in that each foot of line is its own arrester. There is, however, still the important quantitative question—that is, whether the volume of corona discharge is sufficient to relieve the maximum disturbances that arise.

Co-operation in Joint-Pole Occupancy

UPON a clear understanding of mutual privileges and responsibilities depends in large measure the successful operation of a joint-pole agreement. Given this understanding, it only remains for the proper representatives of the utility companies concerned to carry it out with the spirit of mutual helpfulness and a reasonable regard for their principals' interests in order to secure a lasting and satisfactory relationship. In the May 13 issue Fred H. Smith reviewed the more important phases of a working agreement for joint-pole use and ownership, drawing from the experience of the Worcester (Mass.) Electric Light Company certain points of general application.

Readers of Mr. Smith's article will be impressed with the importance of making a broad survey of the problem of joint occupancy before entering into an agreement as to procedure and the allocation of expense. It is obvious that such a problem can be handled in more than one way. Occupancy may involve mere rental or attachment rights, or it may be defined to include actual joint or multiple ownership of overhead structures. The joint-ownership scheme as used at Worcester appears to give admirable results, notwithstanding the fact that the number of attachments varies widely over different sections of the city. In this case there appears to be a mutual recognition by the central-station and telephone companies that joint ownership over a territory "averages up" well for the parties concerned, and so we find the understanding between the utilities singularly free from complications, either legal or practical.

Advance recognition of the part each company may play in obtaining pole locations, the terms upon which unoccupied cross-arms may be used, the standards of spacing and allocation of arms desirable, and the responsibility for maintenance of poles and guys, must all be gone over in laying out a fair and workable scheme of inter-utility pole service. Conditions vary so widely in different localities, as do the forms of utility organization, that the best practice in settling among companies the value of pole occupancy and the costs of maintenance is likely to vary as well. These offer little trouble if the problem is approached in the spirit of friendly co-operation.

Importance of Caution in Calculating Temperature Rise on Intermittent Duty

DETERMINATION of the rise of temperature of standard machines under constant conditions as to load and surroundings offers no difficulty. However, with variations of ambient temperatures and load it is not always possible to state or determine the temperature reached. Many types of industrial motors work on intermittent duty, and if the cycle is regular and uniform, estimates of final temperatures satisfactory for use in the selection of motors may often be made. The root mean square of the current cycle is frequently used for this purpose, but may lead to serious error if the peak load of the cycle is of relatively long duration.

An approximate method for determining the temperature rise of a machine or any part of it, on any given short-time load, say of twenty minutes' duration, is given in another section of this issue by G. E. Luke. It depends on the assumption that the heat losses in any part of the machine are uniformly distributed by conduction through that part, and on certain constants connecting the losses with the final temperature rises on continuous duty. Naturally these constants vary with different machines and speeds, and the article gives the values of these constants for several different types of machine at various speeds. The agreement of the results of tests on several machines with the values computed from the relatively simple formula proposed indicate that the method may prove very useful in the field mentioned.

It should be remembered that the method does not take account of the "hot spot" and should be used with caution in estimating the results of heavy short-time overloads. A more extensive paper by the same author on the heating of railway motors, in which the derivation of the formula used in the present paper is given, was presented recently before the American Institute of Electrical Engineers.

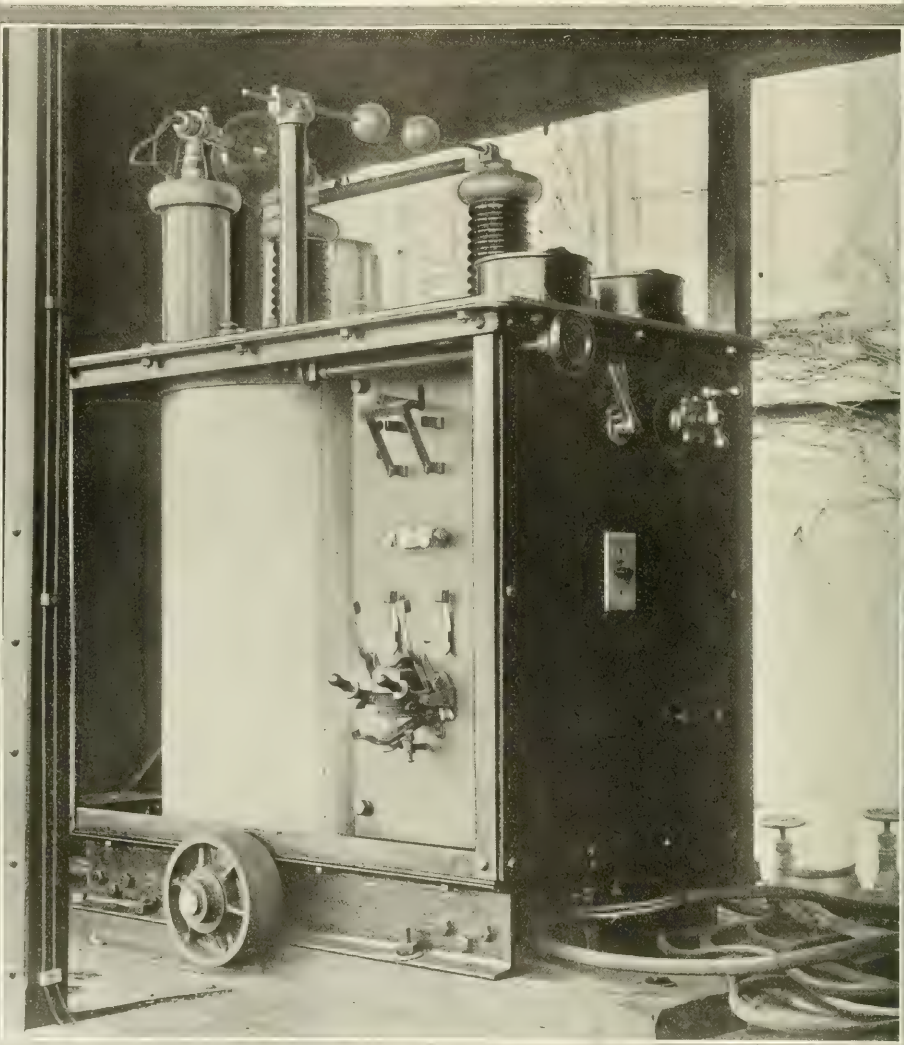
A Source of Help that Should Not Be Ignored

SMALL-SIZED central-station companies have often complained that they can find nothing in the practices of large companies which they can apply to their conditions. Applied in exactly the same way that the larger companies employ them, the practices of the latter may be worthless to small companies, but certain fundamental principles are always involved which are applicable to all. It remains for the smaller companies to find them.

Furthermore, small companies must realize that large companies are sometimes the only ones financially able and adequately equipped to make investigations of a pioneering nature. Hence they are many times the only source of information on new ideas and methods.

Remembering that the problems of all central stations are essentially the same except in magnitude, every small company will do well to study the methods and practices of larger ones with the idea of adapting them to its own conditions. The company that does so will be surprised at the fund of information available.

Kenotron Should Prove Attractive for Testing High-Voltage Cable if Shortcomings Are Eliminated



A DIRECT-CURRENT method of testing long high-voltage lines is desirable as the kilovolt-ampere capacity required for testing with alternating current at double voltage amounts to very large figures. Recognizing this condition, several large central-station companies have been experimenting with the kenotron for this purpose. Although the experience to date has not been entirely satisfactory, it is believed that the difficulties and shortcomings of the present devices will soon be eliminated. To hasten this accomplishment, however, it will be necessary for every user to compile a list of service requirements and make a careful record of shortcomings of the kenotron from this viewpoint. With this information made available to the manufacturers, they should be able to meet the requirements of operating companies.

Investigations are now in progress to determine the proper ratio between direct-current volts and alternating-current volts in order to subject the cables to the same dielectric stress. The underground systems committee of the N. E. L. A. is expected to continue the investigation of this and other phases of the subject. It will help greatly if companies which are equipped to conduct investigations will contribute their experience.

Factors that Determine Sign Legibility

Distance at Which Electrical Announcements Can Be Read May Be Diminished by Brightness of Lamps—Atmospheric Absorption Compensates for Brightness—Mathematical Relation of Factors as Determined by Research

By C. A. ATHERTON
Engineering Department, National Lamp Works of General Electric Company

TO INCREASE the attracting power of electric signs, especially in the better-lighted districts, lamps of higher wattage have become popular. This has usually resulted in increasing the distance over which the sign is effective. Sometimes, however, such a sign has not been legible as far as another similar in all respects but with lamps of lower wattage. This condition has confused the question of the maximum distance at which legibility will be assumed. Does an increase in the brightness of lamps make a sign legible for a greater or for a less distance? The answer may be either way according to the relative effects of the following principal factors: (1) Dimensions of the letters; (2) tip candlepower of the lamps; (3) color of light; (4) brightness of background and surroundings; (5) size of the sign; (6) atmospheric transparency; (7) grouping and choice of letters; (8) familiarity with the words, phrases or publicity pattern; (9) location of the sign.

Letter Dimensions.—There is a theoretical maximum legibility distance beyond which a sign cannot be read. This is attained only when the determining factors are in ideal relation with one another. If details lie closer together than one minute of arc,* their images strike the same unit of the retina, which is stimulated as though only one image fell upon it. The maximum legibility distance theoretically possible is directly proportional to the letter dimensions. All other factors, notably tip candle power, tend to decrease this distance.

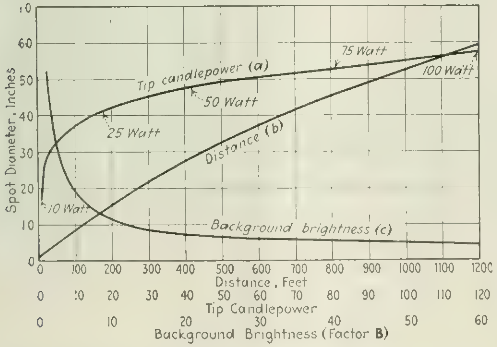


FIG. 1—APPARENT SIZE OF LIGHT SPOT FROM A SINGLE LAMP

(a) Distance = 1,000 ft., field dark ($B = 1$), tip candlepower varying. (b) Tip candlepower = 81 (factor $A = 12$), field dark ($B = 1$), distance varying. (c) Tip candlepower = 81, (factor $A = 12$), distance = 1,000 ft.; background brightness varying.

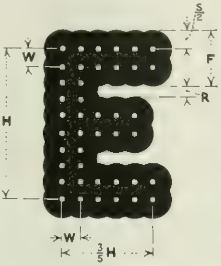


FIG. 2—BASIS FOR ESTABLISHING LEGIBILITY OF ALL OTHER LETTERS

Tip Candlepower.—An exposed incandescent filament seen against a dark field will, owing to irradiation, appear much larger than it is. As the observer moves away the spot of light does not diminish in size as fast as less bright objects do. Its apparent size as compared with less bright objects actually increases. It may first appear one-third as large as the glass bulb; soon it is two-thirds; then it fills the bulb, and as the observer moves away the glass disappears and the spot apparently continues to swell. The relations between spot size, distance, tip candlepower and background brightness under various conditions of weather and atmosphere and for many different pairs of eyes have been determined in a series of investigations for a large range of lamp sizes. The relation between apparent spot size and distance is shown below:

$$S = \frac{D}{A + 0.0083D} + 0.0035D, \qquad (1)$$

where S is the diameter in inches of the apparent spot of light measured in the plane of the light source, D is the distance to the observer in feet, and A is an inverse function (see the table) of the tip candlepower of the light source.

In Fig. 1 the variation of spot size with distance for a popular sign lamp (seen against a dark field), as calculated from equation (1), is shown in curve b. Another curve (a) in the same figure shows the spot size, at a fixed distance, of the various lamps commonly used for electric sign purposes.

Color of Light.—The color of the light used affects the legibility distance of electric signs, but since color is used to obtain greater attracting power and better artistic and spectacular effects, and since, as it is usually applied, the question of maximum legibility distance becomes of secondary importance the subject will not be discussed here.

Background Brightness and Size of Sign.—The distance and tip-candlepower curves of Fig. 1 show spot sizes of single light sources when seen against a dark field. Where other lights are near by, as is the case in an electric sign, the spot size is greatly reduced. The relationship between spot size for one lamp and surrounding or backgrounded brightness is shown in Fig. 1.

Equation (1), which is true for one lamp with no other lights about, has to be modified before it can be applied to practical sign design to take into consideration the brightness of the surrounding field. The effect in the equation is that of increasing the value of the constant A as shown in equation (2):

---

*The minimum angle of visual acuity for normal eyes lies somewhere between 45 seconds and 55 seconds of arc. One minute is used as a convenient standard which allows low legibility at the assumed dividing line. In this respect and in others eyes vary greatly; therefore for individuals the maximum legibility distance as calculated for the average eye may be increased or decreased considerably.

$$S = \frac{D}{AB + 0.0083D} + 0.0035D \qquad (2)$$

B depends on the light that enters the eye and the angular distance of each part of this light from the lamp. For the conditions under which each of the more popular lamps is ordinarily used the values of AB given in the table may be taken as representative.

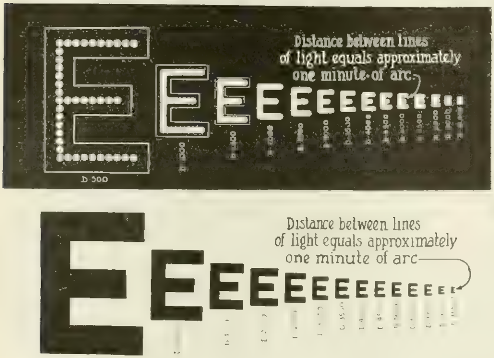

Distance between lines of light equals approximately one minute of arc
D 500
Distance between lines of light equals approximately one minute of arc

FIG. 3—EFFECT OF IRRADIATION IN REDUCING LEGIBILITY OF HIGH-WATTAGE ELECTRIC SIGNS ON CLEAR NIGHTS

The upper series of letters shows the appearance of an illuminated electric sign letter of various distances (H = 10 ft., fifteen 75-watt clear lamps in vertical stroke). The lower series shows the same letters as seen by daylight when the effect of irradiation is negligible. At 5,000 ft. for the lighted letter and at 11,500 ft. for the daylight letter, the space between the strokes is about one minute of arc and the letter is at the limit of legibility. The true effect from the illustration can be best obtained by holding the page at such a distance that the smallest E in the lower row is just legible.

With equation (2) it is possible to reconstruct the exact appearance of any clear lamp sign at any distance, under conditions of clear atmosphere and normal eyes. Fig. 3 shows a 10-ft. (3-m.) Gothic letter E with fifteen 75-watt lamps in the vertical stroke as seen at various distances. Linear dimensions are converted into angles to make the appearance more natural. For comparative purposes the appearance of the same letter seen by daylight, assuming no effect of irradiation, is shown. Between 2,000 ft. (610 m.) and 2,500 ft. (760 m.) the spot size is approximately equal to the trough width, and at 5,000 ft. (1,520 m.) the separation of the strokes is less than one minute of arc and the two strokes are indistinguishable to normal eyes. Not until the observer gets to 11,500 ft. (3,500 m.) does the letter cease to be legible by daylight.

Any letter will cease to be legible at a distance greater than that at which the spaces between the lines of light subtend at the observer's eye an angle of one minute of arc as shown in Fig. 2. For convenience of calculation, a Gothic letter E, whose width is three-fifths its height, is taken as a base and the legibility of other letters relative to an E is determined. Gothic letters are the most commonly used in electric signs. For the letter E the letter height, H, measured on the center lines of the outside rows of lamps, is given by $H = 3F + 2R - S$, where F is the width of the line of light, R is the width of the space between two lines of light[†] and S is the diameter of the apparent spot of light. In the case of a single line of lamps F is equal to the diameter of the spots of light which are its elements, and in the case of two or more lines of lamps $F = W + S$, in which W is the width of the stroke of the letters measured from the center lines of the outside rows of lamps. Where a single line of lamps only is used W is equal to zero. Where the sign is seen at the distance of maximum legibility, by definition, R is equal to one minute of arc, or expressed in terms of distance D is: $R = 0.0035D$. Therefore at the limiting legible distance:

$$H = 3W + \frac{2D}{AB + 0.0083D} + 0.01D \qquad (3)$$

VALUES OF CONSTANTS FOR EQUATIONS (1) AND (2)

Lamp Size, Watts		Dark Districts, Small Signs, 100 Lamps		Bright Districts, Large Signs, 2,000 Lamps	
	A	B	AB	B	AB
10	34	3	102	20	680
25	18	5	90	35	630
50	14	5	70	35	490
75	12	5	60	35	420
100	10	5	50	35	350

Assuming values of B based upon average sizes of signs and average street illumination, the maximum legibility distances for a Gothic letter E with single rows of lamps calculated from equation (3)[†] for 10-watt and 75-watt lamps are as shown in Fig. 4.

Atmospheric Transparency.—Dust, smoke and fog, which reduce atmospheric transparency, first increase maximum legibility distance. By absorbing part of the light the tip candlepower is apparently lowered. In equations (2) and (3) this is equivalent to increasing the constant A. Illuminating the dust or smoke particles creates a brighter background and is equivalent to increasing the constant B and legibility distance.

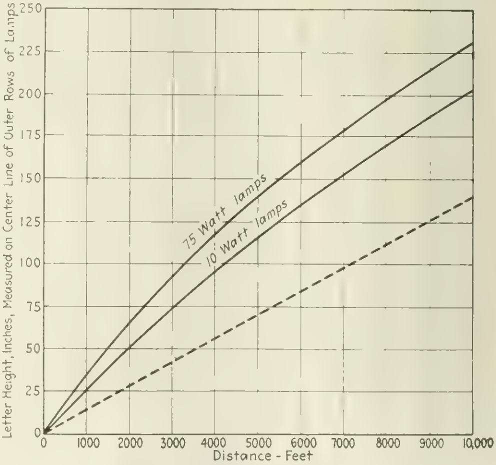


FIG. 4—MAXIMUM LEGIBILITY DISTANCE OF SIGNS OF AVERAGE NUMBER OF LETTERS

Based on average street illumination and clear air when seen by normal eyes and when the determining letter is a Gothic E or its equivalent. The dotted line shows a theoretical maximum distance ordinarily unattainable even under the best conditions encountered in service.

This increase, as the atmosphere changes from clear to hazy, never brings the actual legibility distance up to the theoretical maximum. As the haze increases and the lines of light become apparently thinner they become dimmer. At some point, dependent largely on street illumination, the sign becomes indistinguishable.

[†] AB values assumed are 110 for the 10-watt lamp letter signs and 70 for the 75-watt lamps.

Atmospheric absorption reduces the maximum distance at which the sign, as a spot of light, can be seen. The greater the density, the shorter the distance. The variation of maximum legibility and maximum visability distances with atmospheric transparency is shown in Fig. 6. It is interesting to note that for all conditions of increasingly heavy atmosphere beyond that density which has entirely eliminated the effect of irradiation the maximum legibility distance coincides with the greatest distance at which a sign can be seen. For such conditions of dense atmospheres lamps of high tip candlepower are much more effective than lamps of low tip candlepower. In clear atmosphere greater legibility distances can be obtained with lamps of low tip candlepower.

The extent to which the maximum legibility distance may be reduced by atmospheric absorption is best illustrated by an example. On Michigan Avenue in Chicago a large sign advertises Fisk tires. A long open stretch lies before it. The letters are of the solid massed-lamp type. In the word "Fisk" the over-all height of the letters is 275 in. (7 m.) and the width of the strokes—W in equation (3)—is 40 in. (1 m.). There are 1,250 10-watt lamps in the large letters, and street illumination is comparatively high. A fair value of AB is 300. The maximum legibility distance on a clear night is obtained from equation (3):

$$275 = 120 + \frac{2D}{-300 + 0.0083D} + 0.01D.$$

The determining letter is F, which can be read 1.04 times as far as the letter E, upon which the equation is based; therefore,

$$D = 1.04 \times 10{,}100 = 10{,}500 \text{ ft.}$$

By actual trial on a night when there was no fog and the weather was fair, but with low atmospheric transparency, the sign seemed to fade into a semi-luminous haze at 5,800 ft. (1,760 m.). Absorption had decreased maximum legibility distance to about 55 per cent of what it would have been on the clearest possible night. In this sign and under these conditions both maximum legibility distance and distance of effectiveness would be increased by using lamps of higher wattage. On nights, when atmospheric absorption would just eliminate irradiation, the sign might have been legible up to 20,000 ft. (6,000 m.) and recognized far beyond.

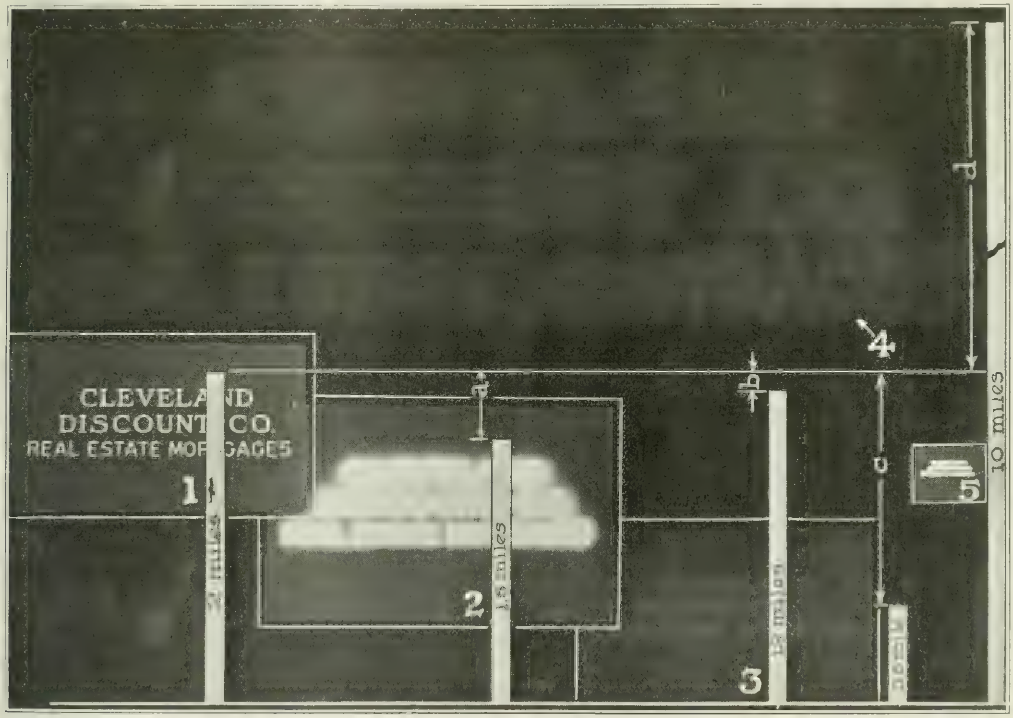


FIG. 5—APPEARANCE OF A LARGE SIGN AT VARIOUS DISTANCES

Under different conditions of atmosphere some of the positions may be beyond the maximum distance of legibility. This illustration should be viewed at such a distance that No. 1 is just legible. 1. Theoretical maximum (no effect of irradiation or atmospheric absorption). 2. Clear air (irradiation effect at a maximum). 3. Light haze (irradiation just balanced by haze). 4. Heavy haze (sign not visible beyond limit of legibility). 5. Clear air (sign recognized by its shape and location).

Letters Used.—The maximum legibility distance depends also upon the choice of letters. Some letters are more easily read than others. A sign in Chicago reading "Apollo" is legible at astonishing distances. It is found that after P has become indistinguishable from F, or O from C, the A and the two L's are clear enough to make it easy to guess the rest. If the lettering had contained all B's and E's and G's, etc., the maximum

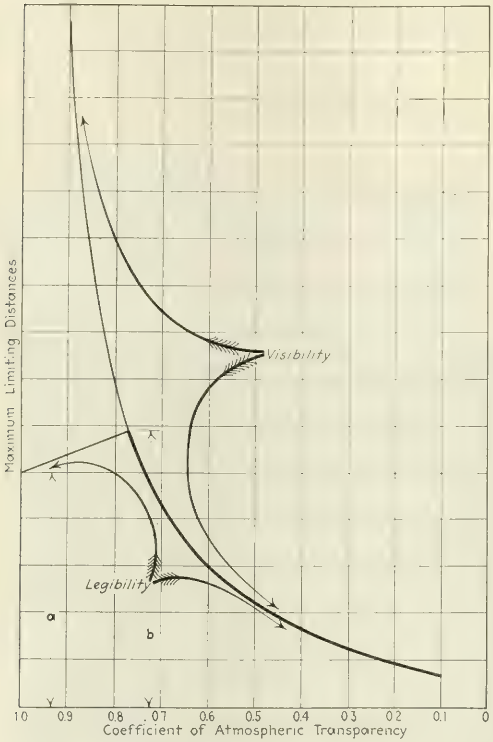


FIG. 6—EFFECT OF ATMOSPHERIC TRANSPARENCY ON VISIBILITY AND LEGIBILITY DISTANCE

a = maximum legibility distance for clear air. $b \div A$ = theoretical maximum legibility distance which might be attained when a certain atmospheric absorption so reduced the apparent brightness of the sign as exactly to neutralize all effect of irradiation, but which is usually unattainable because of street illumination.

legibility distance might have been decreased 30 per cent or more. The relative legibility of an alphabet of Gothic letters of the same height is as follows:[‡] The letter B is most difficult, because it may look like an E or a D or an R or many others. I, A, J, L, etc., are the easiest to read because the shape of each is not like any other one. At great distances an A looks like an isosceles triangle, a J like a right triangle with the hypotenuse to the left, etc. The larger the percentage of these more legible letters in a sign, the greater its maximum legibility distance.

B	0.85	F	1.04	X	1.08
H	0.92	P	1.04	W	1.13
G	0.92	Y	1.04	M	1.13
S	0.95	O	1.06	T	1.15
R	0.97	Q	1.06	L	1.19
E	1.00	K	1.06	J	1.21
N	1.00	C	1.07	A	1.30
Z	1.01	U	1.07	I	1.41
D	1.03	V	1.08		

Distinctive Pattern.—Another phase is the increased maximum legibility distance due to distinctive patterns. The script of a Cadillac motor car sign is recognizable at distances many times greater than the relatively short ones where the few necessary separate letters become clear enough for the whole sign to be read. Although in the strict sense of the word a sign is not legible beyond that distance at which it can be read by one who never has seen its characteristic pattern, many signs far beyond this distance are distinguished in the general mass of lights by their characteristic pattern.

Location.—Often a sign standing alone on a factory roof and commanding an unobstructed view can be recognized at very great distances because of its location. This is limited by atmospheric transparency and by the total beam candlepower of that portion of the sign that is included in the base of a cone the apex of which is at the observer's eye and the angle of which is one minute. The reflected light from the letter face with good white surfaces may increase the total candlepower of the sign 50 per cent or more. At very great distances in ordinary signs the determining candlepower is the sign candlepower in that direction.

An interesting example came to the writer recently when driving at night with a friend about 9 miles (14.5 km.) from Cleveland, where an unusually large roof sign has been erected. On each side of this sign are 1,500 50-watt "Daylight Mazda" lamps. The sign extends from 250 ft. to 330 ft. (76 m. to 100.5 m.) above the street and appeared clear, sharp and white as though it protruded just above the horizon. My friend looked at it and then up at the zenith. "That's a queer place for the moon," he said. The atmospheric transparency was high. The maximum possible legibility distance in a strict sense was about 2 miles (3.2 km.) or less than one-fourth as far from the sign as we were. The sign, aided by its location, has high enough candlepower to catch the eye on clear nights at perhaps 20 miles (32 km.).[¶]

Because the carrying power of a light source depends upon the square root of its candlepower, legibility in this sense is proportional to the square root of the candlepower of the sign, or perhaps five times as great for 75-watt lamps as it is for 10-watt lamps.

The effect of various factors influencing legibility is summarized below:

1. The theoretical maximum legibility distance is limited by the letter dimensions (and the particular letters employed) only.
2. This theoretical maximum is diminished, because to attract a sign must be bright and bright lines look wider than they really are. The amount (*a*) by which it is diminished depends upon the relative brightness of the sign and of the district.
3. The brightness of the sign may be compensated by a certain degree of atmospheric absorption. Even if this degree is just right, however, the theoretical maximum legibility distance cannot be attained. The amount (*b*) by which it will be less than the theoretical maximum depends upon the street and surrounding illumination.
4. When the atmospheric transparency becomes still lower the legibility distance is reduced. The amount of this reduction (*c*) depends upon the atmospheric absorption and the candlepower of the sign. Legibility distance is less for lower atmospheric transparencies and greater for higher candlepower signs.
5. When the atmospheric transparency is fairly high a sign may be seen further than it can be read. The amount (*d*) may be several hundred per cent. If the sign has a distinctive outside shape or is located in a distinctive place, it will be recognized at great distances. This is equivalent to being read by all those who are familiar with the publicity pattern or with the sign itself.

[‡] Many of these values are derived from tests of visual acuities conducted by a committee of the American Medical Association and which were incorporated in a paper by Charles Sheard, Ph. D., published in the *American Journal of Physiological Optics*, April, 1921, Vol. 2, No. 2, pages 168-184.

[¶] This particular sign has about 66,000 cp. and on clear nights would be visible 400 miles (640 km.) away except for the curvature of the earth. For clear atmosphere D (in miles) = 1.7 cp.

Same Wet and Dry Sparkover Obtained with Compensated Impulse Gap

Unaffected by Weather Conditions — Most Sensitive to Impulse Potentials—Characteristics from Test Data—Porous Porcelain Aids Metal Surfaces to Relieve Line Disturbances

By C. E. BENNETT
Chief Engineer Electro Service Company, Atlanta, Ga.

THE ideal lightning arrester would be one without an air gap which would sift out all transient potentials or superpotentials from the line and at the same time interrupt the dynamic current which follows a discharge. Impulses or oscillatory discharges superimposed upon the exposed transmission line naturally subject all of the line insulators, transformers and auxiliary equipment to this impulse or wave impact. The insulating materials have some appreciable power to withstand stresses without rupture for an interval of time until the superpotential is dissipated by grounding through the arrester.

However, all high-voltage alternating-current lightning arresters must necessarily have a spark gap between the line and the interrupting device and ground. If the spark gap can be set at slightly above line potential under all conditions of operation, it is apparent the device would have considerably greater protecting qualities since it would start earlier to drain the line of impulses.

The earlier installations of lightning arresters used horn gaps ahead of the arrester equipment. By some very exhaustive experimental research there was discovered the now well-known impulse ratio, which denotes the ratio of the impulse breakdown voltage of the gap to a continuously applied breakdown voltage. As a result of these data, the shape of the electrode best suited to all conditions was found to be a sphere.

PRESENCE OF MOISTURE SERIOUSLY AFFECTS ORDINARY GAPS

By referring to curves Fig. 3 it will be noted that the breakdown of a sphere gap is very much influenced by the presence of rain or other moisture. When, therefore, it is desired to use an unprotected sphere gap it can be readily seen that if it is set for dry-weather spacing, rain or moisture will cause the gap to spark over at considerably less applied potential. This precludes the use of a sphere gap for outside installations unless protected, as a wet spacing has to be given to it which requires nearly double line voltage to break down when dry. Referring to Fig. 1, we have the two settings, wet and dry, for horns, which show that the two curves more nearly coincide and the ratio of one to the other is approximately 65 per cent. The curves in both Fig. 1 and Fig. 3 show the breakdown or spark-over voltage at 60 cycles and impulse frequencies indicated in kilo-cycles.

In both Figs. 1 and 3 there is a wide difference between spark-over values at 60 cycles for wet and dry conditions, but the divergence is greatest for sphere gaps. Although this is the case, the sphere gap shows the least divergence between wet and dry conditions at impulse frequencies, the curves being almost identical with that for 60 cycles dry. On the other hand, the impulse characteristics of the horn gap differ not only between themselves but also as compared with the 60-cycle characteristics.

With the sphere or horn type of gap the curves definitely show that one setting for either wet or dry conditions, for 60 cycles, may be entirely wrong for impulse potentials, so that if the setting is spaced for 60 cycles, impulse voltages applied may be several times that of the 60-cycle value before the gap will break down. The insulation of the transformers, insulators, etc., may, therefore, be subjected to excessive stresses because the gap does not function properly or quickly.

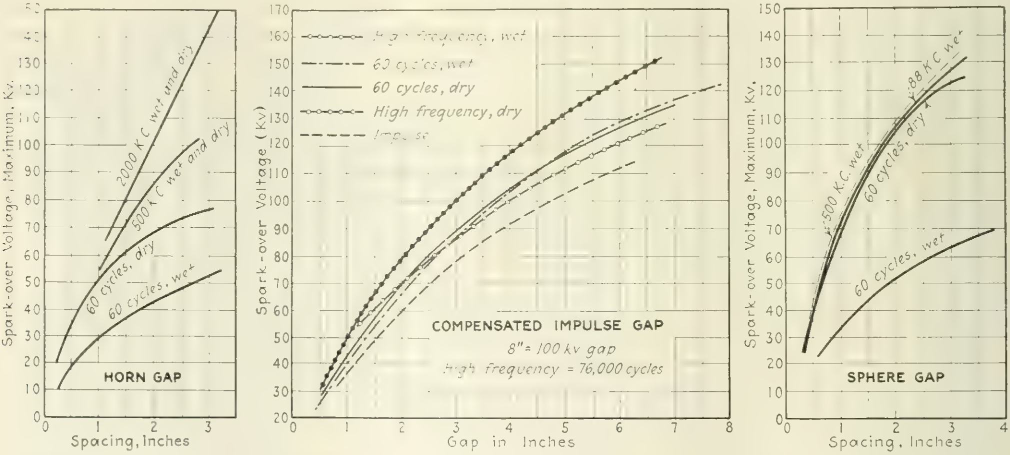
NEW TYPE OF GAP UNAFFECTED BY MOISTURE ACCORDING TO TESTS

The ideal gap is one in which the range of voltage value of the settings under both wet and dry conditions and impulse voltages as against 60-cycle potentials will be nearly equal, and it should also be capable of easy calibration.

The new type of compensated impulse gap shown in the photograph has nearly the same arc-over voltage when wet as when dry, and it has a lower arc-over voltage for impulse potentials than for normal frequencies. These are the advantages that make it unusual and most valuable in service. It may receive a setting for dry conditions under normal voltage at 60 cycles without danger of discharging at lower potentials in wet weather. High-frequency disturbances will dissipate themselves through the gap and arrester even before reaching line-voltage value.

Each unit of the compensated impulse gap consists of a brass-pointed terminal about 1¼ in. (32 mm.) in diameter, mounted in the center of a convex disk of especially designed highly refractory porous porcelain which remains unaffected by the arc heat even if repeatedly applied. On the outer rim of this porcelain disk there is a metallic ring with a projection on the top to form an arcing horn. Back of the porous porcelain disk is an adjustable shield, which can be moved closer to the porcelain or away from it to increase the sensitiveness of the device to impulse potentials. The entire gap is supported from a 11/16 in. (17.4-mm.) shaft, and the arcing ring on the outside of the porcelain disk is supported by the spokes of the spider indicated in the drawing.

By use of the specially prepared and fired porous porcelain a non-metallic surface is presented to the raindrops or moisture, which are instantly spread or absorbed entirely, preventing the retention of drops of water in the gap path. They then do not offer a point for flux concentration or shorten the gap distance, as is the case where all metallic terminals are used. The importance of this characteristic can be appreciated, especially with gaps of short spacing, where the presence of a drop of water may so decrease the gap spacing as to cause the gap to break down at a very much less potential than that for which it is set, with the consequent unnecessary disturbance of service supplied by the circuit. Collection of moisture in the form of drops, which are so often formed on metallic surfaces during foggy or damp weather, even when it is not raining, is impossible on porous porcelain, and the compensated impulse gap will, therefore, not operate at normal line potential due to this cause.



FIGS. 1, 2 AND 3—RELATIVE SPARK-OVER VALUES OF HORN, SPHERE AND COMPENSATED IMPULSE GAP UNDER WET AND DRY CONDITIONS WITH COMMERCIAL AND IMPULSE FREQUENCIES IMPRESSED

By the use of refractory porous porcelain that is not affected by the high temperature of the arc the pitting and roughening of the surface that is always found in sphere or horn gaps after continued service is also avoided and the gap setting does not change its characteristics owing to any roughening effect. With metallic spheres it is not unusual, in short gaps, to find globules of melted metal that will represent 10 per cent of the gap setting and reduce the normal breakdown potential by that amount. In the case of large spheres with wide setting the whole nature of the gap is changed by this roughening or pitting, and instead of presenting a smooth polished surface to the charge, it soon becomes a series of points whose characteristic breakdown potential is entirely different from that of the original gap. This also has a tendency to fix the discharge at one point on the sphere, resulting eventually in actually burning holes through the metal or destroying it entirely. This does not occur in the compensated impulse gap, as is apparent on reference to the photograph of the gap. The fact that has the greatest bearing on the service performed by a line on which the compensated impulse gaps are installed, and which involves all the characteristics of the gap, is the ability to set the gap close to normal line voltage instead of being forced to give it a setting of double the normal voltage value in order to prevent it from operating when there is no necessity. The compensated impulse gap may be set so that it will break down at the required potential under all conditions and only discharge at the time when a discharge is necessary to protect the circuit from unusual conditions or disturbances.

DISCHARGE SURFACE INCREASES WHEN MOISTURE IS PRESENT

The functioning of this device under wet and dry conditions and impulse voltages is as follows:

It is well known that at ordinary commercial frequencies spheres of large diameter have a higher arc-over voltage for a given spacing than spheres with small diameter. In this new type of gap, when the porcelain is dry, the discharge area is equal to that of the brass point in the center, but when it is wet the porcelain acts more nearly as a conductor instead of an insulator and thus increases the available discharge area. In other words, this gap compensates for weather conditions by automatically replacing the small spheres or points with a large spherical terminal with no change in spacing due to the absorption of moisture by the porcelain disk, the porous porcelain, although a good insulator when dry, becoming a conductor when wet. These porcelain disks dry out almost immediately after a rain owing to the hysteresis effect caused by the electrostatic field always present at the gap when in service. Though the moisture in the air manifestly decreases the arc-over voltage value in the usual horn or sphere gap, it increases the arc-over value of these gaps somewhat as the larger disk of wet porcelain is equivalent to and takes on the characteristics of a large sphere. Thus gaps, as shown in the curves, have a higher breakdown value when wet than when dry, a most desirable function.

In the design of the compensated impulse gap it was desired to obtain a gap that would have an impulse breakdown voltage less than that of ordinary sphere gaps under dry-weather conditions. It is on the approach of a storm when the gaps are dry that the greatest stresses are often produced on equipment; the insulators being dry, they do not absorb or tend to dissipate transient potentials as when all the insulators are wet. The potential gradient over insulators, bushings, etc., is considerably less when wet, and they can stand greater shock; as each unit is less likely to be subjected to overstressing. It is necessary, therefore, that a perfect gap should function upon the slightest voltage ripple due to switching surges, induced lightning potentials, static or impulses of any sort during dry-weather conditions.

As indicated in the curves, the dry-weather impulse potential curve of the compensated impulse gap is considerably lower than the 60-cycle continuously applied breakdown voltage, but can be adjusted in relative value. There are two adjustments on the gap which control the sensitiveness. One is accomplished by moving the adjustable metallic plates. When these plates are moved closer to the porcelain disk the sphere-gap characteristics under impulse potentials are obtained and the gap is less sensitive to impulse or high-frequency disturbances.

THEORY OF OPERATION OF COMPENSATED GAP

When the plates are close to the porcelain the total flux between the gap has been largely increased because of the greater capacity brought about by bringing the two comparatively large metallic plates closer toward the center of the gap, but the unit stress between the faces of the gap due to increased flux density has been decreased because of the approach to a sphere gap, and a greater impulse potential is required for spark-over. In other words, the dielectric between the electrodes, which includes the porcelain and air, is more uniformly stressed and therefore requires more potential to overstress or break down the gap.

By revolving the metallic plates away from the rear of the porcelain disks we obtain a highly sensitive setting to impulse potentials, since when the metallic shields are moved back from the porcelain disk the electrostatic capacity over the gap and the flux about the center points have been increased. Therefore the air around the points becomes more quickly overstressed, and as a result a more instantaneous breakdown occurs and at a lower potential than with the other setting, which is very similar to that of a sphere.

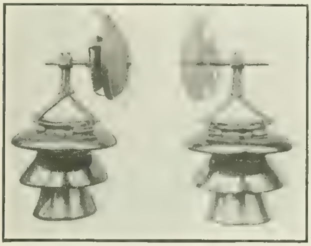
COMPARATIVE PERFORMANCE OF THREE TYPES OF GAPS

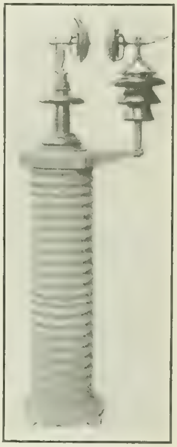
Voltage of System	Type of Gap	120 Per Cent Voltage or Setting for Wet Weather, 60-Cycles	Dry-Weather 60-Cycle Breakdown	Dry-Weather Impulse Breakdown	Wet-Weather Impulse Breakdown
33 Kv.	Sphere	40	81	89	89
	Horn	40	65	90	91
	Compensated	40	41	35	50
44 Kv	Sphere	53	107	113	113
	Horn	53	76	148	148
	Compensated	53	55	48	66
66 Kv	Sphere	73	141	153	153
	Horn	73	93		
	Compensated	73	77	67	85
88 Kv	Sphere	106			
	Horn	106	118		
	Compensated	106	106	93	120
110 Kv	Sphere	132			
	Horn	132			
	Compensated	132	131	115	150

The moving of the adjusting plates forward and backward from the porous porcelain disk, when wet, does not influence the high-frequency or 60-cycle gap setting, the breakdown then following very nearly the characteristics of a large sphere.

The successful gap and lightning arrester must have very little time lag in order to protect apparatus from harm when subjected to impulse potentials.

An impulse voltage reflected upon electrical apparatus must involve the use of time and energy in order to rupture insulation. The destructive discharge through a dielectric requires not merely a sufficiently high voltage but a definite amount of energy. The destructive discharge does not occur instantly with its application, but a finite, though usually small, time elapses after the application of the voltage before the discharge occurs. During this time interval energy must be supplied to the dielectric. As a result, therefore, the perfect gap and arrester combination should function at the beginning of this period in order to absorb and dissipate disruptive energy and at the same time prevent its entering the apparatus which is to be protected.





Each unit of the gap consists of a brass-pointed terminal, mounted in the center of a convex disk of highly refractory porous porcelain. On the outer rim of this disk is a metallic ring. Back of the disk is an adjustable shield for regulating the sensitiveness to impulse potentials. When moisture is deposited on the porous porcelain it has the effect of increasing the discharge area of the gap and hence offsets the reduction in spark-over value ordinarily experienced with other types of gaps in wet weather. The porcelain dries out almost immediately after a rain.

FIGS. 4 AND 5 —COMPENSATED IMPULSE GAP AND SURGE ARRESTER EQUIPPED WITH NEW GAP

If the arrester combination has a perceptible time lag, the impulse energy will be applied to the dielectric for a part of a time at a given rate and overstressing of the dielectric of the apparatus is sure to occur. Continual subjection to overstressing will cause injury and ultimate breakdown of such apparatus.

The compensated impulse gap fulfills all requirements of the ideal gap. It does not change its normal frequency breakdown value when wet or dry and can therefore have the close dry setting slightly above normal line potential with the assurance that it will not discharge at less than line potential when wet. It does not need protection by covering and is set up in free air with nothing to restrict its ventilation.

It will discharge impulse or high-frequency disturbances at their inception, giving them the least chance to rise to destructive values. Its impulse value and its normal frequency value are capable of calibration independently of each other. It presents a fixed breakdown value to all discharges even under the heaviest rainfall and needs no weather protection for this function.

The Story of the Cincinnati House-Wiring Campaign

How the Central-Station Company, Through Intensive Sales Effort, Is Wiring Old Houses at the Rate of 1,364 a Month

By S. D. Heed
General Manager Union Gas & Electric Company, Cincinnati, Ohio

IF A MAN can take cucumbers and cabbages and turn them into a million dollars, his methods merit attention; and though some people may think an ocean pier at Atlantic City has nothing to do with selling pickles, if you doubt it, you have but to ask the H. J. Heinz Company. As any succcessful department store will testify, there are benefits to be derived from a special sale even if the only thing special about it is the publicity. Such slogans as "His master's voice," "The 57 varieties" and "The flavor lasts" were all designed for definite purposes and it all spells "merchandising." It matters little whether you handle talking machines, pickles, chewing gum or house wiring.

House Wiring Must Be Merchandised

Selling house wiring is fundamentally the same as selling any other commodity on the open market. To produce results it must be merchandised. There must be a plan of campaign, supported by publicity and, most important of all, followed up with real salesmanship. It is fatal to make the mistake of employing "order takers." Any one can take an order after the prospective customer is "sold." But to our way of thinking salesmanship does not begin until after the "prospect" has first said "no." And selling wiring is a salesman's job. He will need all the help that can be given.

In the city of Cincinnati 15,000 homes were wired and connected to the lines of the Union Gas & Electric Company during the year 1921. The first four months of 1922 show an average of 1,364 new contracts each month, while in the month of April 1,651 homes were "sold" in Cincinnati, breaking all previous records. If Cincinnati has accomplished anything unusual by wiring about 25,000 homes during the last two years, this has resulted from hard work and not from a lucky turn of the wheel of fortune. Methods have been adapted to conditions, but behind all has been the driving force of persistent salesmanship. That intangible something has been provided which gets the name on the dotted line.

It must be understood that Cincinnati is an old and very conservative city. An overwhelming proportion of its residences were originally built without electric wiring. Since 1908 the people have been using cheap natural gas with exceptionally good service. These factors have greatly retarded electrical progress, so that in promoting electrical development the central-station company felt obliged to do the pioneering work of getting these old houses wired. All supplementary development has been left to the independent contractors and dealers. This activity on the part of the lighting company has so stimulated the electrical business generally that all branches of the industry have profited. Independent wiring contractors are actually doing more work because of it.

In general, this is the sales plan: Cincinnati has been divided into definite territories sufficiently small to intensify sales activity, for too much territory for the individual salesman is worse than too little. A salesman has been placed in each territory with every unwired house as a "prospect." After careful analysis, territories were reduced in size to increase sales activity, and in most instances salesmen have been changed about to overcome staleness. We have worked on the salesmen as well as on the prospective customers. Departmental meetings have been held featuring applied psychology, scientific salesmanship and inspirational talks. Competitive prizes have been given to stimulate individual effort, and letters of encouragement addressed to the salesmen at their homes.

At the beginning of the 1921 campaign we naturally desired first of all to sell to those residences along existing lines and requiring no extensions. An attempt was made to classify from existing data all unwired homes to that end, but this could not be done accurately without a field survey, which we did not have time to make. Moreover, in order to keep our salesmen at maximum production, we realized that they should be kept busy on live "prospects," but we could not take the time necessary to compile preferred lists. To overcome these difficulties we started with newspaper advertising carrying a corner coupon which, if returned, almost invariably produced a contract. As soon as possible we put out a second man in the weaker territories. It is his duty to call at every unwired house and, if possible, make an appointment for the regular salesman to follow him with an estimate, this system gradually being extended to all territories.

Value of House-to-House Selling

This work was conducted very aggressively from house to house, and these men worked each territory systematically block by block. Records of all unwired houses were classified as reached as to prospective business and are followed up until the sale is made. It is recognized as fundamental and irrefutable that persistent, courteous, personal solicitation will eventually break down sales resistance. Salesmen and canvassers are both paid on a commission basis, this being determined not alone by the number of contracts taken but also by the number of outlets sold.

With this organization in the field, it, of course, became necessary to help "open the door" to these men. Advertising has been used as an economical means of doing part of the work which would otherwise have to be done at much greater expense by the individual salesman. Newspapers are the backbone of this effort. Direct-by-mail letters and booklets, screen announcements in the motion-picture theaters and attractive stuffers for monthly gas bills are also used. All advertising carries the atmosphere of better lighting, more desirable living conditions and less labor in the home, and is designed to sell the idea of reliable service. The appeal is maintained by stressing seasonal features and by repeating the following offer, which gave the original impetus to home wiring in Cincinnati:

"We will wire your home, install fixtures complete, run service lines, set meter and turn on the electric light. After using this service for thirty days, if you are not satisfied, we will remove the electric installation, replace your gas fixtures, leave your house in first-class condition, and you will not owe us one cent—not even for the current used.

"If you are satisfied, you may pay us for the wiring and fixtures in eighteen easy monthly installments—the bills conveniently attached to your monthly electric light statements."

About 25,000 homes have been wired under these terms, and not one installation has yet been removed. The deferred accounts thus created have totaled nearly $2,250,000, and they have been collected regularly with very rare and entirely negligible losses. The success of the present campaign is not due to any change in merit of the thing we have to sell or to any change in wording of our proposition to the public. Our results have been obtained absolutely through organized salesmanship. We simply provided that which is necessary to get the name on the dotted line, and this is not hazardous when the customer has thirty days' free trial.

Also, in addition to the wiring possibilities, we believe there are wonderful opportunities for appliance merchandising. Right here in Cincinnati we find that if we were to consider all the possible appliances and then discount the total possibilities to a practical basis of, say, four items, such as a fan, a flatiron, a vacuum cleaner and a washing machine, this would give us at least $200 in retail sales which could be made immediately to the residences which we are electrifying. When these figures are applied to our totals they run into a stupendous total.

On a basis of new customers added during last year this would amount to $3,000,000; on our estimate of the customers to be added this year it would amount to $4,000,000, and on a basis of the consumers on our lines previous to this recent campaign who are not yet well supplied with appliances, we believe there is an additional $6,000,000. These possibilities total some $13,000,000 in appliance sales figured on a very conservative basis. All of this work is staring our dealers squarely in the face and it offers almost unbelievable opportunities to the electrical industry.

Temperature Rise of Electric Machines on Intermittent Duty

In This Article an Approximate Method of Calculation Is Illustrated Which Is Applicable to Entire Machine or to Any Part Thereof—Based on Uniform Distribution of Losses

By G. E. LUKE
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MANY electrical machines are required to operate under a variable-duty cycle. This is especially true of industrial motors. In such applications the first step is to ascertain whether the machine is strong enough mechanically and whether the electrical performance, such as commutation, is satisfactory on the maximum peak loads. Should the application be safe mechanically and electrically, then the only remaining requirement is to know what the temperature rise will be.

In many industrial-motor applications the intermittent load varies with such regularity that the motor is usually applied on the basis of the root-mean-square current taken over the average cycle. This method is satisfactory where the peak loads are of short time duration because the heat loss in the machine can be stored in the iron and copper without an excessive rise. This heat is liberated when the machine is running under light loads.

When a duty cycle exists containing heavy peak loads, for comparatively long periods, the safest method, of course, is to use a machine with a continuous rating equal to the maximum load. If this is not done, then it will be necessary to check the temperature rise on the maximum peak.

The temperature rise of a machine on any given short-time load involves many factors which make a rigid mathematical solution of the problem virtually impossible. However, a comparatively simple approximation can be made by assuming that the heat losses in the machine or any part thereof are uniformly distributed. This is not strictly correct, but is permissible, since the heat losses will distribute themselves to a certain degree by conduction through the iron and copper.

The solution involves the following factors:

W = watts loss in machine or part considered,
T_c = temperature rise in deg. C. on continuous duty,*
T_t = temperature rise in deg. C. at end of time (t),
T_s = temperature rise in deg. C. at start of cycle,
t = time in hours the load is applied,
W/T_c = K_v, or the ventilation constant,
P = weight in pounds of machine or part considered
$t_1 = 0.06\,PT_c/W = 0.06\,P/K_v$.

This constant (t_1) is the thermal time constant of the machine and is equal to the time in hours necessary to raise the temperature of the machine to a rise of (T_c) deg. C. with the loss (W) and no ventilation. That is all of the heat loss to be stored up in the machine.

Assuming that a given load is applied for time (t), the following statement is true:

Total heat energy loss = stored energy
+ energy dissipated by ventilation (1)

The foregoing statement may be put in the following form:

$$t = 2.3t_1 \log_{10} (T_c - T_s)/(T_c - T_t) \qquad (2)$$

This equation can be solved with the aid of logarithm tables or the ordinary slide rule. The solution can also be expressed as follows:

$$T_t = T_c - (T_c - T_s)e^{-t/t_1} \qquad (3)$$

The values of the factor ($e^{-t/t}$) are given in Fig. 1 for various values of t/t_1.

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*This temperature rise is above room air for self-ventilated machines and for forced ventilated machines is the rise above intake air.

When the motor starts cold—that is, with no initial rise—$T_s = 0$—equation (3) becomes:

$$T_t = T_c(1 - e^{-t/t_1}) \qquad (4)$$

When the machine is cooling with no loss, equation (3) becomes:

$$T_t = T_s e^{-t/t_1}. \qquad (5)$$

The above solutions are general and can be applied to a machine as a unit or any part thereof. However, it is more correct to use the above solution with reference to the armature alone, when considering direct-current motors, because the armature is generally the weakest part of the motor under overloads and failures usually occur there first. This is due to the fact that the heat-storage capacity of the armature is relatively less than the motor as a whole, the watts loss per pound being usually much larger for the armature than for the motor.

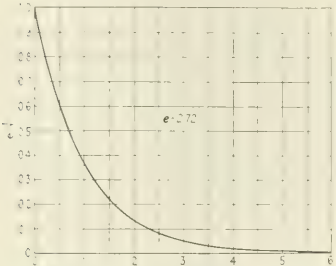


Fig. 1

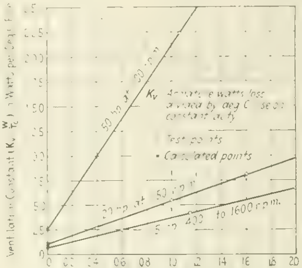


Fig. 2

FIG. 1—VALUES OF e^{-t/t_1} FOR USE IN TEMPERATURE RISE CALCULATIONS
FIG. 2—VENTILATION CONSTANTS FOR THREE DIRECT-CURRENT MOTORS AT VARIOUS SPEEDS

Determination of Constants

As previously indicated, W is the watts loss in the machine or part considered. If the armature alone is involved, W can be found by adding the separate losses or else determined from the efficiency of the motor. Thus the losses in the armature can be considered as the total losses minus the field losses. T_c, which is the temperature rise on continuous duty of the machine or part considered with its loss W, is a function of the ventilation for a given machine and is generally known at the machine's rating. The ventilation constant K_v of which T_c is a function ($T_c = W/K_v$), is given in Fig. 2 as a function of speed for three particular motors. Practically it is represented by a straight line, hence with two points known the line is determined. As previously mentioned the temperature rise is known at the continuous rating, and this locates one point. The second point on the line can be approximated at zero speed; this value of $K_v = 0.01$ armature surface when the r.p.m. = 0. The armature surface is to be taken as the total surface of a cylinder with a diameter equal to the armature diameter and a length equal to that of the armature including the commutator and end windings.

In applying this method equation No. 3 is employed. Any one factor can be determined when the others are known. This method of calculation has been checked by many tests one of which is shown in Fig. 3, which applies to a variable-speed direct-current motor rated at 15 hp., 230 volts, 400-1,600 r.p.m. Thermocouples were placed in the armature so that the temperature rise could be read while running. The ventilation constant (K_v) is given on Fig. 2 for various speeds.

The following cycle run was made:

Conditions during first hour: 230 volts, 53 amp., 1,065 r.p.m.

In this case $K_v = 57$ (see Fig. 1). P (weight of armature) = 279 lb., hence $t_1 = (0.06 \times 279)/57 = 0.294$. The armature loss W = 1,880 watts, so that $T_c = 1{,}880/57 = 33$ deg. C.

With these constants known, the rise T_t for any time (t) can be found. For instance, when $t = \frac{1}{2}$ hour, substitution in equation No. 3 gives:

$$\begin{aligned} T_t &= T_c - (T_c - T_s)e^{-t/t_1} \\ &= 33 - (33 - 0)\,e^{-0.5/0.294} \\ &= 33(1 - e^{-1.7}) \end{aligned}$$

Value of $e^{-1.7}$ is 0.183; hence T_t = 33 × 0.817 = 27 deg. C. (see Fig. 3). The other points are found in the same manner.

Condition during next twenty minutes: 230 volts, speed zero, current zero.

In this case the ventilation is reduced, which will change the value of t_1. From Fig. 2 $K_v = 10.5$; hence: $t_1 = (0.06 \times 279)/10.5 = 1.59$; $T_c = 0$; $T_s = 31.9$ deg. C. when $t = \frac{1}{3}$ hour. Substitution in equation No. 3 gives:

$$\begin{aligned} T_t &= T_c - (T_c - T_s)e^{-t/t_1} \\ &= 0 - (0 - 31.9)e^{-0.333/1.59} = 31.9\ e^{-.209} \end{aligned}$$

Value of $e^{-.209}$ (see Fig. 1) = 0.82; hence T_t = 0.82 × 31.9 = 26.1 deg. C. Other points on the curve may be found in the same way. (See Fig. 3.)

Condition during next half hour: 230 volts, 1,065 r.p.m., 69 amp.

In this case the ventilation (r.p.m.) is the same as in (1), hence K_v and t_1 will be the same. The loss W = 2,750 watts; hence $T_c = 2{,}750/K_v = 2{,}750/57 = 48.2$ deg. C.; $T_s = 26.1$ deg. C.

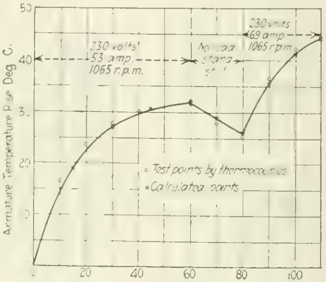


Fig. 3

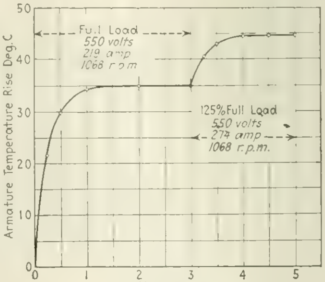


Fig. 4

FIG. 3—HEATING CURVE OF A 15-HP., 230-VOLT, 400-1,600-R.P.M. DIRECT-CURRENT MOTOR. FIG. 4—HEATING CURVE OF A 150-HP., 1,100-R.P.M. DIRECT-CURRENT ARMATURE

When $t = \frac{1}{2}$ hour (30 minutes) substitution in equation No. 3 gives:

$$\begin{aligned} t_t &= T_c - (T_c - T_s)e^{-t/t} \\ &= 48.2 - (48.2 - 26.1)\,e^{-0.5/0.294} \\ &= 48.2 - 22.1e^{-1.7} \end{aligned}$$

(see Fig. 1). Value of $e^{-1.7}$ is 0.18; hence $T_t = 48.2 - (22.1 \times 0.18) = 44.2$ deg. C.

Another example will probably clarify this problem. For instance, an induction motor has a rating of 75 hp., 550 volts, 72 amp., with a 40 deg. C. rise on continuous duty. What horsepower will it carry for one hour starting cold with a rise of 40 deg. C. at the end of the hour?

CALCULATIONS EQUALLY APPLICABLE TO OTHER TYPES OF MOTORS

At the rating the efficiency is found to be 90.5 per cent from the motor performance curve; hence the kilowatt input = $(75 \times 0.746)/0.905 = 61.8$. So that the loss $W = 61.8 - (75 \times 0.746) = 5.8$ kw. Therefore $K_v = 5{,}800/40 = 145$.

The weight of the motor (less the weight of cast-iron frame) is about 1,000 lb.; so that

$$t_1 = (0.06 \times 1{,}000)/145 = 0.413.$$

Hence, from equation (3),

$$T_t - T_c - (T_c - T_s)e^{t/t_1}$$

when $t = 1$, $T_t = 40$ deg. C. and $T_s = 0$.

Therefore $40 = T_c(1 - e^{-1/0.413})$. The value of $e^{-1/0.413}$ is 0.088 from Fig. 1. Hence $T_c = 40/\ 0.912 = 43.8$ deg. C.

With this continuous rise the loss $W = 43.8\,K_v = 43.8 \times 145 = 6{,}360$ watts. From the performance curve the motor will deliver 82 hp. at 550 volts, 77 amp., and its efficiency will be 90.5 per cent, which will give a loss of 6,360 watts. Therefore the above motor will carry 82 hp. load for one hour starting cold with a rise of 40 deg. C. at the end of the one-hour run.

On direct-current motors with highly ventilated armatures the value of the thermal time constant t_1 of the armature is small. In other words, many of these machines when run for a period of one hour will be very near to their final temperature rise. Hence when such a motor has a 125 per cent rating for two hours with a 55 deg. C. rise its final rise on this load continuously will not materially differ from 55 deg. C. This condition is shown on the heating of a 150-hp. direct-current motor armature on Fig. 4. It shows that on such duty cycles the thermal capacity of the motor has practically no effect upon the final temperature rise. In other words, the final rise is approximately the same as that which would be obtained on continuous operation at the overload.

THERMAL CAPACITY MUST BE CONSIDERED CAREFULLY

There are many motors such as inclosed-motors, crane and mill motors which have large copper and iron masses in proportion to the losses, and in these the thermal capacity of the machine is a greater factor. In such motors it is possible to find their one-hour rating two or three times the continuous rating. The method of calculation given above is equally applicable for these motors.

The application of open ventilated and continuous rated motors to short-time loads of 150 per cent or more of the continuous should be done with caution because of the fact that the difference between the internal "hot-spot" temperature and that observed by thermometers increases with the load, so that on overloads it is possible to obtain an abnormal internal temperature without exceeding the safe temperature as found by thermometers.

Squier on "Wired Wireless" for Creating Good Will

Broadcasting Through Lamp Socket as a Means of Promoting Public Friendship—Central Stations Logical Medium for Such Entertainment

WITH their electric service lines extending over the entire country and reaching even the isolated farmer, central-station companies are the logical medium for broadcasting entertainment and news over their circuits and through the lamp sockets, declared Gen. George O. Squier in addressing the electrical apparatus committee at the Atlantic City N. E. L. A. convention last week. Judging from the demand for this wireless service, he expressed the belief that broadcasting through the lamp socket by means of "wired wireless" or carrier current would meet with universal public favor. Hence it should be one of the best opportunities open to public utilities for creating good will. The public has become accustomed to look to the electric socket for every domestic convenience, and it should have the opportunity to look there for entertainment as well.

That the service can be rendered has already been demonstrated in a small way. Just recently, the General announced, broadcasting over 10 miles of cables and through the intervening transformers was successfully accomplished in Chicago with a 50-watt sending set. How the technical problems of extending the service over large networks shall be solved is a detail for engineering talent. That the idea is new and theoretical obstacles exist constitutes no reason for hesitation in rendering this service. The best way to achieve results, said General Squier, is to experiment.

LOOKS TO LAMP SOCKET TO REPLACE ANTENNA AND BATTERY

At present reception of space broadcasting has the objection that antennas in some form are required. Difficulties in erecting aërials have already been experienced in some localities, and they may be expected to increase as outfits are installed promiscuously. With carrier-current broadcasting through the lamp socket the need for the aërial is eliminated. Only a small condenser has to be inserted between the socket and an ordinary receiving set. General Squier looks to the day when the lamp socket will also furnish the power for operating the radio tubes so that the inconvenience of charging storage batteries will be eliminated.

Another possibility presents itself to the central-station company, said General Squier—namely, the broadcasting of entertainment or news originating in its own headquarters and the transmission of entertainment received from space-broadcasting stations as well. With the facilities that engineering talent can provide the customer can select the entertainment desired.

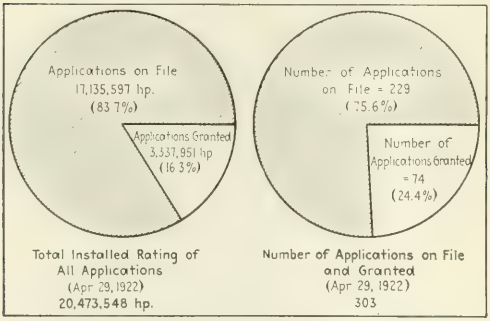
Another very important advantage of carrier-current broadcasting is that it will not interfere with reception of other broadcasting. It can be virtually confined to the wired system or its immediate locality, thus leaving the ether free for such broadcasting as must be carried on by space radio.

The General recognized that certain engineering problems still have to be solved in carrier-current broadcasting over electric service lines, but he expressed the belief that it has come to stay.

Water-Power Applications Total 20,473,548 Hp.

Federal Power Commission Has Received 303 Applications for Preliminary Permits and Licenses and of These Had Granted Seventy-four Up to and Including April 17, 1922

DURING the last eight months applications for preliminary permits and licenses have been filed with the Federal Power Commission at the average rate of about eight a month. The commission on April 29 reported that 303 applications had been filed since the organization of the commission, an increase during the previous eight months of fifty-nine. The installed rating of projects on file on April 29 and granted previous to that date totaled 20,473,548 hp., which is about double the present hydro-electric development of the country.



ALMOST ONE-QUARTER OF THE APPLICATIONS ON FILE HAVE BEEN GRANTED PRELIMINARY PERMITS OR LICENSES

The projects included in filings made during the period from Aug. 31, 1921, to April 29, 1922, involve an average of 100,499 hp. Almost every section of the country is represented in the applications filed during the eight months. California leads the country with eighteen applications filed during this period, and Washington and Oregon follow with six and four respectively. The Pacific Coast States, therefore, lead the country in the number of applications filed during this period with 51 per cent, and they have 64.5 per cent of the total horsepower involved.

The largest project recorded during these eight months was that of the Southern California Edison Company involving a dam and power house at Boulder Canyon, on the Colorado River, and a second dam and power house in Pyramid Canyon, on the same river. This project involves a total development of 1,200,000 hp., but is in conflict with previous filings. The Utah Power & Light Company and Hugh L. Cooper of New York City both filed for projects involving 800,000 hp. each.

The project of the Utah Power & Light Company involves a development on Green River between Flaming Gorge and Rattlesnake Canyon and also one on the Yampa River. The Green River portion of this project involves a series of dams and pools, six in all, with power houses at each, and the development on the Yampa River consists of a series of four dams and power houses. The project filed by Hugh L. Cooper involves a dam and power house on the Columbia River at the Grand Coulee site in the State of Washington.

Table II gives the location and size of the water-power projects for which applications for preliminary permits and licenses were filed with the Federal Power Commission from Aug. 31, 1921, to April 29, 1922. The list of applications filed prior to Aug. 31 appeared in the issues of the ELECTRICAL WORLD for Jan. 1, Jan. 15, Feb. 12, March 12, April 9, June 18 and Sept. 24, 1921.

A total of seventy-four licenses and permits had been granted by the commission on April 17, 1922, of which thirty-eight were preliminary permits and thirty-six were licenses. The developments represented in these projects involve a total of 3,337,951 hp. and are scat-

TABLE I—PERMITS AND LICENSES AUTHORIZED BETWEEN AUG. 24, 1921, AND APRIL 17, 1922, INCLUSIVE.

Project No.	Permit or License	Name of Company	Location of Project	Installed Capacity, Hp.
185	L	Southern Sierras Pwr. Co...	High Creek, et. al., Cal......	4,000
138	P	George C. Hazelet ...	Silver Lake, Alaska.........	1,500
190	P	Unitah Power and Light Co.	Pole Creek & Unitah River, Utah	2,400
173	P	Connecticut River Co......	Connecticut River, Conn....	32,000
255	L	Southern Sierras Power Co.	Transmission line, Cal.......	.....
201	P	City of Petersburg........	Crystal Lake, Alaska........	1,000
223	P	C. B. Hawley............	New River, West Va........	20,000
253	L	Henry Weber.............	Denny Creek, Col..........	100
154	P	Elmore Copper Co........	So. Fork Boise River, Idaho..	6,000
172	P	Louisiana Gravity Canal Co..................	Calcasien River & Bayou, Cocodrie, La.............	55,000
177	P	Ocklawaha Reclamation Farms...............	Ocklawaha River, Fla.......	1,000
206	L	George Inlet Packing Co....	Beaver Falls Creek, Alaska..	90
157	P	Alaska Development & Mineral Co.............	Tyee & Anan Creeks, Alaska.	18,000
212	P	Hirst-Chichagof Mining Co.	Head of Didrickson Bay, Alaska..................	400
213	L	J. H. Cann...............	Cann Creek, Alaska........	75
241	L	Freshwater Bay Lumber Co.	Creek not named, Alaska....	100
63	L	Alaska-Endicott Mining & Milling Co.............	Beardslee River, Alaska.....	1,000
245	L	The Darwin Silver Co.....	Transmission line, Calif......	....
236	L	Blue Mt. Irrigation Co.....	Pole Canyon Spring, Utah...	40
21	P	W. R. Banks.............	Osage River, Mo...........	4,000
163	P	Myser, J. F., & Drach, E. E.	Frying Pan River, Col.......	100,000
159	P	City of Boise.............	Payette River, Idaho.......	30,000
184	L	Eldorado Power Co........	So. Fork, Amer. River, Cal...	100,000
96	L	San Joaquin Lt. & Pwr. Corp.	San Joaquin River, Cal......	45,000
160	P	Alaska Public Utilities.....	Power Creek, Alaska........	1,500
268	P	City of Oskaloosa	Des Moines River, Iowa.....	2,700
214	P	Dixie Power Co...........	No. Fork White River, Ark...	36,000
262	P	Hardaway, Benj. H........	Choctawhatchee River, Ala.	5,000
266	P	Hardaway, Benj. H........	Pea River, Ala.............	3,000
175	L	San Joaquin Lt. & Pwr. Corp.	Kings River, Cal...........	266,000
271	P	Caddo River Pwr. & Irr. Co.	Ouachita River, Ark........	50,000
261	P	Hughes, John H...........	French Creek, Cal..........	4,000
120	L	Southern Cal. Edison Co....	San Joaquin River, Cal.......	195,000
135	L	Portland Ry., Lt. & Pwr. Co....................	Clackamas River, Ore....	30,000
234	P	Portland Ry., Lt. & Pwr. Co....................	Clackamas River, Ore.......	*34,000
155	L	Southern Sierras Power Co.	Snow Creek, Cal............	3,750
292	L	California-Oregon Pwr. Co.	Transmission line, Cal.......	....
298	L	So. California Edison Co....	Kaweah River, Cal.........	9,500
90	P	Baum, F. G...............	Little Colorado River, Ariz...	15,000
143	P	Mushen & Cronemiller....	Deep & Camas Creeks, Ore.	800
61	P	Wrangell Pulp & Paper Co.	Harding Creek, Alaska......	3,000
149	L	Wyoming Power Co.......	Big Horn River, Wyo.......	1,300
150	L	Central Ariz. Lt. & Pwr. Co.	Transmission line, Ariz.......	.....
		Total horsepower................................		1,082,255

* Primary.

TABLE II—PERMITS AND LICENSES RECEIVED BETWEEN AUG. 31, 1921, AND APRIL 29, 1922

Project No.	Permit or License	Name of Company	Location of Project	Installed Capacity, Hp.
ALABAMA:				
262	P	Benjamin H. Hardaway	Choctawhatchee River	5,000
267	P	A. E. Killebrew	Choctawhatchee River	5,000
276	P	Houston Power Co.	Choctawhatchee River	2,000
ALASKA:				
246	P	Frank C. Dougherty	Crater, Long and Tease Lakes	80,000
269	P	City of Wrangell	Mill Creek	2,700
ARKANSAS:				
271	P	Caddo River Pwr. & Irr. Co.	Ouachita River	50,000
286	P	Maxfield, Earnheart	White River	1,200
CALIFORNIA:				
245	L	Darwin Silver Co.	Transmission line	....
255	L	Southern Sierras Pwr. Co.	Transmission line	.
247	P	W. H. Samson	Stuart's Fork, Trinity River	25,000
256	L	Mitchell Terzich	Eagle Creek	
248	P	Southern Sierras Pwr. Co.	Bear Creek and Santa Ana River	25,000
258	P	Southern California Co.	Boulder Canyon, Colorado River	1,200,000
249	P	Lars Jorgensen	Feather River	350,000
260	P	San Joaquin Lt. & Pwr. Co.	South Fork, Merced River	110,000
251	P	R. T. Harding	Bucks and Grizzly Creeks	10,000
275	P	Hutton, McNear & Dougherty	Cascade Creek	15,000
252	P	Ed Fletcher	Santa Isabel Creek	1,800
284	P	Mokelumne River Pwr. & Lt. Co.	Mokelumne River	
261	P	J. H. Hughes	French Creek	4,000
291	P	Great Western Pwr. Co.	Bucks, Pine Rock Creeks	30,000
270	P	Mendota Irrigation District	Kings River	
292	L	California-Oregon Pwr. Co.	Transmission line	....
280	L	Frank M. Wilson	Willer & Camp Creeks	70
298	L	Southern Calif. Edison Co.	Kaweah River	9,500
COLORADO:				
300	P	Thebo, Starr & Anderton	McCloud and Pitt Rivers	160,000
253	L	Henry Weber	Denny Creek	100
301	P	Clare N. Stannard	Grand River	65,000
FLORIDA:				
263	P	William J. Barker	Grand River	65,000
GEORGIA:				
266	P	Benjamin H. Hardaway	Pea River	3,000
303	P	Benjamin H. Hardaway	Chipola River	7,500
IDAHO:				
282	L	Idaho Power Co.	Transmission line	.....
ILLINOIS:				
287	P	State of Illinois	Fox River	2,000
IOWA:				
268	P	City of Oskaloosa	Des Moines River	2,700
KENTUCKY:				
289	P	Louisville Gas & Elec. Co.	Ohio River	90,000
MINNESOTA:				
285	P	St. Cloud Public Service Co.	Rigby site	15,000
250	P	Northern States Pwr. Co.	Mississippi River	60,000
MONTANA:				
273	P	Peter F. Karst	Moose Creek	20
277	P	Eureka Hydro-Electric Co.	Graves Creek	2,500
NEVADA:				
296	L	Mineral County Lt. & Pwr. lines	Transmission line	..
265	P	Guy P. Mohler	Colorado River	400,000
NEW MEXICO:				
254	L	Rio Grande Lt. & Pwr. Co.	Rio Grande River	25,000
NORTH CAROLINA:				
295	L	Black Mountain Tel. Corp.	Transmission line	....
OREGON:				
281	L	California-Oregon Co.	Transmission line	......
259	P	Fort Klamath Meadows Co.	Fort Klamath Meadows	1,000
288	L	Grant's Pass. Irr. Dist.	Dam in Rogue River	2,000
293	P	Pacific Pwr. & Lt. Co.	Snake River	650,000
TENNESSEE:				
299	P	Smith-Sanders Power Co.	Holston River	25,000
UTAH:				
279	P	Utah Pwr. & Lt. Co.	Green River	800,000
290	P	James H. Mays	Huntington Creek	1,200
VIRGINIA:				
283	P	Edward T. Brown	Pitt Spring Run	1,000
WASHINGTON:				
264	P	Northwestern Elec. Co.	Lewis River	125,000
278	P	Spirit Lake Ry. & Pwr. Co.	Toutle River	50,000
257	P	J. G. Galvin	Aarons Creek	12,500
272	P	Hugh L. Cooper	Columbia River	800,000
274	P	Pacific Pwr. & Lt. Co.	Deschutes River	50,000
297	P	Willow Creek Mines	Craigie Creek	650
WISCONSIN:				
302	P	White Rapids Paper Co.	Menominee River	10,000
Total horsepower				5,380,462

tered throughout the country. The largest project for which a license has been granted by the commission is that of the Southern California Edison Company on Big Creek and the South Fork of the San Joaquin River, California, involving a total development of 545,000 hp.

Table I gives the location and size of the projects for preliminary permits and licenses granted from Aug. 24, 1921, to April 17, 1922. A list of preliminary licenses and permits granted prior to Aug. 24, 1921, was published in the Sept. 24, 1921, issue of the ELECTRICAL WORLD.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Powdered Fuel in Power Plants

To the Editors of the ELECTRICAL WORLD:

The editorial on page 168 of the Jan. 28 issue of the ELECTRICAL WORLD, entitled "Future of Powdered Fuel in Power Plants," does not by any means describe the wonderful progress which has been made in the last four years in firing boilers with powdered fuel. The statements you make are misleading. Under date of Feb. 11 you printed a very comprehensive article by a consulting engineer whom we all know and respect very highly, E. B. Powell, of Stone & Webster. This article is a very good answer to quite a number of the points brought up in your editorial of Jan. 28.

Your editorial would have been very appropriate if it had been printed in the early part of 1916, as at that time there was only about 2,000 rated horsepower fired with pulverized fuel in operation, while for some thirty years previous nobody had been able to operate a boiler of more than 100 hp. to 300 hp. or 400 hp. for more than three or four months at a time, owing to the fact that the relation between the amount of coal burned and the size of the furnace was not fully understood and the coal was not pulverized finely enough. H. G. Barnhurst discovered this relation between furnace volume and fuel. Today 140,000 boiler hp. to 150,000 boiler hp. is developed with powdered fuel, compared with about 2,000 in 1916. In regard to the low-grade fuels which you say are hardly touched and heretofore considered unusable one of the first plants installed has been running successfully for at least three years, burning coal containing approximately 30 per cent moisture which has been lying exposed to the weather for fifteen years or more. The fuel was used under ten 500-hp. boilers operated at 150 to 200 per cent continuously.

In another plant, a sugar refinery, where the service has been continuous day and night for three years, they have been using coal containing only 9,300 B.t.u. per pound and 28 per cent of ash under thirteen boilers previously fired with fuel oil. The furnaces were redesigned to suit pulverized-coal conditions and the boilers are operated at 150 per cent of rating.

In the anthracite-coal regions there is a 10,000-kw. plant which has been operating for nearly a year, using refuse from the mines which is usable, and the results are so satisfactory that the owners contemplate building another plant similar to the present one, if not larger, to be operated in the same way. In another plant this same company uses pulverized culm or waste, operating its boilers at 300 per cent of rating continuously and sometimes as high as 400 per cent. Capacity equal to stoker firing can be maintained with even better results when the furnace and equipment are designed to suit known operating conditions.

Regarding the cost of pulverizing, we are supplied with sufficient reliable data and information to say that this expense will run from 30 cents to 70 cents per net ton, depending on the cost of energy per kilowatt-hour and the amount of fuel pulverized per day of twenty-four hours. These figures include all repairs, power, labor and cost of drying the fuel, based on coal at various prices, and do not include the fixed charges, which will be no more of a burden to carry than is the case with a properly installed stoker-fired boiler plant if the cost of repairs, power, etc., is considered.

The developments in the last year or two have been remarkable. The distribution of powdered fuel, or the method of handling it, has been improved to such an extent that it is of virtually equal simplicity with the distribution of fuel oil. By means of an inclosed system of small pipes cleanliness and great efficiency have been insured. It may be said that the distance between the milling plant and the boiler house can be quite disregarded up to half a mile and probably more.

The ash and clinker troubles to which you refer no longer exist. Some boilers are operating continuously two or three weeks, day and night, before the furnaces are even cleaned from slag, and then the time required to clean a 500-hp. boiler is only six man-hours.

The use of pulverized fuel for boiler plants is here to stay both for small industrial plants and, in a more advantageous way, for larger ones, as public service and other power houses.

FREDERICK A. SCHEFFLER,
Manager Power Department.

Fuller Engineering Co.,
New York City.

[We agree with Mr. Scheffler in his statement that the use of powdered fuel is growing by leaps and bounds. Remarkable efficiencies have been obtained and ash and clinker troubles are being overcome. However, the point which we made in the editorial of Jan. 28 has been missed. It was that no data of any consequence had been made extensively available to central-station engineers on detailed operating costs under normal operating and load conditions, nor on maintenance expense nor on the methods of overcoming such operating problems as have become associated with powdered-fuel combustion in the past. If some more comments from users like those which have appeared in ELECTRICAL WORLD by E. B. Powell, Stone & Webster, Inc., and John Anderson, Milwaukee, are made available, the purpose of our editorial will have been accomplished.—EDITORS.]

Preparing Engineering Students for the Industry

To the Editors of the ELECTRICAL WORLD:

Education and graduate student problems seem to be live topics just now in your columns. G. H. Stickney presented in the March 18 issue a view of the situation with which, though it differs from the usual one, I am in practical accord and upon which I trust you will permit me to enlarge. As I analyze Mr. Stickney's letter I note several leading ideas:

1. There is an oversupply of men trained for designing.
2. There is a strong demand for technically trained men to fill executive and commercial positions.
3. There is a dearth of the commercial and executive type in the ranks of engineering graduates.
4. It is difficult to remodel the man after graduation.
5. It should be possible to train the desired commercial-executive-engineer type in schools.
6. Few schools are attempting the job.

It will interest Mr. Stickney, I know, and every one who reads this, I hope, to learn that the Carnegie Institute of Technology is doing the very thing which is so strongly urged in the article mentioned. It is not a new venture and is beyond the experimental stage, having been begun many years ago as a three-year non-degree course, but since 1919 it has been on a four-year basis with standard entrance requirements and an undergraduate curriculum of a pitch equal to other courses leading to a degree of B. Sc. The course is entitled "electrical equipment and construction." The usual standard courses in electrical engineering and commercial engineering are also offered, and it must not be inferred that these have been superseded by the one under discussion or that the latter is a substitute course or merely an option. Electric equipment and construction is a major course, one of a group which are sometimes referred to as "training for executives" and which cover many subjects knowledge of which is essential to an executive or a proprietor-manager. In addition to the fundamental scientific and cultural subjects which are essential in any major electrical course, the following among other studies are included in the curriculum: Economics, industrial history, modern industries, psychology, personnel work, principles of selling, advertising, employment problems, accounting, credit and banking, business law and specification and contract writing. To give the course the desired vocational trend, a place is accorded to several special electrical subjects, such as underwriters' and city electric codes, estimating from plans, shop practice in electric wiring, installation and maintenance methods, winding and repair, storage-battery practice, illumination and photometry.

The inception of the course was due to the realization by those responsible for it of the existence of the six fundamental conditions above mentioned. There are many young men who by temperament are unfitted for the work for which most electrical engineering courses now prepare them but who none the less would be happy and successful in other fields which the electrical industry affords but for which there is very little special training available. It was believed that the central-station and other operating companies, large industrial concerns, the jobbing and supply interests, contractors and dealers and the commercial divisions of manufacturing companies all needed technically trained men prepared to engage in the work of sales, installation, operation or maintenance.

If the student pursues a course in which machine design and manufacturing principles and processes are strongly featured, it is natural that he should upon graduation endeavor to enter the field of design and the technical end of manufacturing, regardless of economic and working conditions and of his aptitude for this branch of the business. It is not intended to disparage the older training or unduly to laud the newer, but to emphasize the fact that a great field has been overlooked by those responsible for most engineering courses, in consequence of which many young men laboriously train for work which they will never perform and after graduation go through a painful process of readjustment to work for which their college course did not prepare them.

H. A. CALDERWOOD,
In charge of Electric Equipment
and Construction Department.

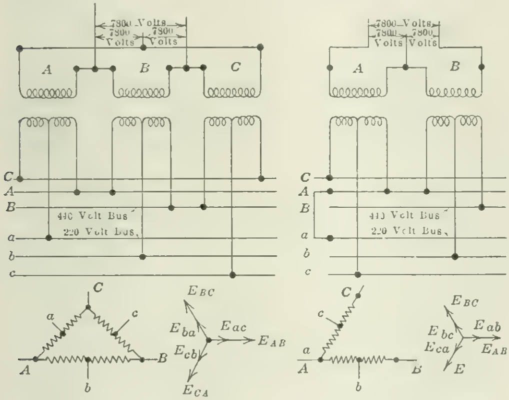
Carnegie Institute of Technology,
Schenley Park, Pittsburgh, Pa.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Two Voltages Obtained from Single Bank of Delta-Connected Transformers

TWO voltages are obtained from a single bank of transformers at the Brooklyn Bridge Freezing & Cold Storage Company, New York. As shown in the accompanying drawing, three single-phase, 250-kva., 7,800/440-220-volt oil-insulated, self-cooled transformers are connected in delta. The middle points of the secondary windings are brought to a secondary bus.



BECAUSE OF THE TWO VOLTAGE CONNECTIONS ON TRANSFORMERS INDIVIDUAL COMPENSATORS FOR MOTORS ARE NOT NEEDED

Left—Three transformers connected in closed delta. Right—Connections to be made for open delta should one transformer be damaged.

The 220-volt bus is used to operate auxiliaries and also for starting three 440-volt, 250-hp. synchronous motors and two 440-volt, 50-kw. synchronous motor-generator sets, thus doing away with individual auto-transformers for starting these motors. Both the 220-volt and the 440-volt buses are permanently tagged as shown in the diagram, so that the same direction of rotation is obtained by connecting the motor leads to the bus having the same marking.

From a vector diagram of the voltages we see that the 220-voltage is not in phase with the corresponding phase of the 440-volt side, but is 60 deg. behind or ahead as we care to view it. The actual kilovolt-ampere capacity of the bank is, therefore, slightly reduced, depending on the 220-volt load, but the advantages obtained far outweigh this slight disadvantage up to a 220-volt load of about 20 per cent of the ampere capacity of the bank. That is, the amperes at 220 volts should not exceed one-fifth of the ampere capacity of the bank at 440 volts, as all the load taken from the 220-volt connection is equivalent to the same load on 440 volts at a lower power factor. If the 220-volt load is larger than 20 per cent, then a different arrangement is to be preferred.

In case of breakdown on one of these transformers, it can be cut out of service and the two others operated on open delta. The capacity of the bank is such that when operating on open delta the bank is just capable of carrying the normal load of the plant. The extra cost of operating the bank in closed delta at the lower load and efficiency is found to be less than the interest on the investment of a fourth transformer kept as a standby.

To illustrate, assume, in case of a breakdown, that any transformer is damaged; then it will be necessary to make new connections as follows: The 440-volt bus that connects to the common point of the two transformers is connected to the 220-volt bus of the same letter, that 220-volt bus being disconnected from the transformer to which it was originally connected. The 220-volt bus connected to the damaged transformer is then connected to the transformer from which the 220-volt bus was removed to make the first connection. The change can be made in a few minutes and does not change the direction of rotation. A specific case where trasformer *C* is damaged and transformers *A* and *B* are operated on open delta is shown on the right in the illustration.

EUSTACE C. SOARES,
Electrical Engineer.
Ophuls, Hill & McCreery, Inc.,
New York.

Substantial Outdoor Construction for Light Load Centers

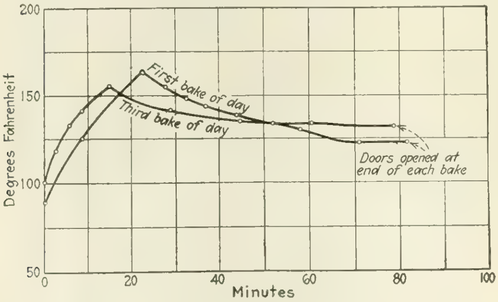
RUGGED outdoor pole-type construction has been adopted by the Northwestern Electric Company of Portland, Ore., for use in lightly loaded distribution centers. The modern erections are of a substantial kind, allowing great freedom in extension and maintenance. This type of substation is inexpensive and readily lends itself to large expansions in the load. The stations are complete with switching arrangements for shunting the apparatus in case of necessity.

WOOD-FRAME OUTDOOR SUBSTATIONS PROVE ECONOMICAL

S. F. PEARSON,
Engineer.
Northwestern Electric Company,
Portland, Ore.

Electric Ovens Dry Paint on Light Metal Ware Satisfactorily

AN OPERATING economy in drying paint on light metal ware of 12 lb. to 60 lb. per kilowatt-hour, the extent of the saving depending upon the bulkiness of material handled and the time of day, has been obtained in the factory of the Schleuter Manufacturing Company, 4616 North Broadway, St. Louis. This factory contains three electric ovens used for drying colored paints at temperatures varying from 160 deg. to 270 deg. Fahr. These ovens have taken the place of large gas and low-pressure steam ovens because of their speed, cleanliness and even heat. The materials handled consist of dustpans, water coolers, bread boxes, small metal tubs and similar sheet-metal products. With fuel-fired ovens it is usually necessary to keep the material in the open air for a considerable length of time after removal from the oven to permit the paint to harden, but this is not necessary with electric heat. The improvement in production obtained by the Schleuter company has been so thoroughly satisfactory that it plans to use electric heat for a number of other purposes. These ovens are usually operated about eight hours a day, although both day and night operation are sometimes necessary. In that case even better economy is obtained.



OPERATING CURVES SHOW THAT TEMPERATURE DROP IN OVENS IS SMALL

The ovens are of the standard box or kiln design with large double doors at one end. The loading is done by hand, either with long wooden frames for such equipment as dustpans or with large, light-weight wooden or metal trucks which can be wheeled in and out of the oven. These ovens are heated by standard air heaters, which are placed in the lower side walls of the oven.

The largest oven installed has a capacity of 36 kw. and operates at a baking range of 270 deg. to 450 deg. Fahr. Four inches of heat-insulating material covering all sides has been built into this oven. This oven does black and color work at the higher temperatures and has automatic temperature control. Each oven is loaded the first thing in the morning, and then the current is turned on immediately. The first bake will take about one hour and twenty-five minutes to meet the maximum temperature, when the doors can be opened and the charge removed. Succeeding loads in the oven will require about an hour to reach the maximum temperature. The average weight of metal dried in this oven when handling dustpans is 432 lb., producing an electrical efficiency for this operation of 12 lb. of metal dried per kilowatt-hour.

The two other ovens are of 27-kw. capacity each and are used for light color work at temperatures varying from 150 deg. to 180 deg. Fahr., and they are accordingly constructed with only 2 in. of heat-insulating materials on all sides. They are hand-controlled and require little attention as they come up to their necessary temperatures very quickly and can be cut off by hand, the bake soon cooling down sufficiently to allow the doors to be opened.

The ovens are equipped with safety switches so that when the doors are open it is not possible for current to flow into the heating element. Bulky equipment placed in these ovens is mounted on light trucks, and as the drying takes place at a low heat, the desired temperature is very quickly reached. With color work on water coolers or bread boxes a temperature of 150 to 170 deg. Fahr. can be obtained in about twenty minutes. The current is turned off, and the material remains in the oven until it has been there a total time of two hours. Electrical efficiency of these low-temperature ovens will vary from 20 lb. to 60 lb. per kilowatt-hour, depending upon the bulkiness of the material handled and the time of the day at which the bake is performed. The afternoon work in these ovens requires very little electrical energy, since the ovens retain sufficient heat to keep them at about 100 deg. Fahr., and the increase in temperature from 150 deg. to 170 deg. can be quickly and economically obtained. The accompanying time-temperature chart shows the performance of one of these ovens with a typical load. Power for operation of the ovens is obtained from the distribution circuits of the Union Electric Light & Power Company.

JAMES W. CARPENTER,
Industrial Heating Engineer.
Union Electric Light & Power Company,
St. Louis, Mo.

Ring-Lubricated Bearings Should Not Be Neglected

REGULAR inspection of the oil rings on generators, converters or motors should be made by the operator to determine if they are turning properly. This is especially necessary when a machine is started up, as the rings are apt to stick at this time. The fact that the oil need be changed only once or twice in a year does not necessarily imply that the bearings are foolproof and need no attention on the part of the operator. If the rings stick and fail to revolve, the bearing will get no oil. This frequently happens, resulting in an overheated bearing and sometimes in enforced shutdown of the machine.

Consequently it is an important duty of the operator to make regular inspection of these rings to see that they are turning. If they are not, they should be started with a small hardwood stick which should be kept on hand for this purpose. At the same time, the operator should see that the gage glasses on bearings are at least half full of oil and that there is no leakage around the glasses. In case of any apparent leakage, lack of oil or chronic sticking of any particular oil ring, the matter should be reported to the foreman. When inspecting oil rings on a running rotary, operators should wear goggles to protect their eyes from possible flashovers.

The foregoing instructions are given to operators of the Consumers' Power Company.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

Adapting Standard Reflectors and Guards to New Type of Mill Lamp

SOME engineers may have experienced difficulty when replacing standard lamps with the new mill-type tungsten lamp in standard guards and reflectors. This type of lamp has a ring filament which is mounted closer to the lamp base than the filament in the older types of lamps. The bulb shape is also new. Because the source of light is held higher up inside the reflector the light is concentrated directly under the reflector and covers a small area. In many cases this is objectionable. In addition, the reflector efficiency is materially decreased because the light is pocketed in the neck of the reflector. The dotted curves of the accompanying illustrations show this concentrating effect with four types of reflectors.

By using a standard 1⅜-in. socket extension in each of the reflectors shown the light center is brought farther down in the reflector near the normal position for which the reflector was designed, resulting in a distribution of light almost normal, as shown by the solid-line curves, and the reflector efficiency is also appreciably increased, as shown in the following table:

Reflector Using New Mill-Type Tungsten Lamp	Reflector Efficiencies without Socket Extension, Per Cent	Reflector Efficiencies with Socket Extension, Per Cent
Porcelain-enameled shallow dome...	58	76
Porcelain-enameled bowl	46	61
Aluminum-finish bowl	39	50
Light-density opal bowl	69	80

Many of the wire guards now in use were designed to fit the old 16-cp. and 32-cp. carbon lamps, and in many cases when the new mill-type lamps are put in these guards the pear-shape bulb touches the strands of the guard near the holder ring. To be effective the outer strands of the guard should clear the bulb so that knocks and shocks may be absorbed by the guard rather than transmitted to the glass. In most of the cases where the guards touch the glass near the neck it is possible to bend the wire strands to clear the lamp. However, when the guards have very heavy strands, confining collars or cast half-reflectors as a part of the guard, it is the best plan to adapt the lamp to the guard by using the same socket extensions suggested for the reflectors. Many of the wire-guard manufacturers have designed or are designing new guards to fit this lamp.

National Lamp Works,
General Electric Company,
Cleveland, Ohio.

JAMES M. KETCH,
Illuminating Engineer.

Successful Handling and Storing of Hogged Fuel

HANDLING and storing of sawmill refuse or hogged fuel for central-station power generation is a matter that has confronted many companies desiring to make use of this low-grade fuel. At least two companies in the Northwest have successfully solved this problem, one being the Portland (Ore.) Railway, Light & Power Company. The method employed by this company for generating power from waste was described on page 373 of the ELECTRICAL WORLD for Feb. 25, and the manner in which the fuel is handled and stored by drag rakes and conveyors may be seen in the accompanying illustrations.

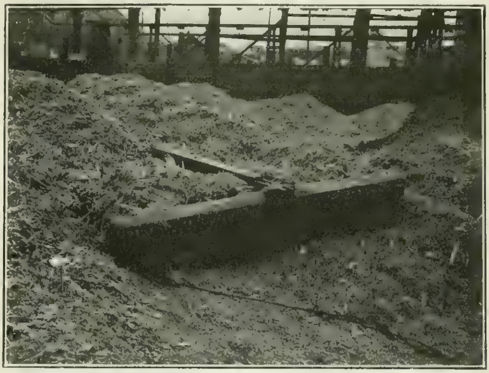
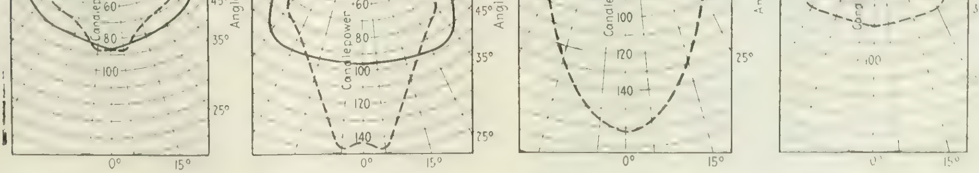


FIG. 1—RAKE USED TO PILE UP HOGGED FUEL

The means for handling hogged fuel, while seemingly crude and laborious, are best adapted to this purpose on account of its bulk and low heat content. This fuel carries water to the extent of about one-half its weight,



BY USING STANDARD EXTENSION SOCKETS WITH THE NEW MILL LAMPS UNIFORM LIGHT DISTRIBUTION IS INSURED

The distribution of light without the extension socket is shown in each case by the dotted lines. As the source of light is held higher up inside the reflector, the light is concentrated to a small area directly under the reflector. When the standard 1⅜ in. extension socket is used the distribution of light is brought back to normal as shown by the solid lines.

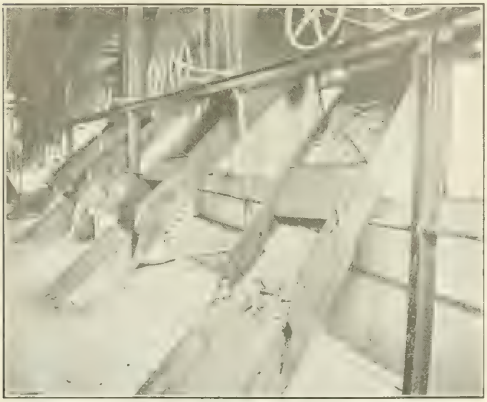


FIG. 2—FUEL DISCHARGED FROM CONVEYOR TO DUTCH OVEN BY CHUTES WITH HANDLE-WHEEL CONTROL

and its bulk is three or four times an equivalent weight of coal and approximately nine times the bulk of coal when based on heating values. Consequently the expensive and highly efficient system of gantry cranes, larries, automatic weighing hoppers, etc., which goes to make up the equipment of a modern coal-storage plant would not justify the investment when applied to hogged fuel.

The manner of building up the storage piles may be seen by the diagrammatic arrangement of the storage rigging shown in Fig. 4, which is the latest development of the system employed by this company. The drag rake (Fig. 1) is attached to the drag lines *A* and *B*, so that it may be pulled in either direction by a double drum logging engine or hoist engine. These lines pass through snatch blocks, C_1, C_2, C_3 and C_4, of which C_1 and C_4 are placed permanently at the ground level and act as guide blocks to carry the drag lines to and from the winding drums of the engine. To change the position of rake travel, block C_2 may be shifted to any one of the stub poles. These poles are about 15 ft. high, set in the ground around the edge of the pile and securely braced by guying. Block C_3 is attached to two drag lines, *D* and *E*, which are carried by means of snatch blocks to a small double-drum hoist in the same manner as the rake lines are handled. By means of these lines block C_3 may be moved across the fuel pile in a path approximately at right angles to the path of the rake.

In storing the fuel it is deposited at a point near the edge of the pile by an overhead conveyor. The drag lines are then arranged so that as the engine is operated the rake is pulled back and forth from the point where the fuel is deposited by the conveyor up over the fuel pile. With each forward movement the curved teeth of the rake pick up from 60 cu.ft. to 100 cu.ft. of fuel and carry it to any part of the pile. The motion of the rake is then reversed, and the curved teeth allow the rake to slide backward over the pile without picking up or displacing any fuel. By a proper manipulation of the lines controlling the position of block C_3 the path of travel of the rake may be changed and the top of the fuel pile built up in any desired manner.

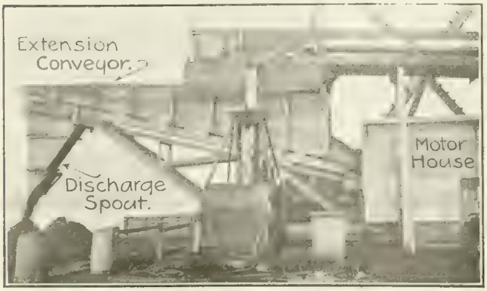


FIG. 3—CONVEYOR PLACED ON TRACKS LOADS BARGES EVENLY

When the fuel is to be reclaimed the rake is operated in a similar manner, the forward motion carrying a rake full of fuel to a conveyor installed near the ground at one edge of the pile and the backward motion carrying the empty rake up to get a fresh supply. This conveyor consists of a link chain with cross-bars at intervals. It carries the hogged fuel over the Dutch ovens of the boiler room, into which it discharges the fuel through chutes, as shown in Fig. 2.

Two men, a drag operator at the hoists and a signal man on the pile, furnish all the labor needed to operate the storage equipment. Sometimes in reclaiming fuel a third man is required to watch the conveyor that takes the fuel away. Two men can handle from 40,000 cu.ft. to 60,000 cu.ft. of fuel per eight-hour shift, the exact amount depending on the size and shape of the pile and the speed of the hoist engines. The steam hoists formerly used for this work are being rapidly replaced with electrically driven machinery.

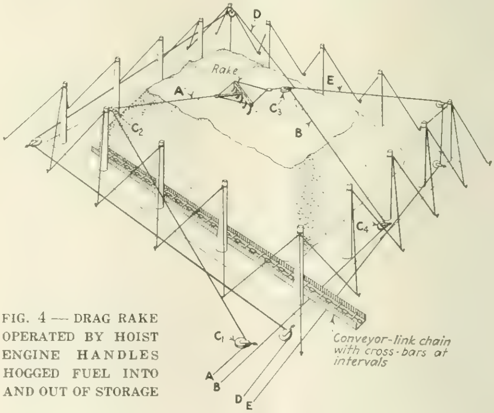


FIG. 4 — DRAG RAKE OPERATED BY HOIST ENGINE HANDLES HOGGED FUEL INTO AND OUT OF STORAGE

A barge-loading conveyor that has proved itself especially effective in handling hogged fuel is shown in Fig. 3. It consists of a short extension conveyor, with a receiving hopper and discharge spout, mounted on a truck that moves back and forth on a dock track. It is therefore possible to shift the conveyor over the barge while loading and later to draw it back of the dock line to clear river traffic. The loader is moved back and forth to load the barge evenly and to prevent listing. At the same time the barge is moved along the dock under the loader by means of a small electric winch. It is highly important to keep the barge on an even keel since any tendency to list will be increased by a shifting of the fuel.

H. S. Bastian,
Assistant Construction Engineer.
Portland (Ore.) Railway, Light & Power Company.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

An Experiment in Building Local Harmony

By A. M. Wilson

Professor Electrical Engineering, University of Cincinnati, and Chairman Grievance Committee, Electric Club of Cincinnati

THERE is an instructive story in the record of the part played by the Electric Club of Cincinnati in developing and maintaining harmonious relations among the electrical fraternity in Cincinnati. In the fall of 1921 conditions were such that the newly appointed management, in looking over the situation, was confronted with the problem either of assuming responsibility for advocating the abandonment of the club as an organization or of establishing it in such a way that it would have a real purpose and render a constructive service. After much deliberation it was decided to call a meeting of those who had shown an interest in the organization for consultation regarding future plans. It was the consensus of opinion that one more vigorous effort should be made to meet the situation.

There were three problems which apparently needed attention. The first and most important one was due to a feeling on the part of a number of electrical contractors that they were being discriminated against in the awarding of contracts for wiring houses. The second problem was the result of belief on the part of some of these contractors that the central-station company's solicitors, who went out securing contracts for the wiring of old houses, were using arguments which put the contractors at a serious disadvantage. The third problem was one affecting both the contractors and the jobbers and had to do with the financing of selling electrical devices on the installment plan and the sale of incandescent lamps. In all three of these problems the policy and practice of the local public utility were vital factors.

At the meeting which was held under the auspices of the newly elected management of the Electric Club in the fall of 1921 the various problems of the industry were reviewed, and it was suggested that a small committee be appointed which would take them up and see if a means could not be found to bring about a feeling of confidence and co-operation between the contractors involved.

A committee of three, known as the grievance committee, was appointed, consisting of one contractor, one jobber and one disinterested person who was at the same time familiar with the local situation. The first problem which was attacked arose from a complaint on the part of several of the contractors that they were unable to get meters installed as promptly as the contractor who had taken over the central-station company's wiring business. The committee met in President Freeman's office. There were present, besides Mr. Freeman and the committee, Mr. Hubbell of the Underwriters' Inspection Bureau, Superintendent Healey of the distribution department and Mr. Heed, the general manager of the Union Gas & Electric Company.

As a result of this meeting it was agreed that any reputable contractor who had demonstrated to the satisfaction of the Underwriters' Inspection Bureau that he would comply with the Underwriters' requirements in every case should have exactly the same sort of service as was given to the contractor who had taken over the company's wiring business. It was agreed that it would be impossible to extend this privilege to all the local contractors, because, on account of the activity of the company, a number of so-called curbstone contractors had sprung up concerning whose business methods and wiring practice the local inspection bureau could not have complete information. The solution arrived at was entirely satisfactory to the local contractors and met that particular grievance completely, so far as the committee has been informed.

The second question which the committee had to consider involved reports that the company's solicitors, in seeking contracts for the wiring of old houses in competition with the solicitors of the contractors, were obtaining their contracts by unfair means and were professing to offer advantages which contractors in general could not. A number of apparently specific cases of this kind were presented to the committee, but on investigation it was brought out that they were in reality only different versions of a few cases which had been magnified in repetition from one to another.

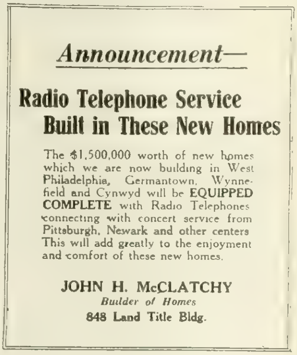
Grievances Not Worthy Serious Consideration

The committee investigated every grievance of this kind which came to its attention and found not a single one worthy of serious consideration; and it was felt by all who were thoroughly acquainted with the facts that if the contractors had put forth the same amount of energy in soliciting business and in selling wiring devices that they had in enlarging upon the reports of the shortcomings of the company's solicitors they would have been much happier and much better off financially.

There are one or two other matters which may be taken up in the future if it appears that the welfare of the local electrical interests will be advanced by doing so, but there can be no doubt that the work of the grievance committee up to the present time has been of sufficient value to the local electrical interests to justify the effort put forth. There are a great many schemes which are impracticable but in the discussion of which facts are brought out which are of real value. In the case of the grievance committee, if nothing more is accomplished than has already been done, its organization will have been more than justified. Indeed, it seems obvious that, particularly where such a condition prevails as was present in Cincinnati, the mere existence of such a committee serves to promote a feeling of confidence, and therefore of co-operation, among the various interests that should work together.

A Building Contractor's Appreciation of the Electrical Home

WHAT is probably the first instance of a general installation of radio-telephone service in new houses is seen in this advertisement of a Philadelphia building contractor. This builder is one of the foremost promoters of building operations in that city and makes it a point that every new development of merit shall be incorporated in the houses. Here is another step toward the complete electrical equipment of the home—one which shows the importance which contractors and real-estate men attach to these conveniences.



Announcement—

Radio Telephone Service Built in These New Homes

The $1,500,000 worth of new homes which we are now building in West Philadelphia, Germantown, Wynnefield and Cynwyd will be **EQUIPPED COMPLETE** with Radio Telephones connecting with concert service from Pittsburgh, Newark and other centers. This will add greatly to the enjoyment and comfort of these new homes.

JOHN H. McCLATCHY
Builder of Homes
848 Land Title Bldg.

MAKING RADIO SERVICE PART OF HOME EQUIPMENT

A Rate Decrease Makes Graphic Window Display

TO BRING home to the public what its new residential rate means in the way of reduced costs of lighting and appliance service, the Hartford (Conn.) Electric Light Company recently ran these interesting window displays, in which the costs of operating lamps and appliances on the old and new rates were compared diagrammatically. Streamers run from lamps of different sizes to the old and new points on the rate chart helped to focus attention on the savings resulting from the new rate, the area between the old and new rate lines also being featured as an integrated saving. Tabular data on appliance operating costs showing the saving per hour in operating different devices were shown on one chart, with the extent of additional use the new rates permit without increasing the former bills.

The new rate which went into effect on Jan. 1 is a combination flat rate and meter flat rate with a charge of 5 cents a month per 100 sq.ft. of floor area plus 6 cents per kilowatt-hour, as explained in the ELECTRICAL WORLD for Dec. 31, 1921, page 1341. R. D. Cutler is sales manager and G. P. Luscomb is appliance manager of the appliance department at Hartford.

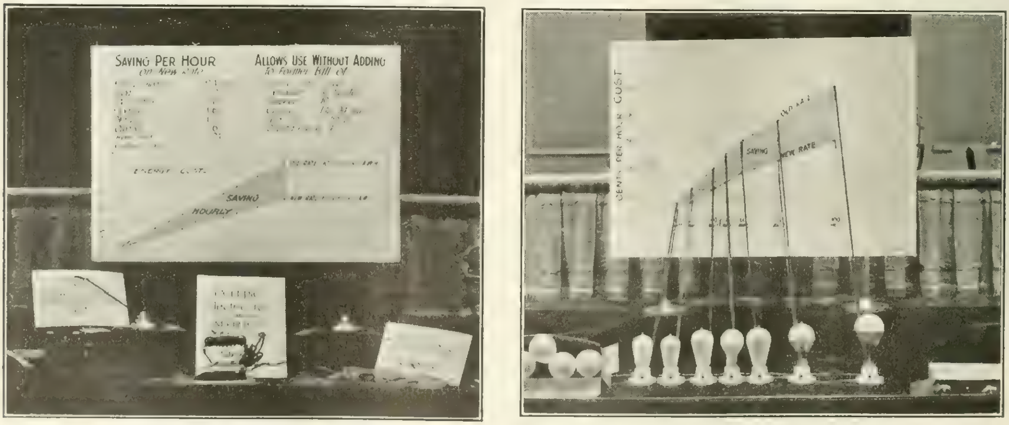
What Other Companies Are Doing

New England.—Appliance sales in nine electric utilities under the management of Charles H. Tenney & Company increased from $44,376 in the first quarter of 1921 to $52,841 in the corresponding quarter of 1922. The number of appliance units sold increased by a larger total. In eleven Tenney companies the number of meters set in the first quarter of this year was 847, against 736 for the same period a year ago. Cyrus Barnes, general sales manager, attributes these gains to vigorous continuous campaigning for new business and wiring. April, 1922, will show further gains when analyzed.

Oklahoma City, Okla.—Classes for the study of power-plant engineering have been formed by the employees of the Oklahoma Gas & Electric Company. These classes are conducted as round-table discussions, and at the first meeting, on April 18, about twenty men attended. This course is being conducted by E. E. Hunter and W. J. Brown of the company's power-plant department.

Salt Lake City, Utah.—Salt Lake City's second electrical home is now in course of construction and is expected to be ready for opening about June 15. The manager of the Mine & Smelter Supply Company is building the house for his own use, but has granted permission to the Rocky Mountain Electrical Co-operative League to exhibit it as a model electrical home.

Worcester, Mass.—In March, 1922, the Worcester Electric Light Company installed 708 residential, 97 commercial, 17 power and 14 heating and cooking services, the total meters in use being 36,712, compared with 33,176 a year ago. Vigorous sales efforts by the appliance and other sales departments are yielding fruit, and local interest in house-wiring opportunities has become very active.



TWO CHARTS SHOWING GRAPHICALLY THE SAVINGS EFFECTED BY HARTFORD COMPANY'S NEW RATE

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Why Should We Chase Prices Down the Spiral?

By Le Roy Clark
President Safety Insulated Wire & Cable Company, New York, N. Y.

PRICE has become entirely too great a factor in the sale of a number of important lines of electrical material. The reduced volume of business during the period of depression following the war has built up a degree of competition that has deteriorated into a contest in which the cutting of prices has become too conspicuous a feature, and the cutting of prices never yet created or stimulated business. As a result the tone of the market is off. You find the manufacturers of these products even yet saying that "business is rotten" and deploring conditions, in spite of the fact that building construction is increasing steadily and the demand for their goods improving very noticeably. In other words, this trouble that is bred of unprofitable and unreasonable price competition is an artificial condition within the power of these manufacturers themselves to restore to a healthful balance.

LE ROY CLARK

What causes these falling prices in the face of increased demand? An illustration from the insulated wire industry may give the answer. A salesman representing Wire Manufacturer A calls upon a customer who is in the market for a few thousands of dollars' worth of wire and quotes him $5.85 per 1,000 ft. He returns later to see if he is to get the order, and the customer says, "No, I bought it from Manufacturer B at $5.80." The salesman from Manufacturer C is told the same thing, and what does he do? Does he say, "Well, we can't get them all," and hustle on and get orders from the next man? He does nothing of the sort. Both he and the salesman for Manufacturer A wire or telephone immediately to their respective sales managers and say, "We must have a price to beat Wire Manufacturer B, who is selling at $5.80." Back comes a wire, "Make the price $5.75."

The next thing that happens is that the salesman for Wire Manufacturer B loses a sale to Wire Manufacturer A on the new cut price, and he wires in to his sales manager, "Wire Manufacturer A selling at $5.75. Must have a price to beat." He then receives authority to sell at $5.70, and so it goes. Each salesman thinks he must be able to compete on price for every order, and the weak sales manager is so determined to "hog" the business he meets each appeal with a new reduction. The result is a progressive spiral of prices downward.

If these figures, these new prices, were based on cost, it would mean something, but they are not. They are simply moves in a game of price politics, and while the manufacturer is worrying and grumbling over poor business, he is, in a misguided eagerness to get more orders, continuing and intensifying a predicament of his own making. Because his profits are small he concentrates his selling force on getting more business, and to get more business he still further reduces his profit by cutting prices, as though price were the only thing he had to offer to his trade.

Two Courses of Action

There are two courses of action which would, in my opinion, materially help this deplorable condition. In the first place, the manufacturers must stop being afraid to lose an order. The other fellow must have some business. He is entitled to it. He *must* get it to live, and he is going to get it. And, after all, there is, always has been and always will be business for all whose sales policies are properly balanced to provide real service to the market. This bit of practical business philosophy must be thoroughly implanted in the mind of every salesman. The loss of an order because some one wants to quote a "fool" price is no reason for discouragement, when there are other orders to be had from other customers. Besides, there are many other elements than price in the value of a commodity. Has he nothing to say of his quality and of his service?

The second point is this, that no manufacturer should lower a price to meet competition without careful investigation. Prices ostensibly are set in accordance with cost and to provide a fair margin of profit, and it should take more than a telegram from a faint-hearted salesman, based on the statement of a purchasing agent announcing that some competitor has cut under this price, to influence the manufacturer to sacrifice this proper profit. Too often it is not the voluntary act of the competing manufacturer that starts the price spiral on its downward way, but the chance act of some salesman who weakens at the test and gives a lower price to some favored customer or some "prospect" whom he is overeager to win. Therefore every case should be investigated and the facts ascertained before cutting prices. If the salesman will learn to smile when he meets a cut-price competition and go his way and sell to somebody else, and if the sales manager will learn not to be smoked out by some fearful salesman's clamor, much of this trouble will be ended.

In a word, be willing to lose an order now and then. Don't, in the absence of facts, believe all the bad you hear about your competitor. And, above all things, don't make prices that will give your stockholders reason to question your fitness to handle their money.

Mass Production Important Factor in Future Transformer Prices*

By M. O. Troy

Manager of Transformer Sales, General Electric Company

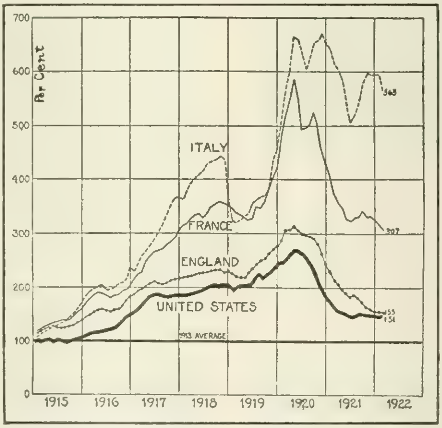
TO ACHIEVE much success in the further reduction of transformer prices, we must look to mass production resulting from standardization. Purchase price bears directly upon investment charges in transmission and distribution systems, and for this reason its study is important in analyses of operating costs and engineering developments. At the same time, the prices of modern transformers are remarkably low in comparison with the cost of other electrical equipment.

When one takes the total costs of installed apparatus, such as the hydraulic development, the power station, the line and distribution system, or the steam plant and all that follows thereafter, and figures this per kilovolt-ampere, the costs of the power transformer can hardly be found in the sum. Were it necessary to spend on power transformers three or four times the amount expended today in order to obtain present results, the investment costs would not be seriously affected. Particularly with distribution transformers, the manufacturer's profits on an individual sale are small. He looks to his turnover for profits, realizing these through selling a large number of units per year.

Through standardization the manufacturer is enabled to concentrate on a production of larger magnitude and in some measure to substitute machine for manual methods of factory operation. This is necessary to offset the increased cost of skilled labor, coal, transportation and other economic factors, which will probably never go back to pre-war levels. As a result of the standardization work accomplished during the past few years, many gains have been made. Before this work was seriously begun something like 8,900 transformer specifications were maintained, and the total number of variations in transformer type, rating, voltage, etc., which could be drawn upon without extreme departures from normal practice was about a million and a quarter. There are now about 3,800 specifications, and this means that larger stocks of the more authorized ratings, etc., can be carried and tends to simplify the work of manufacturer, distributer and user.

Future possibilities of price reduction cannot be as great with the power transformer as with the distribution transformer, because quantity production will never become possible with the former to the extent attainable with the latter. But if such prices are made lower in future, it will come about largely because of the process of standardization and concentration of effort as set forth for the distribution transformer. In purchasing, the user will gain, however, through a closer study of relative prices of power transformers of different ratings and voltages. It is a fact not always appreciated that as voltages rise the cost of providing a much larger kva. rating does not go up in proportion. Thus, for a comparatively small additional investment, the purchaser of an 8,000-kva., 220,000-volt transformer can be furnished a unit of 15,000 kva. or 20,000 kva. rating, on account of the requirements of insulation, mechanical strength and other factors.

Wholesale Commodity Prices in Four Countries



(Federal Reserve Agent, New York District)

WITH business now definitely on the upgrade this chart offers a large degree of satisfaction to American industry. It shows that in the return to normal or pre-war prices the United States has made greater progress than have England, France or Italy, where the wholesale commodity prices are still 55, 207 and 463 per cent, respectively, above the 1913 average.

The Jobber Should Be Considered a Part of Manufacturer's Organization

By a Pacific Coast Jobber

THE responsible jobber should receive the same considerate treatment that is given to an authorized agent of a manufacturer if the jobber is conscientiously building up an outlet for the lines he is carrying. This is vitally necessary to encourage the jobber continually to expand his efforts and to repay him for the pioneer and missionary work he has done. The amount of energy and salesmanship put into the development of a given line in a territory can never be repaid the jobber unless he is assured of a reasonable continuity in the distribution of the goods. This assurance would be virtually the same as that given a regular agent of the manufacturer and would enable the jobber to proceed confidently and safely with development work which otherwise would not be justified.

Too many manufacturers lack a proper appreciation of the relation a jobber holds to the industry in building up the business of the manufacturer. Given a quality product, and the successful jobber demands one, the field is cultivated by the direct efforts of the jobber. He must do the necessary missionary work, not only among the electrical contractors but also largely among the architects, builders, general contractors and industrial establishments. Such work costs money, but if it is well done the manufacturer's line is firmly established. Right then comes the crux of the situation. Will the manufacturer appreciate the good work that has been done and give the jobber his continued support, and will he have confidence that the jobber is in fact pushing the distribution of his materials to the reasonable limit, or will he become greedy for still more rapidly increased sales and try to effect this by dividing the distribution of his goods among several jobbing concerns serving the same limited territory?

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*Abstract of a paper presented before the Providence Section of the A. I. E. E.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

A Million-Volt Testing Transformer.—J. F. Peters.—The design and construction of a million-volt transformer is given. The problem of obtaining the proper installation protection in this type of transformer is discussed.—*Electric Journal,* March, 1922.

Theory of the Two-Phase and Three-Phase Generators.—G. Shimidzu and K. Ito.—In this mathematical paper the authors, by seeking complete solutions of fundamental differential equations, determine the instantaneous value of current subjected to sudden change of load in general. As an illustration of this method the value of sudden short-circuit current of a generator is calculated. In conclusion, the results are compared to those obtained by the usual methods that have been employed previous to this time. These calculations are made with the assumptions that the poles are non-salient, that the entire iron core is finely laminated and that the wave form of flux produced in both the armature and field coil is sinusoidal.—*Journal of the Institute of Electrical Engineers of Japan,* March, 1922.

Lamps and Lighting

The Elements of Good Foundry Lighting.—J. M. Shute.—An evaluation of the factors which are considered in the solution of foundry lighting requirements is given with practical suggestions for the maintenance of the equipment. Investigations have shown that three governing factors determine the lighting requirements. First, the dust and gas in the atmosphere and the film of dust which adheres to all objects make it necessary to use equipment which does not depend upon the walls and ceiling for reflection but directs its light toward the work. Second, although the work appears to be of rough nature, lack of proper illumination often results in imperfect molds from which good castings cannot be obtained. Third and most important is the safety element. The lighting system becomes a form of insurance on the business and should not be neglected because of an erroneous belief that it is unimportant.—*Electrical Review and Industrial Engineer,* April, 1922.

Generation, Transmission and Distribution

La Basse-Isère Hydro-Electric Plant.—A. Dumas.—Situated on the Isère River, this new French hydroelectric plant utilizes a head of 10 m. obtained by damming the river and constructing a canal 1,600 m. in length and a tailrace of 500 m. Seven 5,600-hp. vertical-shaft, single-runner Francis turbines of 107 r.p.m. are directly connected to seven three-phase generators of 4,000 kw. (70 per cent power factor) at 50 cycles and 5,500 volts to 6,200 volts. An 85-kw. exciter unit is keyed to the end of the main shaft. An outdoor transformer station has been built for the transformation of the generator voltage to the line voltage, which is 120,000. This is the first outdoor transformer station of such large output and high voltage in France. There are twelve single-phase transformers of 3,333 kva. arranged in Y-groups with grounded neutral. The high-voltage oil circuit breakers are designed for 400 amp. and a rupturing capacity of 400.000 kva. The 100-km. high-voltage line, unfinished at present, comprises six aluminum cables of 102 sq.mm. cross-section.—*Le Génie Civil,* Feb. 25, 1922.

Tuning of Choke Coils (Part II).—F. Noether.—In Europe there are in use chiefly two arrangements for the suppression of dangerous currents in so-called arcing grounds—the Y-point grounding choke coil of Petersen and the phase choke coil of Bauch. The author gives a very comprehensive analysis of these two protective apparatus, explaining mathematically the different conditions which may be expected in using these protectors. The entire problem is a question of the electrical stability or instability of the device, and it is shown that in both cases two stable conditions and one unstable condition can be expected. The mathematical considerations lead the author to the conclusion that it is theoretically impossible to prevent a displacement of the Y-point of a system so protected; but while the Petersen coil may cause a permanent displacement, the Bauch coil, if properly dimensioned, will always restore the original symmetrical phase condition.—*Elektrotechnische Zeitschrift,* Dec. 23, 1921, and March 23, 1922.

Traction

Overhead Construction of the Mittenwald Road.—H. Westphal.—The Mittenwald railway is the shortest route from Augsburg, Bavaria, over Innsbruck, Austria, into Italy. The electrification of the entire road was finished in 1913. This paper gives a detailed description of the Bavarian part of the overhead construction of this road, built complete by the Bergmann works in Berlin. Until the new Walchensee plant is put into service the power supply of the road is furnished from the Ruetz works, near Innsbruck, at 50,000 volts, single-phase, 15 cycles, and transformed to 15,000-volt overhead voltage in three substations along the road. The structural-steel towers have been built at an average distance of 90 m. These support a simple, self-tightening catenary suspension system holding up a 100-sq.mm. profilized ("figure 8") copper wire. Double-bell insulators are used throughout. They show a wet flashover of 90,000 volts. Pin-type insulators with a wet flashover of 115,000 volts hold the 50,000-volt feeders on the main steel towers.—*Elektrische Kraftbetriebe und Bahnen,* Feb. 24 and March 10, 1922.

Regenerative Braking and Single-Phase Commutator Motors.—B. Nordefeldt.—The author discusses regenerative braking on electric railways, especially from the point of view of the problems which arise when it is employed with single-phase traction. He points out that regenerative braking is of two kinds, that required as a speed check on long down grades and that required for bringing the train to a standstill.—*Electrician (London)*, March 17 and 24, 1922.

Installations, Systems and Appliances

Energy Distribution of Radiant Electric Heaters.—C. F. Wagner.—While superficially most heaters have the same general characteristics, a more careful investigation discloses variations in maximum intensity and in heat distribution. The author presents a few comparative tests made upon three representative types of heaters.—*Electric Journal*, March, 1922.

History of Electric Cast-Iron Melting.—W. E. Moore.—After a short preliminary history this subject is taken up under the headings of metallurgy of electric melting, physical properties of electric cast iron, cheaper character of the charge for electric furnace cast iron, and the electric furnace for chilled iron and malleable iron.—*Paper presented before the American Electrochemical Society*, Baltimore, April 27, 1922.

Electrochemistry and Batteries

The Lead-Hydrate Storage Battery.—A battery of this type has been developed and is now being made by a reputable English firm that has 300 per cent greater capacity—so it is claimed—than any other battery for the same weight. It is also stated that this battery never sulphates and cannot be overcharged or overdischarged. Another claim is that the battery can be charged in fifteen minutes, which, if true, would mean that vehicles propelled by lead-hydrate batteries would have a radius of 300 miles instead of the present limited radius of 50 miles. In a demonstration, after charging this battery for nearly a quarter of an hour at more than 100 times normal rate and discharging at a rate commencing at 500 times the normal charging rate, the plates tested, both positive and negative, showed no sign of injury of any kind.—*Electrical Review (London)*, March 24, 1922.

Cast Iron as Produced in the Electric Furnace, and Some of Its Problems.—George K. Elliott.—The author reviews the scant literature that is published on the electric furnace as applied to the cast-iron industry. The conditions favorable to the production of cast iron in electric furnaces are discussed, and a preference is expressed for the duplex process with basic-hearth electric furnace. Desulphurization and deoxidization in the electric furnace are described. Problems involving sulphur, oxygen and other gases and impurities are discussed.—*Paper presented before the American Electrochemical Society at Baltimore*, April 27, 1922.

Units, Measurements and Instruments

Investigations of Current Transformers.—H. W. Price and C. Kent Duff.—A study of magnetic leakage and leakage reactance of current transformers and of their effect on core loss and magnetizing requirements due to the non-uniformity of core flux and the resulting effects on the ratio and phase angle. Five papers on current transformers are included in this bulletin. The first is an investigation of flux distribution in the cores of current transformers of different types. Leakage reactance is a result of leakage flux—that is, flux which fails to pass through all the turns of both windings because of the strong opposing magnetomotive forces that result from the two windings. In the second paper a method of measuring ratio and phase angle is given. A description of the method employed and some discussion of errors in measurements from changing turns-compensation due to change in wave form are also given. Several oscillograms showing the wave form of various current transformers are shown. The third paper considers the through-type portable current transformer. This is a quantitative investigation of the variations in ratio and phase-angle errors with changes in position and arrangement of primary conductors in several types of transformers. A method for finding the turn ratio of current transformers without the use of auxiliary exploring coils is the subject of the fourth paper. This method is too inconvenient for commercial use, but has several interesting features. Minimizing the errors of current transformers by means of shunts is taken up in the last section of the bulletin. Here the effects of ratio and phase-angle errors of turns-compensation and secondary and primary shunts of resistance or condensance or both are shown. Copies of this bulletin may be obtained without charge from H. W. Price, Electrical Building, University of Toronto.—*Section No. 4, Bulletin No. 2 of the School of Engineering Research, University of Toronto.*

Telegraphy, Telephony and Signals

Radio Service in Aviation.—P. Brenot.—An interesting historic article describing the gradual development of radio telegraphy and telephony on aircraft from its beginning in 1910 to the present day. The author suggests closer co-operation between the builders of air vessels and the manufacturers of radio apparatus, because many radio sets cannot be used on planes without considerable reconstruction of the latter.—*Radioélectricité*, March, 1922.

Improving Antenna Efficiency.—M. B. West.—The purpose of this article is to discuss the question of what really occurs in an oscillatory circuit, with particular reference to the power factor of an antenna circuit. Consideration of the problem indicates that the antenna system is probably the least efficient part of the equipment that goes to make up a radio station, and it is certain that it can be very greatly improved. Actual oscillograms taken of the plate current in vacuum-tube transmitters show great wave-form distortion, and conclusions drawn from them indicate clearly that the greatest efficiency results when conditions are such as to produce maximum distortion.— *Q S T*, April, 1922.

Miscellaneous

Electrical Engineering Progress and Development.—A collection of short articles dealing with modern equipment and practice in the electrical field. Following is a partial list of the subjects covered and their respective authors: "The Boston-Washington Superpower System," by Prof. L. P. Breckenridge; "The Transmission of Power," by H. W. Buck; "Hydro-Electric Power and Western Agriculture," by D. L. Huntington; "City Transportation," by H. W. Blake; "Electrical Public Utilities," by William McClellan; "Railroad Electrification," by E. H. McHenry; "Electricity in Productive Industry," by F. C. Pratt; "The Telephone Today," by R. W. King; "Illumination and Engineering," by H. V. Bozell; "Radio Broadcasting," by H. P. Davis; "The University and Engineering Training," by E. M. Herr.— *Yale Alumni Weekly*, March 10, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Philadelphia Electric Offers $7,500,000 in Bonds Yielding 5.53 per Cent

THE great reduction in the price of capital seeking investment in gilt-edged public utility securities was emphasized last week when the Philadelphia Electric Company placed on the market $7,500,000 in 5½ per cent series twenty-five-year first lien and refunding mortgage gold bonds at 99½ and interest, which will make the yield a little under 5.53 per cent. These bonds are callable only for the sinking fund on any interest date, on thirty days' notice, to and including June 1, 1927, at 107½ and interest; thereafter they are callable as a whole or in part and for the sinking fund at 107½ and interest to and including June 1, 1932, and thereafter at a premium of one-half of 1 per cent for each year of unexpired life or fraction thereof.

Railroad Electrification in Mexico

ENGINEERS are making a study of the practicability of electrifying two or more divisions of the National Railways of Mexico. Oil for fuel for the engines must be now hauled from Tampico, and it is asserted that upon the mountain divisions electric power would be much cheaper and more satisfactory than steam. Power may be obtained, it is said, from the plants of the Guanajuato Electric Light & Power Company and the Northern Power Company, which are in proximity to two of the more important divisions of the railroad system. Should it be found, however, that the National Railways of Mexico can obtain cheaper power by constructing their own hydro-electric plants, this may be done, an abundance of water power being available for the purpose, according to the reports of engineers. The main hydro-electric plant of the Guanajuato Electric Light & Power Company is at El Duro, in the State of Michoacan, and the plant of the Northern Mexico Power Company is at Boquillas, in the State of Chihuahua.

Springfield (Ohio) Rate Dispute Settled at Informal Conference

AGREEMENT for a reduction in the domestic light rates at Springfield, Ohio, was reached at a conference on May 12 between members of the City Commission and representatives of the Springfield Light, Heat & Power Company, and has been ratified by the board of directors of the power company. Under this agreement the present rates of 11 cents for the first 15 kw.-hr. and 7 cents for all additional energy consumed will be reduced to 9 cents for the first 15 kw.-hr., 6 cents for the next 45 kw.-hr. and 3 cents for all additional energy. The agreement, which was reached in an impromptu conference on the sidewalk after the regular negotiations conducted at the meeting of the commission had apparently failed, is to run for a period of five years.

C. I. Weaver, general manager of the company, told the commission following the reaching of the agreement that under it the company's revenue would be reduced approximately $45,000 annually. He declared that the company would operate at a loss the first year, but hoped to make up for this through the five-year average.

Los Angeles-Southern California Edison Contract Consummated

FOR a consideration of $12,044,369.97 paid in cash, and on the execution of a contract by which the city agrees to purchase at wholesale all of the electric power which is not generated from its aqueduct, Los Angeles took over by purchase on Tuesday, May 16, the distributing properties of the Southern California Edison Company which lie within its boundaries. A resolution was adopted by the City Council stipulating "that the city will not support or lend its encouragement to any movement or measure which seeks to supplant the company by some other agency as the source from which it is purchasing its requirements for wholesale power over and above its own production," and that the city will not enter into competition with the company's electrical business in territory outside of its corporate limits.

The power purchase contract is for thirty years, but contains a provision that it may be canceled at the expiration of ten years, but only by a vote of the people. All operating and clerical employees of the company in Los Angeles went over to the city temporarily or permanently with the transfer, and the exchange of ownership was effected without an interruption of service or accounting.

Explaining the contract, W. B. Mathews, special counsel for the Los Angeles Public Service Department, said: "The contract provides that the Edison company has first right to purchase any surplus power generated by the municipal plants in addition to the amount needed to operate the city's system. It is indeed a fortunate circumstance that the Edison company is largely officered and controlled by men prominently identified with the business life of Los Angeles and deeply interested in the welfare of the city. This fact greatly facilitated the progress of negotiations resulting in the sale and transfer to the city of the Edison system. The city's growth makes it certain that it will be for many years a heavy purchaser of power from the company for distribution to the people of Los Angeles."

Speaking of the transaction, Vice-president and General Manager Ballard of the Edison company said: "With the taking over by the city of Los Angeles of the Southern California Edison Company's distributing properties located within the city there terminated in mutual pledges of co-operation a most vexing economic problem. Calm judgment on the part of the city and company officials has resulted in the best possible arrangement that could be arrived at under the mandate of the people that the municipality itself distribute the valuable electric product of the aqueduct to consumers within the city. The $12,044,369.97 we received from the sale of our distributing properties will become part of the $22,500,000 appropriation which we have made for this year's development and transmission of power in the High Sierras."

Interconnection Advocated for Texas

THE great advantages that would accrue to electric light and power service in Texas through the interconnection of transmission lines upon somewhat the same general plan as has been outlined for New England in the report of the Superpower Survey to the national government were dwelt on in a recent interview given by C. E. Calder of Dallas, the retiring president of the Southwestern Electrical and Gas Association and the president of the Dallas Power & Light Company and the Texas Power & Light Company. Predicting that some day every city in the state will be connected with the others under the central control of one company or an association of companies, Mr. Calder continued:

"It is simply a matter of economy and efficiency in distribution. For instance, a city which has connections with out-of-town plants, as in Fort Worth during the recent flood, can connect with the outside lines over an emergency period and enjoy uninterrupted service. A connecting system of power plants also serves to distribute peak loads by utilizing the reserve power of connecting plants at the periods of greatest strain."

Mr. Calder pictured the future development of a Texas superpower system as a growth of plants on the river banks, convenient to communities needing and capable of using power and extending gradually into the eastern agricultural sections and more slowly into the prairie region of the west, but always becoming more and more closely connected.

French Place $8,000,000 in Electrification Contract

THE forward-looking policy of the French railroads in electrifying their main lines is evidenced by the recent definitive action of the Paris-Orleans Railway, one of the six great systems of France. According to dispatches recently received, this railroad, which operates over 5,000 miles of route, has placed an eight-million-dollar contract for eighty freight locomotives and eighty heavy high-speed passenger motor cars to operate on 1,500 volts direct current.

This equipment, according to a statement from the International General Electric Company, will be furnished by a group of French manufacturers headed by its French representatives, the Compagnie Française Thomson-Houston. While the larger part of the order will be manufactured in France, the statement reads, considerable material of American manufacture will, it is understood, also be required.

The engines will be used on an extension of the original electrification made a quarter of a century ago by the French Thomson-Houston Company with General Electric apparatus. The first part of the new 1,500-volt section will cover 125 miles of dense main-line traffic between Paris and Vierzon. The motor cars will replace and extend the present suburban steam service out of Paris.

The high-speed through-passenger service from Paris to Vierzon on the way to southern France will be served by 250,000-lb. electric locomotives capable of regular running speeds between 80 and 85 miles per hour. While these machines are not included in the contracts thus far awarded, the railway company is expected to announce the placing of this business at an early date and to give consideration soon to the purchase of large numbers of additional locomotives for use on the 2,000 miles of its system in the central plateau region.

Consolidation of Public Utilities at Columbus, Ga.

COMPREHENSIVE plans for the consolidation of electric, railway and gas utilities at Columbus, Ga., under the management of Stone & Webster, Inc., have been approved by stockholders of the Columbus Railroad Company, and if sanctioned by the Railroad Commission of Georgia will be put into effect in the near future. The Columbus Electric Company owns all the common stock of the Columbus Power Company, the Columbus Railroad Company and the Gas Light Company of Columbus. Recent legislation in Georgia has given to the railroad company, long engaged in the electric railway and retail electric light and power businesses, the right also to generate and furnish gas to consumers. It has long been apparent that it would be desirable to consolidate the subsidiary companies of the Columbus Electric Company in order that a flexible financial structure might be set up, adequate to care for the expected growth of business and such as to give the stockholders of the Columbus Electric Company direct ownership in the physical properties. The laws of the state confer the right to consolidate the power and railroad companies; the market is regarded as favorable for long-term or permanent financing, and the time is looked upon as advantageous for financing $1,750,000 of 6 per cent coupon notes of the electric company, due July 1, 1922.

The plan contemplates the changing of the name of the Columbus Railroad Company to the Columbus Electric & Power Company and provides for the issue by the new company of first mortgage bonds and 7 per cent cumulative first preferred stock to cover the indebtedness of the Columbus Electric Company, of 7 per cent cumulative second preferred stock to be exchanged for outstanding preferred stock of the Columbus Electric Company and the Columbus Power Company and of $1,500,000 new common stock to be distributed share for share for the present common stock of the Columbus Electric Company.

The initial capitalization of the Columbus Electric & Power Company will total $10,095,700, of which $5,167,000 will be in bonds and the balance in stock. A considerable amount of duplication of corporate administration will be eliminated by the consolidation. Gross earnings of the combined properties for the twelve months which were ended Jan. 31, 1922, were $1,824,787.

Officers of A. I. E. E. Formally Elected at Annual Business Meeting

AT THE annual business meeting of the American Institute of Electrical Engineers, held in New York on May 19, the report of the committee on tellers on the election of officials for the administrative year beginning Aug. 1, 1922, was presented, and the following were declared elected:

President—Frank B. Jewett, New York.

Vice-presidents—District No. 1, Giuseppe Faccioli, Pittsfield, Mass.; District No. 3, W. I. Slichter, New York; District No. 5, R. F. Schuchardt, Chicago; District No. 7, H. W. Eales, St. Louis (re-elected); District No. 9, H. T. Plumb, Salt Lake City.

Managers—H. M. Hobart, Schenectady; Ernest Lunn, Chicago, and G. L. Knight, Brooklyn, N. Y.

Treasurer—George A. Hamilton, Elizabeth, N. J. (re-elected).

The above, together with the following hold-over officers, will constitute the board of directors for the next administrative year: William McClellan, New York; A. W. Berresford, Milwaukee; N. W. Storer, Pittsburgh; C. G. Adsit, Atlanta; F. W. Springer, Minneapolis; Robert Sibley, San Francisco; F. R. Ewart, Toronto; L. E. Imlay, Niagara Falls; F. F. Fowle, Chicago; L. F. Morehouse, New York; Harold B. Smith, Worcester, Mass.; James F. Lincoln, Cleveland; E. B. Craft, New York; R. B. Williamson, Milwaukee; A. G. Pierce, Pittsburgh, and Harlan A. Pratt, New York.

The wide geographical distribution of the Institute's directors is indicated by the fact that twelve states and Canada are represented in the above list.

At the meeting of the board of directors held on the same date F. L. Hutchinson was re-elected secretary of the Institute for the coming administrative year.

New N. E. L. A. Section Chairmen

AT THE recent annual convention of the National Electric Light Association, held in Atlantic City, the following were elected to head the four sections for the coming year: R. F. Schuchardt, Technical Section; O. R. Hogue, Commercial Section; William Schmidt, Jr., Accounting Section; H. T. Sands, Public Relations Section. These new chairmen will succeed the following, who have headed these sections during the past year: N. A. Carle, Technical Section; R. H. Tillman, Commercial Section; E. J. Fowler, Accounting Section; M. J. Insull, Public Relations Section.

R. F. SCHUCHARDT
Electrical Engineer
Commonwealth Edison Company

O. R. HOGUE
Power Sales Department
Commonwealth Edison Company

WILLIAM SCHMIDT, Jr.
Secretary and Assistant Treasurer
Consolidated Gas, Electric Light & Power Co. of Baltimore

H. T. SANDS
Charles H. Tenney & Company

N. A. CARLE
Vice-President and General Manager
Public Service Production Co.

R. H. TILLMAN
New Business Manager
Consolidated Gas Electric Light & Power Co. of Baltimore

E. J. FOWLER
Statistician
Commonwealth Edison Co.

MARTIN J. INSULL
Vice President
Middle West Utilities Co.

Chairmen of N.E.L.A. sections for the coming year: Mr. Schuchardt, Technical Section; Mr. Hogue, Commercial Section; Mr. Schmidt, Accounting Section; Mr. Sands, Public Relations Section. Chairmen of N.E.L.A. Sections during past year: Mr. Carle, Technical Section; Mr. Tillman, Commercial Section; Mr. Fowler, Accounting Section; Mr. Insull, Public Relations Section.

Bond Issue of $12,500,000 Sold by Commonwealth Holding Company

The Commonwealth Power, Railway & Light Company, New York, has sold $12,500,000 twenty-five-year 6 per cent secured sinking-fund gold bonds, the proceeds of which will be applied to the payment of banking indebtedness due Nov. 1, 1922, and convertible bonds due May 1, 1923. This provides for the greater part of the indebtedness of the company. The issue is offered at 90, yielding more than 6.80 per cent.

In arranging this financing it was found desirable to group into one company the ownership of all the controlled companies engaged in the electric light, power and gas business, and to this end the organization of a new company, known as Commonwealth Power Corporation, has been effected to acquire the common stock of the Consumers' Power Company, Central Illinois Light Company, Illinois Power Company, Southern Indiana Gas & Electric Company and Springfield Light, Heat & Power Company, together with $5,318,500 of the preferred stocks of some of these companies, all of which stocks have been pledged as collateral to the $12,500,000 twenty-five-year bonds to be sold. All of the preferred and the common stock of the Commonwealth Power Corporation come into the treasury of the Commonwealth Power, Railway & Light Company, either directly or through its subsidiary the Union Railway, Gas & Electric Company, so that the equity ownership of the Commonwealth Power, Railway & Light Company is not in any way adversely affected through the new issue of bonds.

Westinghouse Reports Sales for the Year of a Hundred Million

In spite of the extremely adverse conditions of the past year, the sales of the Westinghouse Electric & Manufacturing Company amounted to almost exactly $100,000,000, as shown by its annual report, as of March 31, 1922. This is the largest volume of business ever handled by this company except during the abnormally active three years from 1919 to 1921. Manufacturing costs were high, however, and could not be reduced as rapidly as prices fell. Furthermore, the expense of development work and about $1,500,000 for depreciation of inventory were charged against manufacturing costs, so that the increase in surplus was only slightly greater than the amount paid out in dividends.

The excellent "cash position" of the company is shown by the fact that its current assets—including cash, United States securities, and accounts and notes receivable—total $41,700,000, while its current liabilities—accounts payable, dividends unpaid, accrued interest, etc.—are only $11,400,000. In addition, the company possesses an inventory of $55,000,000.

Chairman Guy E. Tripp states in his report: "The contraction in orders booked continued throughout the year until January, 1922, when there began a substantial improvement which has since been maintained. In addition to the favorable indications for an increasing demand for the regular lines of your company's products, a large demand for radio-telephone receiving apparatus has recently developed, with a prospect of its continuance for an indefinite period. It should be pointed out, however, that the ensuing year promises to be a period of keen competition."

The income account for the year is as follows: Gross earnings, $99,722,026.09; cost of sales, $93,461,846; net manufacturing profit, $6,260,180.09; other income, $2,673,808.65; gross income, $8,933,988.74; interest on bonds and notes, $3,096,600.08; net income available for dividends, etc., $5,837,388.66.

Hoover Calls Coal-Price Conference

To make effective a plan intended to prevent a runaway market in coal a general coal-price conference has been called by the Secretary of Commerce to be held in Washington on May 31. This announcement by Secretary Hoover followed a preliminary conference on May 18 at which fifty operators, representative of all the non-union fields, voted to use the Garfield schedule of prices of Oct. 29, 1917, as a basis for fixing fair prices of coal. At the same time announcement was made that buying for the larger consumers will be done through committees so as to unify these purchases and prevent the entrance of speculators.

Federal Court Sustains North Carolina Company Against Southern Power

The suit of the North Carolina Public Service Company against the Southern Power Company has been decided in favor of the former company in the United States Circuit Court of Appeals at Richmond, Va., which has ruled that the defendant company cannot refuse to sell electrical energy to the plaintiff for resale and distribution to citizens of Greensboro and High Point, N. C. In this suit, which has been before the courts for nearly two years, the North Carolina company claimed that the Southern Power Company had discriminated against it by refusing to renew a contract on equitable terms, and the former company obtained a mandamus from the United States District Court forbidding discontinuance of service at Greensboro and High Point pending the determination of the case. It was alleged that no other supply of power than that of the Southern Power Company was available at the towns named.

The Circuit Court of Appeals in its finding for the plaintiff said:

"The right of eminent domain could not have been conferred on the defendant except in consideration of the service to the public expected of it in the exercise of the charter powers granted. This power of eminent domain cannot be separated from the duties assumed by the corporation. Exercising this right to carry its lines and power anywhere in the state by condemnation, the defendant has carried them to cities and towns and has there made contracts with other public service corporations under its charter power to use its property for 'transmission of current to independent vendors thereof.' Among these independent vendors furnished with current is the Southern Public Utilities Company. This company is nothing more than an offshoot of the Southern Power Company, controlled by it and with the same stockholders. It has made contracts with the Southern Public Utilities Company to furnish it current at a rate materially lower than that demanded of the North Carolina Public Service Company."

(For previous decisions rendered in this suit see Electrical World for Dec. 25, 1920, page 1,282; July 9, 1921, page 88, and Jan. 21, 1922, page 152.)

Freight Rates Cut 10 per Cent

MOST unexpectedly the Interstate Commerce Commission on Wednesday handed down its decision on freight-rate revision, making a horizontal cut of 10 per cent effective July 1. From all early indications the cut is not being received favorably either by the railroads or the shippers. The 10 per cent reduction makes a considerable difference in the revenue of the railroads, but it is not sufficient to make any appreciable difference in the price of commodities. In coal, for instance, the most that any power company can expect will probably be not more than 50 cents per ton. On the average haul the reduction will probably be around 25 to 30 cents per ton.

In making its decision the commission refused to consider a lower valuation of the roads, but it did take the position that 5¾ per cent was a fair return. Prior to this time the roads had been permitted to earn up to 6 per cent.

Utah Light & Traction Offers $12,471,000 in Bonds to Yield 5.70

ANOTHER low-priced issue of electric light and power securities has come on the market this week, the Utah Light & Traction Company offering $12,471,000 in first and refunding mortgage 5 per cent gold bonds, series A, due Oct. 1, 1944, at 91 and accrued interest, yielding a little over 5.70 per cent. Of these bonds $12,136,000 were acquired in 1914 and 1915 in part payment for the properties by the Oregon Short Line Railroad Company (Union Pacific system) and have in the interim been in the treasury of that company. Their availability at the price quoted gives one more evidence of the growing ease of the money market where attractive public utility issues are concerned.

Senate Committee Not Likely to Favor Ford's Muscle Shoals Offer

TWO important developments took place in Washington during the week in connection with the investigations concerning the Muscle Shoals power and nitrate projects. The first was the appearance before the Senate committee on agriculture and forestry of Col. Hugh L. Cooper, the government's consulting engineer in the design and building of the Muscle Shoals power projects, with a new set of recommendations, which include the idea that the whole Muscle Shoals problem shall be referred to the Federal Power Commission, Congress meanwhile making an appropriation of $7,500,000 for another year's work to complete the dams.

The second important development was the presentation of informal proposals by the Alabama Power Company to proceed under the contract it has with the government for the purchase of the government's interest in the steam-power plant at Gorgas, Ala., on the Warrior River.

The Secretary of War reported to the Senate committee and to the House military affairs committee, which are considering the offers for Muscle Shoals of Henry Ford, the Alabama Power Company and others, that he has been offered $2,500,000 for the government interest in the Gorgas plant, the railroad and the transmission line to Sheffield, Ala. The sum mentioned being, for the single item of the Gorgas plant and appurtenances, half the $5,000,000 that Mr. Ford is offering for all of the government's $107,000,000 worth of property.

Survey of Simplification Needs to Be Conducted by Standards Committee

AT THE request of Secretary Hoover the American Engineering Standards Committee will undertake at once a canvass to determine what simplification in manufactured products is most needed. This canvass will be conducted through the engineering and technical bodies having representatives on the committee or co-operating in its work, and it will extend into almost every industry in America. It is a step in the movement fathered by Mr. Hoover to retrieve for industry a few of the billions of dollars wasted annually, and it indicates a co-ordination of this work and the work of the American Engineering Standards Committee.

What the relationship between the simplification work of the Department of Commerce and the standardization work of the Standards Committee should be has been the subject of considerable discussion. It is clear now that there will be no duplication or overlapping. The executive committee of the latter body has by resolution pledged co-operation. Representatives of the committee recently held a conference on the subject with Mr. Hoover, and subsequently an arrangement was made for permanent exchange of representatives between the two organizations.

Witnesses Heard For and Against the Bacharach Bill

ANOTHER hearing on the Bacharach bill was held before the House judiciary committee in Washington on May 23. This measure, which is designed to limit the power of federal courts in injunction proceedings, is not expected to become a law in the near future, but great interest is shown in the measure, and the hearings are well attended by many who believe the bill to be a dangerous and improper one. The hearing of May 23 was stopped by the demand for the presence of members of the House on the floor to answer to roll calls, and another hearing was set for June 8.

The chief witness at last Tuesday's hearing was Alfred P. Thom, general counsel of the National Association of Railway Managers, who appeared in opposition to the measure. He took the position that the proposed bill was obnoxious to the Constitution in that it would emasculate the equity powers of the federal courts, rendering them incapable of granting relief.

The only advocate of the bill to be heard was S. A. Ettleson, corporation counsel of Chicago. He related experiences of the city government with the traction company there and said the enactment of the Bacharach bill would save the citizens of Chicago $60,000 a day in street-car fares, a reduction in the fare being now prevented by federal court injunction.

The State Bar Association of Ohio was represented by F. E. Eagleson of Columbus, who contended that the bill if passed would deprive the federal courts of fundamental jurisdiction.

California to Increase Safety Standard of Pole Lines

THE California Railroad Commission has commenced an inspection of all pole lines in the state with a view to requiring elimination of hazardous conditions and the more complete enforcement of state law requirements relative to safety of employees and of the public. Utilities will be required to eliminate all hazardous conditions of line construction and comply fully with the requirements both under the state law and under the commission's rules on safety. For several years the commission has been preparing a new code of construction to improve safety conditions. Owing to the conditions which existed during the war and for a year or two thereafter detailed inspection work was postponed. Under the present plan all electric, railway, telephone and other utilities and municipalities operating pole lines will undergo a careful and thorough inspection.

Class D Members of the N. E. L. A. Meet at Atlantic City

A MEETING of Class D members of the National Electric Light Association was held during the Atlantic City convention last week. Routine reports of officers of the exhibition committee were presented. John Mustard of the Wagner Electric & Manufacturing Company, J. W. Perry of the Johns-Manville Company and F. D. Fagan of the Edison Storage Battery Company were re-elected to the exhibition committee for a term of three years. The reports showed that the exhibition this year included 25 per cent more exhibits than at any previous convention. It was also stated that the expenditures would come within the estimates originally prepared. A rising vote of thanks and appreciation was given to L. W. Shugg, director of exhibits. Several speakers commented on the able manner in which Mr. Shugg had handled his difficult duties.

The exhibition committee held its annual meeting on Wednesday, May 17. After transacting routine business officers were elected for the ensuing year as follows:

Chairman—C. L. Peirce, Jr., Hubbard & Company, Pittsburgh; secretary and treasurer, Frank H. Gale, General Electric Company, Schenectady.

Electric Rolling Mills Discussed by Steel Engineers

A POWER consumption of 88.5 kw.-hr. per ton of rolled product was one of the things dwelt upon in the description of the rotary-converter induction-motor system installed at the Calumet Steel plant, Chicago, given by F. R. Bert before the Association of Iron and Steel Electrical Engineers on May 15. Because of the fact that the plant had not been running continuously for some time complete economic data were unavailable. However, it was found that the total bills for energy had never equaled the old coal bills. From an operating viewpoint the shutdowns due to this new type of equipment were very small. Out of 2,700 hours of operation, a delay of only two-tenths of 1 per cent resulted.

According to Mr. Bert's figures, an increased tonnage of 10 per cent was obtained with this system. Its flexibility is shown at an input of 280 kw., where the time to attain full speed was only six seconds. The only trouble with the system was due to some wrong connection on the master control of the direct-current field which made the speed changes swing completely from low to high speed. This fault, however, was remedied and high flexibility returned.

The relation of the engineer to fuel conservation was presented very forcefully by J. W. Hayes of Chicago.

New York Commission Says Utilities May Not Recover Losses from Customers

"THE public does not insure a utility against loss. If poor business judgment has been exercised in the management of a property, the public should not suffer thereby. Neither should future ratepayers be called upon to reimburse the company for losses sustained by insufficient rates granted to past consumers of the company."

This ruling was made by the New York Public Service Commission on Monday in an order issued to the Western New York Utilities, Inc., of Medina directing that it return to the schedule of electric rates charged in Albion, Barker, Lyndonville, Medina and other places in Orleans, Niagara and Monroe Counties prior to Feb. 23, 1921, when the company increased its charges. Present rates are to be set aside on June 1, and the rates formerly charged are to prevail for a year and thereafter until changed by the commission. The general average reduction ordered is about 15 per cent. It was claimed by the company that it had never obtained an adequate return upon the value of its property used in the public service, and evidence was given by it that its rates for power in previous years had been too low.

Electric Steam Generator of 25,000-Kw. Rating Installed

THE Electric Furnace Construction Company of Philadelphia announces that an electric steam generator recently constructed and installed by the Dominion Engineering Works, Montreal, at the plant of the Laurentide Paper Company, in the Province of Quebec, and designed for 25,000 kw., is averaging 34,000 kw. and producing 100,000 lb. of steam per hour at 125 lb. pressure. This, the Philadelphia company says, is the largest electric steam boiler ever built, although the space occupied by it is small compared with that taken by the fuel-fired boilers it is replacing. The saving in coal alone, it is reported, amounts to 150 tons a day.

Danger from Amateur Radio Outfits

THE Cleveland Electric Illuminating Company is urging the City Council to enact an ordinance requiring the inspection of amateur radio plants in order to avoid the danger of their wires coming into contact with high-tension light, power and telephone wires. At a committee hearing, representatives of the company said that 489 aërials had been removed from its poles. Most of them were soon reattached in even more dangerous locations than before, in some instances joining to insulators carrying primary wires, in others crossing or paralleling high-tension wires at a distance of only a few inches.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Sandusky Increases Output.—Station records of the Sandusky (Ohio) Gas & Electric Company for the month of April show that 985,000 kw.-hr. was generated. For the same month last year the output was 733,000 kw.-hr., an increase this year of nearly 35 per cent.

Transatlantic Radio Telephony.—A loud-speaking wireless-telephone installation has just been completed at Lausanne, France, which will be in communication with the Eiffel Tower telephone every evening and will be able to record communications from London, Berlin and even America.

Water-Power Development in Dutch East Indies.—A well-illustrated summary of the water-power situation in Netherlands East India, including Java, Sumatra, Celebes and Algemeen, has been issued in Dutch by the government of those countries, where extensive plans for electrification are in process of formulation.

Extension in Kentucky Mining Field.—It is reported from Whitesburg, Ky., that the Kentucky & West Virginia Power Company, which supplies about 90 per cent of the mine power used in the Hazard coal fields, has purchased the power and light plant of W. C. Daniel at Whitesburg and will bring in its high-tension wires, supplying that city and a number of coal mines in the vicinity.

Water Power on a Japanese Pacific Island.—No place nowadays is too remote or too small to escape the worldwide movement to exploit water power. Two little hydro-electric plants are to be established by the village of Mine, on the island of Hachijoshima, which is one of the seven islands of Izu on the outskirts of Japanese territory far on the Pacific. The project is to be financed by twenty-year bonds, the cost being estimated at 125,000 yen.

Daylight Saving Causes Confusion at Washington.—Daylight saving went into effect in Washington on May 15. The clocks were not put forward and as a result great confusion ensued. The government departments now open at 8 a.m. and close at 3:30 p.m. This arrangement supersedes the staggered-hour plan and increases materially the peak load which the street railways are called upon to handle. Congress, the theaters and many stores are retaining the same schedule of hours they have been following. Effort is being made to induce Congress to enact a daylight-saving law for the District of Columbia, but apparently no such action will be taken.

Employee Meetings in the Intermountain States.—The Rocky Mountain Electrical Co-operative League is sponsoring a series of employee meetings for the purpose of acquainting every employee in every branch of the electrical industry with the aims and purposes of the league and the work which it is doing and of thus extending the spirit of co-operation. At the first of these meetings, held in the main office of the Capital Electric Company, Salt Lake City, with almost 100 per cent attendance of that company's employees, the interest and enthusiasm shown are described as remarkable.

Daylight Saving in the Eastern States.—Three out of every four residents of New York State are now enjoying the benefits or suffering the penalties of daylight saving. Using the 1920 federal census statistics as a basis of computation, it is found that last year 75½ per cent of the people in the State had daylight saving, while this year, owing to opposition in the agricultural communities, the percentage has shrunk to 73. Two out of every three persons in New England and the States of New York, New Jersey, Pennsylvania, Delaware and Maryland are observing daylight-saving time. The total population of these states, based on 1920 census figures, is 31,334,717, of whom 20,727,116 live in cities, towns and villages where daylight saving is observed.

How Service Was Maintained in Flooded Illinois Town.—Beardstown, a city of 8,000 people on the Illinois River, was flooded during the recent period of high waters in the Middle West. How the Central Illinois Public Service Company, working under extreme difficulties, was able to give the city continuous gas and electric service is recounted by a local paper, which says as regards the work of the central station: "Maintenance of electrical service was a feat in itself. With a total of only fourteen minutes' intermission during the entire period of the flood, the company is believed to have established a noteworthy record. At the crest of the flood the water in some sections was so high as to be only a foot from the wires. The longest single intermission was approximately eight minutes. This was caused by a storm at Keokuk."

Radio Plants Soon to Link Continents.—High-power wireless stations of the Radio Corporation of America will be completed this year at Bogota Bay, Colombia, and in Cuba, and the great Buenos Aires station will be in operation by the middle of 1923, according to E. J. Nally, president of the company, who has returned from conferences in Europe at which a working agreement was reached among the chief wireless companies of England, France, Germany and America. From any part of the United States wireless messages may be relayed speedily to Buenos Aires, South Africa, Java, Calcutta or Melbourne, when the radio building programs of the great American and European countries are completed. At present France has the most powerful station in the world in the American-built Lafayette towers near Bordeaux, but this will be superseded by the end of this year by the Port Jefferson station of the Radio Corporation. The station under construction at Ste. Assise, near Paris, will be second. The British wireless chain connecting England with all parts of the empire will have one station comparatively close to Argentina; that will be the station at Bathhurst, in Gambia, on the extreme western point of Africa, where the continents of Africa and South America make their closest approach. The plans of France for extremely long-distance communication are centered in the station at Ste. Assise. This station is expected by its promoters to communicate with Saigon, Indo-China, 5,500 nautical miles; Buenos Aires, 5,950 miles, and, of course, many nearer points. Holland is building one station at home and one in Java for communicating a distance of 6,100 miles, almost entirely overland.

Associations and Societies

Geographic Division Conventions of N. E. L. A.—Now that the Atlantic City convention is past, interest centers on the annual meetings of the geographic sections of the National Electric Light Association, which, as announced below, include those of the Pacific Coast Section, at Los Angeles, assembling next Wednesday; of the Northwestern, the North Central and the Canadian sections, meeting in June at Boise, St. Paul and Ottawa respectively, and of the New England Section, which is to meet at New London, Conn., in the first week of September.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A. Geographic Divisions—Pacific Coast, Los Angeles, May 31-June 3; Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.

American Association of Engineers—Salt Lake City, June 5-7.

American Society Heating and Ventilating Engineers—Buffalo and Detroit, June 6-10.

Electric Power Club—Hot Springs, Va., June 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

Society for the Promotion of Engineering Education—Urbana, Ill., June 20-23.

American Society of Civil Engineers—Portsmouth, N. H., June 21-22.

American Association for the Advancement of Science—Salt Lake City, June 22-24.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30. (For program see issue of May 13, page 968.)

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of May 13, page 972.)

A. I. E. E., Pacific Coast Convention—Vancouver, B. C.—Aug. 8-11.

International Association of Municipal Electricians—New Bedford, Mass. Aug. 22-25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Betterments and New-Business Expenditure in Relation to Rates.—Where the physical value of a company's properties has been fixed, the Supreme Court of Washington has held in State ex rel. City of Spokane and State ex rel. Spokane Falls Gaslight Company vs. Director of Public Works, the Department of Public Works must at each subsequent hearing upon rate controversies ascertain the betterments since the date of the preceding hearing and the cost of reproducing such betterments and supplement the former finding with the additions. The reasonableness of an expenditure incurred in obtaining new business also falls, in the opinion of the court, within the regulatory power of the department. (205 Pac. 3.)*

Supreme Court Gives Final Blow to New York State 80-Cent Gas Law.—The Supreme Court of the United States has handed down a unanimous decision virtually disposing of the remaining litigation involving the question of the price of gas in New York. In line with its decision in the Consolidated Gas Company case, it held the 80-cent gas rates as fixed by the law of 1906 to have been confiscatory for the entire period of 1919 to 1920. Seven subsidiaries of the Consolidated Gas Company were affected, and approximately $10,000,000 which had been impounded pending the outcome of the rate cases is freed. It was said that the gas cases were perhaps the bulkiest and most expensive ever presented to the Supreme Court. The court cut the compensation of the special master from $118,000 to $49,250.

Powers of California Railroad Commission.—Finding, in Water Users and Taxpayers' Association of Merced vs. Railroad Commission, that the commission's regulatory powers do not include corporate governmental agencies such as municipal corporations or irrigation districts, even when engaged in the exercise of proprietary functions, the Supreme Court of California none the less decreed that the commission had the power to approve a contract between the San Joaquin Light & Power Corporation and the Merced Irrigation District for the purchase from the latter by the light and power company of hydro-electric energy, as against the objection that the commission had no power, in determining the basis of the price to be paid for such hydro-electric energy, to take into account properties and plant of the irrigation district which were not in existence at the time of such determination, when the cost of their construction and their output of hydro-electric energy could not be known. (205 Pac. 682.)

Contract Made by Power Company to Furnish Energy to City Plant May Be Upset by Commission.—The city of Cimarron, Kan., having found its municipal plant inadequate and contracted to purchase electrical energy from the Midland Water, Light & Ice Company, subsequently brought suit against that company to enforce the terms of its fifteen-year contract and claimed that the Public Utilities Commission, which had granted increased rates, was without jurisdiction. The Kansas Supreme Court has overruled the city's contention and found that under a statute passed before the making of the contract the commission possessed the power which it had exercised. (205 Pac. 603.)

Contracts Between Public Service Corporations Which Involve Obligations to Public Are Subject to Commission's Control.—In a suit brought by the Oklahoma Gas & Electric Company and three other utilities engaged in the distribution of gas against the Oklahoma Natural Gas Company, a producing concern, a writ of prohibition was sought to enjoin the Corporation Commission of the state from proceeding to inquire into contracts entered into between the plaintiffs and the defendant. The Supreme Court of Oklahoma found that a writ of injunction could not be issued when the contracts concerned might be unconscionable, oppressive or impair the obligations of the utilities to the public. The question was not, the court said, whether the petition of the Natural Gas Company to the commission did or did not allege facts entitling it to relief from the contract, but whether under any circumstances the commission had jurisdiction. (205 Pac. 768.)

Municipality Cannot Increase Contract Rates Deemed Inadequate—The Supreme Court of Iowa, in Town of Sibley vs. Ocheyedan Electric Company, an action to recover a sum claimed for electrical energy furnished to the defendant by the plaintiff city, affirmed judgment for the defendant, asserting that under the statutes of the state the municipality has no power to increase contract rates entered into in 1914 for twenty years, on the plea that they were no longer adequate, unless the consent of the other party to the contract is obtained. Where a municipality is authorized to make a contract for the sale of the product of its electric light plant to those outside its corporate limits, the court held, the terms and declarations of such contract rest within the sound discretion of the municipal authorities, and when it has been fairly entered into it can only be overthrown by the courts for fraud, abuse or excess of authority, or other like grounds (187 N. W. 560.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Money Expended from Earnings for Additions and Betterments Excluded from Valuation.—The city of Cushing, Okla., asked for a reduction in electric rates, and at the same time the Minnesota Electric Light & Power Company filed an application for an increase. In valuation proceedings the Corporation Commission of Oklahoma refused to include property valued at $12,515 not used in the public service and also expressed its belief that, although $27,500 was charged to depreciation reserve, all expenditures for replacements or renewals have been made from earnings and charged to operation. The commission also found that only $56,000 of new capital had been invested, while during the same period $91,481.97 had been expended for additions and betterments, leaving $35,481.97 which had been taken from the earnings of the plant and so invested. The commission takes the position that this represents an investment not by the company but by the public and cannot be included in the valuation for rate-making purposes. Nor will the commission permit expenses incurred in making fights for increased rates to be added to operating expenses.

Fair Return During Business Depression.—In settling rates for the Indiana Bell Telephone Company the Indiana Public Service Commission recently made these comments on the right of a public utility to a fair return upon its property during a period of business depression: "It is contended that because other business is slack and suffering loss public utilities should likewise be forced to forego all earnings on their investments, and in this particular case it is strenuously contended that this utility should be required to continue to operate at an actual daily loss. All these curious arguments overlook the important fact that the public utility business is radically different from any other. Public utility business is regulated, and other business is not. . . . There is another important difference between the public utility business and private unregulated business. In time of adversity, or in hard times like the present, the private business ceases to borrow money, immediately cuts down expenses by discharging men, by cutting wages, by refusing to buy unless the price is satisfactory, and, if necessary, it reduces its output or closes up shop and waits for more prosperous times. The public utility can do none of these things. It must continue to operate at full blast, regardless of the nature of the times."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Charles Foster has opened a consulting office in mechanical and electrical engineering in the Sellwood Building, Duluth, Minn. Mr. Foster has had thirty years' experience in the design, construction and operation of public utility plants. He was born in Dwight, Ill., in 1874 and received his technical training at the Iowa State College. He started his engineering experience as shift engineer at the Ames (Iowa) municipal lighting plant, after which he operated several plants in the Northwest Central States, including those at Algona and Sheldon, Iowa, and Bismarck, N. D. Later he designed and constructed electric light and power heating plants for the State Capitol at Bismarck and spent nine years as designing and construction engineer for a contracting firm doing business in the territory adjacent to St. Paul. He was later associated with Charles L. Pillsbury, consulting engineer, St. Paul, and designed and supervised the construction of the new electric light and power plant at Hibbing, Minn. Mr. Foster's engineering practice and experience cover virtually all branches of electrical and mechanical engineering.

CHARLES FOSTER

Fred W. Insull, president of the Public Service Commission of Oklahoma, has been appointed chairman of the railroad committee and a member of the oil and gas committee of the Tulsa Chamber of Commerce.

W. E. Brown has been transferred from the Northern Texas Electric Company to the Houston Electric Company, where he will act as superintendent of power. Mr. Brown was secretary to the manager of this company for two years previous to his transfer.

Milton H. Locke, for many years connected with the sales department of the Connecticut Power Company, has resigned to become commercial manager of the Salem (Mass.) Gas Light Company.

C. W. Hunter, gas engineer with Stone & Webster, Inc., has resigned to become vice-president in general charge of the business of the Davis & Farnum Manufacturing Company, Waltham, Mass.

W. F. Raber, vice-president and general manager of the Arkansas Valley Railway, Light & Power Company, is serving as a representative of the city of Pueblo on the Colorado Tax Revision Committee of One Hundred.

A. J. Muth of Chicago has been elected by the Board of Public Works at Goshen, Ind., as superintendent of the municipal light, water and heat plant to fill the vacancy caused by the resignation of Joseph H. Stewart of Goshen, which becomes effective June 1.

Dr. Carl Hering of Philadelphia was made an honorary member of the American Electrochemical Society at its recent meeting in Bethlehem, Pa. Dr. Hering is one of the founders of the society and an ardently interested worker in its affairs. He has made extensive studies of electric furnaces.

William F. Strouse, chief engineer of the Public Service Commission of Maryland, has resigned, effective July 1, and will be succeeded by H. Carl Wolf, now engineer of utilities for the commission. Mr. Strouse will continue as a member of the commission engineering staff in the capacity of valuations engineer.

H. D. Miller, who has been connected with the Western States Gas & Electric Company, Stockton, Cal., since 1919, has recently been promoted to the position of commercial agent. Prior to entering the army in 1917 Mr. Miller was in the service of the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

Carl G. Schluederberg has been elected president of the American Electrochemical Society, his election having taken place while he was en route to the United States from South America, where he made a survey of business conditions for the Westinghouse Electric & Manufacturing Company. Mr. Schluederberg, who is executive assistant to the manager of the Westinghouse Electric Company, has been extremely active in American electrochemical circles and is a member of the Pittsburgh Section, A. E. S. He has been a member of the board of directors for the past six years.

E. E. Hunter, chief engineer of the Oklahoma Gas & Electric Company, has been elected vice-chairman of the Oklahoma Section of the American Institute of Electrical Engineers.

Vreeland Y. Leonard of Indianapolis has taken over the management of the utilities department of the Interstate Public Service Company, Columbus, Ind. He succeeds Kenneth Swan, who has been transferred to the engineering department of the company. Mr. Leonard, who will have charge of the local electric lighting plant, was formerly a consulting engineer.

Harry Reid, who was recently elected president of the Great Lakes Division of the N. E. L. A., is the head of the Interstate Public Service Company, Indianapolis, Ind. Mr. Reid was born in Johnstown, N. Y., on Dec. 31, 1879, and at the age of twenty-one years obtained a position as cashier with the Fulton Gas & Electric Company of Johnstown and Gloversville, N. Y. He served this company in almost every capacity except that of manager until 1907, when he became owner of the Versailles (Ky.) Electric Light Company. He disposed of this property in 1912 to the Middle West Utilities Company and became its first vice-president. In 1913 Mr. Reid was elected president of the Kentucky Utilities Company, a position he still holds. In 1917 he was elected to the presidency of the Interstate Public Service Company.

HARRY REID

Oscar Clifford has been appointed commercial agent of the Reno (Nev.) properties of the Stone & Webster Company, succeeding W. H. McInnis, who was transferred to a similar position with the Keokuk Electric Company.

W. E. Murchie, superintendent of the municipal light and water plants at Muncie, Ind., has resigned. He was succeeded by Clarence Griffith, who was formerly connected with the light plant. Mr. Murchie will go to Goshen to be manager of the Goshen and Warsaw light plants, which were recently bought by the Middle West Utilities Company.

R. H. McLain, until recently in the power and mining engineering departments of the General Electric Company at Schenectady, has resigned to become sales manager of the Maine Electric Company, manufacturer of dynamos and motors, Portland, Me. Mr. McLain is well known in the material-handling field, having specialized on the handling of materials with electrical machines while with the General Electric Company. He was born in 1886 and was graduated from the University of North Carolina in 1906, going soon thereafter into the employ of the General Electric Company in the testing department, where he remained for two years. Later he was transferred to the industrial-control engineering department and finally to the power and mining engineering departments of the company. While in this work he had an active part in the electrical engineering of many coal and ore-handling docks on the Great Lakes, along the Atlantic seaboard and on the Panama Canal, his experience including the electrification of cranes and hoists of all sizes and kinds. Mr. McLain has been interested in technical society work, being an associate member of the A. I. E. E. and connected with the committee on cranes and hoists of that society, an associate member of the Association of Iron and Steel Electrical Engineers, a member of the American Institute of Mining Engineers and of the Society of Terminal Engineers. He has served as chairman of the equipment committee of the material-handling division of the A. I. M. E. and was president of the Society of Terminal Engineers for the year 1921-22. He has prepared a number of short articles and papers dealing with material handling for these societies and for various publications.

R. H. McLAIN

B. A. Plimpton has been appointed sales manager of the Locke Insulator Corporation, Le Roy, N. Y.

George W. Sanford has been made general manager of the Bristol Brass Corporation, manufacturer of brass, Bristol, Conn.

Travis Welch has been appointed Western representative for the Beverly Lights Corporation, Providence, R. I., with headquarters in San Francisco.

O. E. Crites, sales manager for the Sheridan County (Wyo.) Electric Company, has resigned to take over one of the Colorado districts for the Hoover Vacuum Cleaner Company.

Clarence W. Kinney, formerly electrical engineer, Royal Worcester Corset Company, Worcester, Mass., has joined the organization of the Economy Electric Company in the same city.

E. F. Du Rieu of the General Electric Company has left for Australia, where he will be connected with the Australian General Electric Company, Melbourne.

J. P. Hutcheson has returned to the Electrical Engineering & Manufacturing Company, Pittsburgh, after an absence of two years, as manager of the Cleveland office of the company. Mr. Hutcheson was on the sales force of the Westinghouse Electric & Manufacturing Company for a number of years, resigning to go with the Electrical Engineering & Manufacturing Company in 1919. In 1921 he left to become district representative in Chicago for the Latrobe Tool Company.

K. A. Pauly, head of the steel-mill section of the power and mining department of the General Electric Company, has recently been appointed chief engineer of the power and mining department of that company, succeeding D. B. Rushmore, who has been appointed to the consulting engineering department. Mr. Pauly was born in Springfield, Mass., in 1872 and entered the Massachusetts Institute of Technology, being graduated in 1896. He was employed by the American Telephone & Telegraph Company from his graduation until 1899, when he entered the General Electric Company's test department. He left the test department in 1901 and was in the induction-motor designing department until 1905, when he entered the power and mining engineering department.

K. A. PAULY

J. S. Tritle has been appointed manager of the merchandising sales department of the Westinghouse Electric & Manufacturing Company. Mr. Tritle was engaged in the electrical engineering and contracting business in St. Louis from 1894 to 1902, when he was appointed chief superintendent of construction at the St. Louis world fair. He held this position until 1905, when he was appointed district manager of the Kansas City office of the Westinghouse Electric & Manufacturing Company. Later, when the Kansas City and St. Louis offices were combined, with headquarters at St. Louis, he was made district manager of the St. Louis office, which position he has held ever since.

J. S. TRITLE

Obituary

Francis F. Squire, vice-president and general manager Fiberloid Company, Springfield, Mass., and previous to that secretary and treasurer of the Connecticut Valley Metal Trades Association, died at his home in Springfield on May 8, at the age of forty-six.

Francis G. Wood died recently at his home in Utica, N. Y. Mr. Wood was a pioneer in telephone-line construction and operation in that section and for years was identified with the Central New York Telephone & Telegraph Company and later in an executive capacity with the New York Telephone Company.

Richard H. McGrath died at his home in South Braintree, Mass., on April 18 after a long illness. He had been in the employ of Stone & Webster for about eighteen years, during which time he had been connected with the Chase-Shawmut Company, the Minneapolis General Electric Company, the Fort Hill Chemical Company, the General Electrochemical Company, the Cell Drier Machine Company, the American Valley Lumber Company and the Chicago, Wilmington & Franklin Coal Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

General Conditions Proving Basis for Confidence

WITHIN the past two months there has been an unmistakable improvement in general business conditions all over the country, and a consideration of the general situation is giving confidence to many manufacturers whose business still has to feel largely increased demand. Foremost among the industries showing great improvement is the steel industry. Records of output and unfilled tonnage of both the United States Steel Corporation and the independents are distinctly favorable, while the construction trades and allied industries for some time past have sent in record-breaking reports, with iron and steel leading. Closely connected with this is the gain in general transportation disclosed by the weekly figures on car loadings, figures which have grown each week recently.

There have been reports of scarcity of supplies in various lines, building materials being prominent in this regard, and as a result prices have shown a firm upward tendency. Retail trade has improved slightly, though still below normal, and the prospect of better crops makes it almost certain that the end of the summer will witness a further betterment. Copper mining and lumbering in the West and Northwest are again on their feet. Coal mining and the textile industry are seriously disturbed by labor troubles, but the agitation has not extended to other fields. Foreign exchange is better and may help exports to regain some lost ground, and the stock market is showing activity.

New Motor Business Dominated by Sales Engineer

SLOWLY but surely the curve of motor sales is rising out of the trough which expresses the effect of the recent extreme depression of general business upon the movement of this class of apparatus. Although small-order sales dominate the market, their persistence and tendency to multiply offers much encouragement to the manufacturer and distributer of first-class products.

This branch of the industry suffers by contrast with wartime demands. Misapplications of motors from the standpoint of efficiency and power factor were forced by the pressure to equip old tools for direct and group driving, and the rush to install anything that would do the immediate work in hand left American manufacturers with an enormous overcapacity in motors on their hands. Within the last year or two many industrial concerns have revamped their motor layouts, and this has led to the redistribution of some machines and to the purchase of new ones in considerable scattered quantities. There is no question, however, that the fitness of many motor installations for present and future economical service would be difficult to demonstrate, and now that general business is picking up in so many sections, capable motor sales engineers are advocating investigations of motor loading, power-factor conditions (especially in relation to bills for energy purchased) and reapplication of motors for more accurate service.

Sales of motors are subject at present to extremely acute competition and are accompanied by more "proposition" work and technical analysis than has been the case for a long time. On this account certain new designs of motors have made better headway in the market than might have been expected, and the competition between makers of advanced designs and some of the older builders of motors is exceptionally sharp for the moderate volume of business offered. Deliveries are in comfortable shape, and not much is heard at present about price movements. Well-informed opinion is to the effect that the opportunities for business in motors depend at present very largely upon the skill with which the motor designer, manufacturer and sales staff succeed in convincing the buyer that particular types and ratings of motors will render the most economical over-all service in competition with other lines.

Collection Conditions Vary, but General Trend Is One of Improvement

COLLECTIONS in various sections of the country in the last month have varied a great deal, mainly on account of local conditions, but increasing business is being noted and with that comes encouragement in the credit field. It is found that delinquents in the contractor-dealer industry are becoming fewer as the building boom continues, for many of the buildings started in the early spring are ready for electrical work and contractors are moving their stocks much more rapidly than two months ago. Jobbers, too, are experiencing a greater demand, and more firms in this class are discounting their bills with manufacturers than formerly. Credit departments are feeling the effects of a long, dull winter, however, and estimates place the average length of collections still at around sixty to sixty-five days.

In the East jobbers and contractor-dealers are doing better as a rule in cleaning up their past-due bills, while the smaller dealers handling appliances and electrical equipment at retail are somewhat slow. This is due to the mood of the public, which is still buying conservatively. However, there has been no increase in the last thirty days in the number of delinquent accounts reported to credit associations, while, on the other hand, the number of reported accounts settled has been larger. An average of from sixty to seventy days is being maintained.

Although marked differences of opinion as to collections are reported by leading New England jobbers, the prevailing view is that the last thirty days proved much poorer than the previous period in the credit man's department, and that immediate prospects indicate hard work in rounding up delinquents. One jobber who has always selected credit risks with great care reports about sixty days on collections, but others of high caliber find it difficult to settle their accounts on less than ninety days just now. A good deal of trouble has been experienced in putting trade acceptances through. Contractor-dealers are to some extent affected by labor troubles in the textile fields and leather sections. Apart from labor troubles, however, the underlying business situation shows a good deal of strength, and the tendency for business to increase in electrical circles is looked upon as encouraging.

Collections throughout the Middle West have not changed materially excepting where the transactions are radio equipment. Well-established jobbers and retailers are not worrying credit men so much as the small country dealers who depend upon the customer's final settlement in order to pay their own bills. This condition has existed all winter, but patience is shown and a time extension given to each worthy dealer. Where the collections are for radio, a better response has been noticed, which jobbers say is a result of low stocks and quick turnover. By paying up the old bills dealers feel that their chances for obtaining quicker shipments will be improved. On an average good accounts will run about sixty days.

Reports relative to collections in the St. Louis territory show, on the whole, rather satisfactory conditions. This is an important season in this regard for boot and shoe and wholesale dry-goods establishments in this district, and both of these interests report results better than a year ago. Payments on current business are generally excellent. As has been the case for a year or more, old accounts are being paid more slowly, though old indebtedness has been considerably reduced. The average time for collections remains at about sixty days. Money is readily obtainable from the banks, and interest rates are lower, ranging from 6 to 7 per cent.

General reports seem to indicate an improvement in collections in the Southeast, there being some tendency on the part of debtors to liquidate accounts that are quite old. It is still necessary, however, to bring a great deal of pressure to bear to get collections in promptly, and all jobbers are using extreme care in the extension of new or additional lines of credit to any but the most reliable purchasers. Acceptances rediscounted and purchased in the open market in this district for March were double those of February and exceeded those of March, 1921, by 500 per cent. Commercial failures show a slight decrease in number but an increase in total liabilities.

On the Pacific Coast collections are still rather slow, but within the next month or so the vigorous measures taken to restrict the duration of cash sales are expected to bring a decided improvement. Time sales of electrical appliances are reported to be in much greater proportion to total sales than was the case a year ago. Many dealers who have not catered to this class of trade to any extent before are finding that more and more of their former cash customers are seeking to buy on time now.

Trade Commission Attacks Douglas Fir Company, Alleging Trade Restraint

FORMAL complaint has been issued by the Federal Trade Commission against the Douglas Fir Exploitation & Export Company and 107 stockholders and officers in the respondent association who are lumber manufacturers in the States of Oregon, California and Washington. The complaint charges conspiracy to hinder and obstruct competition and alleges that the respondent association is not engaged solely in export trade and therefore does not come within the jurisdiction of the Webb-Pomerence act.

The Trade Commission in announcing the complaint says: "It is alleged that the association controls the manufacture and sale of 85 per cent of all the Oregon pine, red fir and yellow fir which is manufactured in the United States. It is further alleged that in order to carry out the conspiracy the respondents coerced competing manufacturers to join their association and to abide by their plan of equalization of distribution of orders, attempted to injure foreign competitors by price cutting, refused to sell lumber to export merchants who would not make 85 per cent of their purchases from the association or who bought any lumber elsewhere below the association prices, and followed other coercive and unfair methods of business."

April Electrical Imports Less Even than Preceding Month

IMPORTS of electrical goods into the United States through the port of New York in April amounted to only $23,784. This figure, supplied unofficially by the Bureau of Foreign and Domestic Commerce, Department of Commerce, is less by almost $3,000 than the negligible total of electrical goods brought into this country the preceding month.

As in the previous month, the largest source of electrical imports was Germany, though her total was not large enough to cause much worry to American electrical manufacturers. England, France, Norway, Italy and Czechoslovakia also appear on the list of exporting countries.

The value of each article together with the country of origin was as follows: Carbons, Germany $2,050; England $10; cable instruments, England $150; dynamo brushes, England $1,385; France $200; hair driers, Germany $2,105; heating and cooking utensils, Germany $2,901; lighting fixtures, Czechoslovakia $6,800, Germany $925, England $700, Italy $55; table lamps, Germany $1,588; wireless apparatus, France $515, England $760, Germany $125; hair straighteners, Germany $466; flatirons, Germany $946; batteries, Germany $31, England $41; controllers and switchboards, England $225; fans, Italy $350; hat pressers, France $300; bicycle headlamps, England $35; massage and toilet apparatus, Germany $966; phonograph parts (electric), France $12; push-buttons, Germany $110; resistances, England $23, Norway $10.

Metal Market Situation

THE upward trend in copper continued all last week, and by Monday of this week the generally established price for electrolytic copper, immediate delivery, was 13⅝ cents per pound with some offered at 13½ cents. Predictions were freely made that the price would not endure long because of the large demand from consumers in this country who are continuing their purchases regardless of the higher prices, apparently being convinced that the advance will continue.

The sustained demand from domestic sources has been the most significant factor in the market. In the past year or so whenever price advances were made the users in this country invariably withdrew from the market, and within a few weeks prices would recede once more. However, in the past conditions were radically different and really did not justify the attempts to advance quotations. Now the statistical position of the metal is as satisfactory as producers could want, and consumers evidently realize the advisability of covering for their requirements. Consequently, far from there being a let-up in demand after each advance, there has actually been a more urgent call. At the end of last week consumers were actually crowding each other in an effort to place their orders.

Conditions among copper users have improved very much in the past two months, and it is believed that future orders, which in April were considered to cover requirements rather well for the second quarter and part of the third quarter, are proving inadequate. Manufacturers of wire have found their bookings increasing, as have various other manufacturers of electrical equipment, while the automobile industry is running full blast and is taking all the copper and brass that manufacturers can produce for it.

In addition to the good domestic business the export demand has been growing daily. Higher quotations on foreign orders have not caused any drop in buying.

NEW YORK METAL MARKET PRICES

Copper:	May 16, 1922	May 23, 1922
London, standard spot	£ s. d. 60 10 0	£ s. d. 62 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.25	13.87½
Electrolytic	13.00 –13 12½	13 75
Casting	12 62½	13.12½
Wire base	14.62½–14.87½	15.12½–15.37½
Lead, Am. S. & R. price	5.35	5.50
Antimony	5.37½–5.50	5.37½– 5.50
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.50	5.50
Tin, straits	30.75	30.87½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.25 –11.37½	11.50 –11.75
Brass, heavy	5.25 – 5.50	5.25 – 5.75
Brass, light	4.87½– 5.12½	4.87½– 5.25
Lead, heavy	4.50 – 4.62½	4.70 – 4.80
Zinc, old scrap	2.75 – 3.00	2.75 – 3.00

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A DEMAND well maintained and fairly well distributed throughout the various electrical lines marked last week's market, and it differed little in that respect from the weeks immediately preceding it. The electrical industry as a unit, it must be admitted, is not enjoying as rapid a rise as some others, steel and lumber, for instance; but every inch it has regained during the last six months has been recaptured for good and, however slow the return to prosperity is, there is no doubt that the electrical trade is well started on it.

Boston and St. Louis are the first of the larger centers to report any considerable stiffening of wire prices, but happenings in the copper market take all the elements of surprise out of the advance. In Boston and the surrounding territory electric ranges and refrigerating units are in surprisingly good demand. There have been moderate increases on lock nuts, bushings and conduit boxes in Chicago. Good business is looked forward to in the Southeast within the next ninety days, there being $25,000,000 to $35,000,000 worth of fruit and melons to be shipped from there in that period. There have been very large orders for railroad equipment placed in St. Louis in the last few days, and industrial electrical equipment also is picking up there.

NEW YORK

Business in the electrical trade appeared to move along on an even keel during the past week, and the demand for wiring supplies has been well sustained. No unusual conditions have arisen and no important price changes have been announced. Some price competition is still in evidence, but the trade in general is more brisk and does not wait so much upon prices.

Building activity continues unabated, and a considerable quantity of wiring supplies has been ordered for future delivery. In addition to this, jobbers report an increasing number of inquiries, indicating further prospects of future business.

Of the appliances, fans, flatirons, toasters and vacuum cleaners are moving fairly well, but the rest of the line is very sluggish. Radio equipment is still much in demand, but the public appears more inclined to buy parts rather than complete sets. Dealers, however, are anxious to obtain stocks of complete outfits, and orders are booked far ahead of deliveries.

Conduit.—Pipe is moving satisfactorily, but there is a rather wide range in quotations. Some jobbers have not as yet advanced their prices in accordance with the latest schedule. Good-sized stocks in jobbers' hands have enabled them to hold to the former quotations. Prices on rigid conduit showed the following range this week. For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Demand is rather spotty, and prices this week have softened somewhat. Quotations on No. 14, rubber-covered, single-braid, are from $6 to $6.15 per 1,000 ft. In quantities of more than 5,000 ft., prices range from $5.90 to $6 per 1,000 ft. Stocks are fair to good.

Flexible Armored Conductor.—The movement of this material continues to be satisfactory and stocks generally are in good shape. No. 14, two-wire, single-strip, is quoted at $43 to $45 per 1,000 ft., and double-strip at $45 to $47 per 1,000 ft.

Loom.—There is only a fair demand for this material. The $\frac{7}{32}$-in. and ¼-in. sizes, listing at $5.50 and $6 per 100 ft., are quoted at 70 per cent off list in coil lots, and the ⅜-in. size, which lists for $9 per 100 ft., is quoted at 55 per cent discount.

Sockets.—Schedule material is moving steadily with no new prices announced. In standard-package lots pull-chain sockets sell for 33 cents, key sockets for 18 cents each, and keyless sockets for 16 cents each.

Fans.—There is every promise of a good fan business this year. Jobbers report that a number of dealers have already reordered and sales are running considerably ahead of those of last year.

CHICAGO

Reports from the majority of dealers indicate that, while the electrical market has sustained its previous three weeks of good business, the local conditions both in demand and supply have changed little. The activity on conduit and rubber-covered wire is still strong owing to the building of new residences. Advances were noticed on lock nuts, bushings and conduit boxes, following the recent rise in steel prices. Mill-type lamps are moving steadily since the railroads and industrials are back again in the buying field.

A contract for about 15,000 tons of structural steel was awarded recently to the Fort Pitt Bridge Works. This material will be used for the new Stevens Hotel to be built on Michigan Boulevard.

Conduit.—The conduit situation is approaching the point, at least among the better class of jobbers, where a fixed price of $43 per 1,000 ft. for the ½-in. black pipe in 5,000-ft. lots is being maintained. Several jobbers say they prefer to stay out of this market entirely rather than to sell at a loss, since price competition has been very active during the past months. The demand for conduit is steady because of the activity in the building industry. Stocks are good.

Wire.—No price changes were noticed on wire this week, and the call for rubber-covered No. 14 has been up to the standard maintained during the last three weeks. It is available in 5,000-ft. lots at $6 per 1,000 ft. The supply is also good. Movement on weatherproof and bare wire, while active, has not shown any pronounced changes. Bare wire is selling around 16½ cents per pound.

Flexible Armored Conductor.—Activity in the building of new homes has relegated this material slightly to the rear, since the call for wiring materials has been mostly for conduit and rubber-covered wire. However, dealers are reporting fair shipments on the two-wire, double-strip in 5,000-ft. lots for $43 per 1,000 ft. Stocks are ample.

High-Tension Equipment.—Orders for a 6,000-kva., 33,000-volt outdoor substation and several smaller ones of the same voltage, all for the Middle West, were accepted during the week by one manufacturer. This company also speaks of a good business on 13,200-volt outdoor disconnecting switches and on farm-line equipment.

Sockets.—No price changes have occurred in this material, but jobbers say that the demand due to the building activity has been good. In standard packages of 250 the pull sockets sell for $33 per 100. The key socket is quoted at $18.15 per 100 and the keyless at $16.50 per 100. Stocks are good.

Dry Cells.—The radio requirements have produced a fair but steady call for these cells. They are still available in barrel lots for $30.52 per 100.

Lock Nuts and Bushing.—This material has seen an advance of about 10 per cent, along with the increased strength in the steel industry.

Lamps.—Dealers report that, while a slump has been felt, the market has been fairly vigorous because of the increased buying by the railroads and by the industrials. The demand for the daylight bulb has been steady since most department stores are becoming aware of the advantages of this lamp in their display windows.

Conduit Boxes.—Prices on conduit boxes have been advanced about 7 per cent, but the demand is unaltered.

BOSTON

Little change in trade is apparent beyond a gradual expansion in the demand for wiring materials and a healthier tone in appliance sales. Building continues to grow in New England, but so far electrical supplies have not been heavily drawn upon on account of the early stages of work in progress. Building and engineering contracts for the week ended May 16 totaled $7,118,300 against $3,796,500 for the same week last year. Only one similar week in the past twenty years equals this record. Activity in the paper industry is good and metal-working plants are a little busier. Retail trade is fair and in some textile centers a few employees long on strike have returned. By and large there is little real change in the cotton-manufacturing situation. Prices of electrical supplies reflect an advance of about 5 per cent in rubber-covered wire and stiffening quotations on bare copper and weatherproof wire. The local demand for electric ranges and for electrically driven refrigerating apparatus reflects some improvement. Central-station outputs in representative cases show increases of 15 to 30 per cent or more above this time last year.

Electric Ranges.—Interest in ranges has broadened considerably during the past few weeks. One central-station company recently reported a sale of twenty-four ranges for apartment-house service on a repeat order. Competition is sharp among manufacturers, but the outlook appears good for the season.

Motors.—Nothing beyond small-order sales and in sizes below 10 hp. or thereabouts features the market. Considerable "shopping around" is evident among purchasers, and a good deal of effort is being expended on sales engineering analyses in the hope that the groundwork is being laid for much more future business than is at the moment in sight.

Wire.—Sales of weatherproof wire and rubber-covered wire are fairly good. Prices tend to stiffen on all wire, owing to the advance in copper. Monday's base on weatherproof was about 15½ cents, and the latter was moving at about $6.60 per 1,000 ft. in 5,000-ft. lots. Bare copper wire base was about 14 cents. Outside construction work is hitting its stride and central-station companies are buying better, but under sharp competition.

Bells and Buzzers.—Demand is light, with good stocks. Price sheets were recently issued in jobbing circles reflecting some readjustments, without marked changes up or down. Class A, iron-box, 2½-in. buzzers are moving slowly at 67 cents in lots of 100 or over. Duplex signals in lots of 10 to 100 are quoted at $1.

Motor-Driven Refrigerating Plants.—One dealer reports sales so far this year exceeding all last season's and has set a minimum of 100 with confidence that it will be exceeded. The advent of smaller sizes of equipment has aroused considerable popular interest.

Electric Vehicles and Industrial Trucks.—A revival of interest is evident in Boston, and increased sales are anticipated soon. Present demand for industrial trucks is very light, though occasional tenders are in demand from large mills. Battery-renewal business is moderate on road trucks.

Appliances.—Vacuum cleaners and washing machines are moving better, and the lighter staple appliances are in fair demand. Small sales of motor-driven sewing machines are features of confidential reports in central-station circles, and flatirons are moving actively. Fans are about to move after a long-delayed warm season. Portable lamps are still moving well considering the season.

ATLANTA

General conditions in the Southeast continue to improve, the past week being marked by unmistakable symptoms of quickening business activity and general optimism. Building permits issued in Atlanta for the first two weeks in May had a valuation of $788,285, aggregating about $200,000 more than for a corresponding period in April. Home building still leads all other classes, and the "Own your own home" exposition that was held in Atlanta last week is expected further to stimulate this movement.

The peach crop of Georgia is beginning to move, and it is expected that it will run between 7,000 and 8,000 cars. This should bring $6,000,000 to $8,000,000 to the growers in the neighborhood. Watermelons are already moving out of Florida, and it is expected that Georgia's crop will be in the market during June. Cantaloupes will move in large quantities during the next thirty days, Georgia alone shipping approximately 3,500 cars. From these three sources—that is, from peaches, watermelons and cantaloupes—the Southern farmer will receive within the next sixty to ninety days from $25,000,000 to $35,000,000. The larger portion of this money will be spent for farm and home equipment.

All electrical jobbers report their business as steadily improving and are very optimistic over the outlook. A few sales campaigns are under way and others will be launched, which should boost sales considerably.

Lighting Fixtures.—Industrial, commercial and residential lighting fixtures are all moving satisfactorily, with the commercial and residential types particularly good. This line is expected to have an even brisker movement during the next thirty days. Stocks throughout the territory are in fine shape.

Portable Lamps.—These have been very slow for several months past but are now beginning to pick up. Both the metal and silk-and-mahogany types are moving, with one jobber reporting the small, or boudoir, lamp the best seller at present. All stocks are in excellent condition.

Fans.—A rainy, cool snap during the past week temporarily slowed up the movement of fans. The movement in general, however, is very brisk and jobbers are expecting an unusually good season. The 16-in. oscillating type is the best seller at this time. Stocks and shipments are good.

Lamps.—While the movement of lamps at this season of the year is always slow, all jobbers report sales holding up remarkably well, with the demand distributed throughout the line. Stocks are good.

Vacuum Cleaners.—Vacuum cleaners are not showing up as well as was expected, jobbers reporting few sales. A sales campaign started on May 1 should stimulate the movement shortly. Stocks and shipments are satisfactory.

Heating Devices.—Owing to campaigns, the entire line of heating devices is moving very satisfactorily, and one jobber reports small soldering irons for radio use as particularly good. No changes in prices are reported and stocks and shipments are good.

Distribution Transformers.—There has been a slight slump here, though jobbers still report a fair movement in the popular sizes. Sizes larger than 25 kw. continue rather slow. Stocks and shipments are satisfactory.

"White-Way" Lighting Equipment.—Only a fair amount of interest is being displayed at present, though jobbers expect the movement to pick up. No price changes are reported and shipments are good.

ST. LOUIS

Increased activity in business generally is indicated by the volume of orders being placed for rolling stock by the various railroads and transportation companies, concerns in this territory receiving large orders last week for both freight and passenger equipment. One single order was for 2,000 refrigerator cars, the estimated value of which is $5,000,000. The electrical jobbers are receiving their share of the increased business, but there has been no spectacular buying of electrical goods. Improved sales are found in motors and other industrial equipment, and the demand for house-wiring supplies is continually advancing.

The Union Electric Light & Power Company is doing extensive work this year in preparation for heavier loads. Test borings have been completed for its Cahokia steam plant, to cost $8,500,000, and construction work is expected to be actively under way within a month. In addition, substantial increases in substation capacity are planned, and a full-automatic converter station is now under construction to serve additional load in the down-town district. This construction work will, of course, directly result in the sale of a large amount of electrical equipment, and it also indirectly connotes the possibilities of a large volume of sales of all classes of electrical goods to the power users in this territory.

Wire—A stiffening of prices is noted, especially in No. 14 rubber-covered, for which one jobber is asking $6.50 per 1,000 ft. in 5,000-ft. lots. Individual orders are increasing in size, several last week being for 100,000 ft. Other sizes of rubber-covered are quoted as follows, for 5,000-ft. lots: No. 12, $8.50 per 1,000 ft.; No. 10, $11.25 per 1,000 ft.; No. 8 $15.05 per 1,000 ft. The prevailing base on bare wire is 17 cents per pound, and that on weather-proof around 16 cents per pound.

Cable.—The demand has been especially strong, and one large order for 27,000-volt three-conductor cable was placed last week. Deliveries are being made longer as the factories become more heavily loaded.

Insulators.—Immediate deliveries are obtainable in all usual items. Prices remain unchanged, sales show some increases, and inquiries are very encouraging.

Pliers.—Increased wiring and line work is causing some improvement in demand, more particularly for the smaller sizes, but the total movement is still slow. Klein's 6-in. side cutter sells for $2.80 and the 8-in. side-cutter for $3.75.

Transformers.—Substantial improvement is found in the sale of distribution transformers, virtually normal production being reported by one local manufacturer. Several inquiries are pending which should soon result in the sale of large units of 13,200-volt and higher ratings.

Fans. — Cool weather the past week retarded the usual early sales. Dealers' stocks left over from last season were quite small, and they have purchased new stocks of reasonable amounts to meet the opening demand. Conservatism nevertheless controls the buying.

Flatirons.—Without special campaign work the demand continues comparatively strong, and sales are about 10 per cent better than they were this time last year. Stocks in the hands of both dealers and jobbers remain low but ample.

SAN FRANCISCO

Building construction remains at high tide. Many big jobs are approaching completion, but there are more smaller jobs to take their place and the month-by-month value of building permits is increasing. The growth of certain hitherto sparsely settled semi-suburban districts is amazing. The approach of the fruit season has meant the renovation of many canning and packing plants and a good season is expected. Another seasonable source of electrical business is the preparation of summer resorts for what is expected to be an excellent year. Tourist bureaus report one of the earliest and largest travel inquiry seasons they have ever known.

Schedule Material.—The campaign for convenience outlets is showing results, although these have not yet acquired the momentum expected. Certain districts, such as the Richmond district of San Francisco, are being built up by contractors who sell not vacant lots but lots with completed residences and are therefore not particular about equipping such residences with the latest electrical features unless they are visible, such as fixtures. The result is that much of this work is being done by "mushroom" firms content to work for the equivalent of a day's wages per day and which figure their jobs accordingly. However, the campaign will eventually reach the public in such a thorough way that this condition will be remedied. Big sales of all varieties of staple material are reported with stocks adequate for prompt deliveries.

Conduit Fittings.—Changes in price have caused a run on standard fittings and standard boxes, but local stocks have been improved so that prompt deliveries can now be made. This was not the case a month or so ago when even some of the standard boxes and covers were short. The big jobs are well taken care of by Eastern shipments, but the smaller jobs and shelf or bin stocks are the subject of much competition and are split up among a variety of firms in addition to jobbers.

Household Appliances.—The California Electrical Cooperative Campaign is putting over a "June bride" week from June 5 to 10, at which time the desirability of electrical appliances for wedding gifts will be exploited.

PORTLAND—SEATTLE

The employment situation, which was rather serious last winter, has virtually ceased to create alarm as summer approaches. Very little forced lack of work now exists. The first one of the Washington coal mines closed when the strike was called has again resumed operations, but on an open-shop basis. The water-front strike which has been on for several weeks in Portland is quiet. Cargoes are being handled with little delay with the exception of vessels of the Shipping Board, which discriminates against the employers' union because of existing conditions and refuses to allow its ships to be worked.

Lumber production for the week ended May 13 was 1 per cent above normal. New business for the week was 15 per cent above production, and shipments were 3 per cent above production. An encouraging feature of the lumber situation is a considerable increase in the percentage of rail to water shipments reported for the past week over former weeks. This clearly indicates a revival of trade with the interior. Several transmission lines are under construction and a number of others are contemplated. Some important telephone toll lines are under construction, and a 5-mile extension of the Yakima Valley electric railway line is being put in. These are encouraging signs.

Sales in the electrical trade have been steady during the week, with a volume of business about equal to that of previous weeks. Contractor-dealers report business good, and in some cases excellent, without considering the stimulation due to radio. Most dealers are handling radio equipment, and this has been very active. Fixture and wiring business continues to increase.

Knobs.—No. 5½ "Nail-it" knobs are quoted at $22 per 1,000 in unit packages of 500. No. 5½ solid knobs are quoted at $9.65 in similar quantities.

Tubes.—Tubes 3 in. x $\frac{5}{16}$-in. are quoted at $5.85 and 4 in. x $\frac{5}{16}$-in. tubes at $7.50 per 1,000 in quantities of 500.

Cleats.—Two-wire and three-wire porcelain cleats are quoted at $17 per 1,000 in unit packages of 250.

SALT LAKE CITY—DENVER

There was not much change in the market situation as reported last week. Labor troubles that were brewing in the coal camps are quieting, with prospect of increased production. Non-employment is growing less each week as farming activity and construction work gets under way. In some phases of home building a shortage of skilled labor has been experienced. Wages are fair, giving steady workers a buying power that is reflected in a better market. The report comes from Idaho, the state that was hardest hit of all of the Intermountain commonwealths, that a financing corporation is granting ample loans to bridge the time between planting and harvest. Growers of various agricultural crops will now be able to maintain their regular standard of acreage. A year or two of good harvests should get the "Gem State" well on the way toward recovery.

Electrical merchants in the Salt Lake City jobbing territory are all on the qui vive about the Rocky Mountain electrical exposition planned for Oct. 2 to 14. An electrical illumination display that will cost more than $10,000 is to be installed for the occasion. It is planned to induce manufacturers of electrical products in every part of the country to exhibit their products, with the view of introducing them. An extensive advertising campaign, involving both periodicals and direct-by-mail pieces, has been worked out. Of much encouragement to business interests of this territory is the fact that the metal market is steadily improving, with the demand increasing and prices stiffening. Production will be on a considerably better basis in the near future.

Radio.—Jobbers of and dealers in radio are now in a better position to meet orders. A half dozen brands are now offered on the retail market.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News fromJobbers and Foreign Fields and a Record of New Devices and Trade Literature

Line-Hardware Manufacturer Starts Production

The Seyler Manufacturing Company, Sharpsburg, Pittsburgh, has been organized and has moved into its new factory building. The plant has 65,000 sq.ft. of floor space which will be devoted exclusively to the manufacture of hot galvanized pole-line hardware, "Bo-arrow" arms, pins, house brackets, mast irons, secondary racks, etc. The company was organized by Carl Seyler, formerly general manager and vice-president of the Hubbard Company, Pittsburgh. Associated with Mr. Seyler is N. C. Husted, in charge of sales engineering. Mr. Husted was also formerly with the Hubbard Company. The company has been in production for over a month, and, it is stated, is now in a position to make prompt shipment.

Westinghouse to Furnish Only Copper Cooling Coils

In order to protect its customers, the Westinghouse Electric & Manufacturing Company announces it has refused to furnish any more iron cooling coils with water-cooled transformers. Heretofore the practice has been to furnish either copper or iron cooling coils, the former being somewhat more expensive.

In the future, copper coils only will be furnished, but at the same price as previously charged for iron. The decision to furnish copper coils only was made when it was ascertained that a number of Westinghouse customers bought iron cooling coils instead of copper cooling coils to save money and that this frequently resulted in trouble for the customers because of the rusting or clogging of the iron cooling coils.

Johns-Manville Johns-Pratt Sales Arrangement Canceled

The arrangement whereby Johns-Manville, Inc., for many years has acted as exclusive selling agent for the electrical products manufactured by the Johns-Pratt Company, Hartford, Conn., has been canceled, effective June 15, according to a joint announcement of both companies. The announcement states that, owing to changing business conditions in the electrical trade, the companies have decided to manufacture and market their respective products separately.

"When the connection was established in 1887," it is explained, "it was a necessary arrangement to assure a widely distributed stock of electrical products. Today, to effect the greatest economy to all concerned, direct sale by the manufacturer through organized distributers has become necessary. Both parties to the agreement feel that they can serve the trade more effectively and economically by concentrating on their own lines."

Belden Company Moves Into New Magnet-Wire Plant

The Belden Manufacturing Company during the last week in April moved the sales department for its magnet-wire and dry-cotton tape departments from the main office, 2300 Southwestern Avenue, Chicago, to its new magnet-wire plant, 4625 Van Buren Street, in that city. By locating the sales department for these products at the new factory, the company announces, closer touch can be maintained between production, sales and deliveries and better service rendered the trade. The new plant, which will be devoted to the manufacture of magnet-wire and dry-cotton tape, has a total floor space of 112,000 sq.ft. It is situated on the Belt Railway of Chicago, affording very good shipping facilities. The other products of the company, such as insulation, insulating parts and various types of wire and cable, will continue to be made at the main plant on Southwestern Avenue.

Modern Electrical Devices Discussed at Jobbers' Meeting

About forty electrical jobbers representing the Erner Electric Company of Cleveland held a meeting in South Bend, Ind., recently. The principal address was made by L. A. S. Wood, manager of the illuminating section of the Westinghouse Electric Company. Business sessions for the purpose of educating the salesmen and jobbers on modern electrical devices and showing recent developments of the trade were held, and a series of meetings in each of the company's branches are being planned for the same purpose.

General Electric in Patent Suit Against Cutler-Hammer

A suit has been brought against the Cutler-Hammer Manufacturing Company alleging infringement of Abbott patent No. 1,367,341, covering what is known as sheath wire. The bill of complaint was filed in Milwaukee on Feb. 21, 1922. The complainants in the case are the General Electric Company and the Edison Electric Appliance Company.

Slate Producers Form an Association

At a meeting held recently at the Hotel Commodore, New York City, a temporary executive committee was elected by producers of slate for the purpose of forming a National Slate Association. Oliver C. Bowles of the United States Bureau of Mines presided. The purpose of the association is to mobilize the entire slate industry into a body which will extend and promote the use of slate and see that the public is fully informed of the advantages and economies of this product.

The following were elected members of the temporary executive committee: W. H. Keenan, Bangor, Pa., chairman; E. R. Norton, Granville, N. Y.; G. F. Barnard, Boston; N. M. Male, Pen Argyl, Pa.; G. H. Shinville, Fairhaven, Vt.; F. C. Sheldon, Granville, N. Y.; R. C. Berlin, Slatington, Pa., and A. H. Morrow, Paulet, Vt., treasurer.

Russell Electric in New Quarters

The Russell Electric Company, Chicago, obtained a fivefold increase in floor space when it moved its manufacturing quarters from 140 West Austin Avenue to 340 West Huron Street. President T. C. Russell stated to a representative of the ELECTRICAL WORLD that this increase was necessary because 1922 business so far was double that of the same period last year. To take care of this expansion, the capital stock has also been increased from $2,500 to $100,000.

New Head for Robbins & Myers Company

The Robbins & Myers Company, manufacturer of fans and small motors, Springfield, Ohio, has announced the decision of C. S. McGilvray, president, to accept appointment as chairman of the board of directors and the acceptance by F. S. Hunting, general manager of the Fort Wayne division of the General Electric Company, of the presidency. Mr. Hunting has been in charge of the production of small motors for the General Electric Company for a number of years and is considered exceptionally fitted for the duties of president of the Robbins & Myers Company, according to the announcement. There are no other changes in official personnel, Wilbur J. Myers and H. E. Freeman remaining as vice-president and treasurer respectively.

Sales of the company have increased recently, owing partly to seasonal influences, but a successful fan season is predicted by officials. Bookings for April were in excess of $500,000, as compared with $180,000 in January. A satisfactory profit for the month was reported, after all fixed charges and depreciation had been deducted. It is reported that a refinancing program is under way which will place the company in an exceptionally sound position.

Most of the present indebtedness is to be refunded. New York, Chicago and Cleveland bankers are understood to have underwritten the financing.

Stock of Johns-Pratt Company Acquired by Colt

The Colts Patent Fire Arms Manufacturing Company of Hartford, Conn., has just purchased the Johns-Pratt Company of Hartford, at a price said to amount to $275 per share for the stock of the latter company. No announcement has been made as to whether or not there will be any change among officials of the Colts Patent Company with its new addition. It is understood that the Hart & Hegeman Company, whose president, Shiras Morris, is also president of the Johns-Pratt Company, is not involved in any way in this purchase.

The De Laval Company Reports Increasing Business

The last part of 1921 and 1922 to date have shown an increased demand for the products of the De Laval Separator Company, according to the *De Laval Centrifugal Review*, the house organ of that company. One of the factors in this greater activity has been the demand on the part of central-station companies for transformer-oil purifiers.

"Sales have shown a steady increase," it is stated, "and each month's business for the last six months has been far ahead of the corresponding period of the year previous. The number of new installations of transformer-oil purifiers has shown a steady increase. The larger central stations distributing electricity must by some method maintain the dielectric strength of oil in their transformers, and the smaller plants are now recognizing the need for means of purifying lubricating oil. Many new installations of the De Laval centrifugal purifiers are being made."

Booth Electric Triples Capacity

The Booth Electric Company, Chicago, is now at 411 North Wells Street, having moved from 326 Madison Street. W. K. Booth, the secretary of the company, stated recently to the ELECTRICAL WORLD that this change increased the floor space of the company about three times. This addition will provide better means for assembling the electrical furnaces manufactured by the company.

Wadsworth Electric Company to Build New Plant

The Wadsworth Electric Company, Covington, Ky., is planning the erection of a plant able to handle a volume of business five times greater than the capacity of its old building. This announcement was made by George B. Wadsworth, president of the company, following the announcement of the sale of its present plant on Pike Street. The company manufactures saf[illegible] and meter switches.

Corporation to Carry on Carroll Electric Business

The Carroll Electric Company, electrical supply jobber, 714 Twelfth Street, N. W., Washington, D. C., has incorporated its business as of April 1, 1922, according to the announcement of Louis D. Carroll, vice-president. The new corporation will retain the name of the old partnership and will continue to operate as in the past under the partnership agreement. The officers are: Harry D. Carroll, president; Louis D. Carroll, vice-president, and Harry W. Clayton, secretary. The branch offices of the company in Baltimore and Norfolk will be maintained as before.

Tafel Electric Now Occupying Own Building

The Tafel Electric Company, electrical supply jobber, Louisville, Ky., recently moved into its own building at 329 Main Street, the change being necessitated by increasing business. The new quarters consist of a four-story building, 38 ft. x 225 ft., which has been the property of the company for the past two years. The company is one of the older electrical houses of the South, but has been in the electrical jobbing business only since 1914, when the contracting and repairing departments were dropped. The territory covered by the company includes all of Kentucky, Tennessee and southern Indiana, and it is stated to be the only exclusively wholesale electrical jobbing house in Kentucky. Paul Tafel is president and general manager and E. W. Smith is vice-president.

Reorganization of Electrical Warehouse Company

Announcement has been made by the Electrical Warehouse, Inc., 452 West Larned Street, Detroit, that Waldso Turner, the former president and treasurer, has retired from the management. Mr. Turner will devote all his time to the Turner Engineering Company, of which he is president and treasurer. F. Zinsmeyer has been elected president of the company, and T. J. Riley is the new vice-president and assistant general manager. This company serves as wholesale distributer for thirteen well-known manufacturers.

Langmuir Patent Suit Injunction Against Incandescent Products

The General Electric Company has been granted a preliminary injunction by the United States District Court for the District of New Jersey in its suit against Incandescent Products, Inc., Arlington, N. J., for infringement of its Langmuir gas-filled lamp patent No. 1,180,159.

The defendant was alleged to have been selling imported Austrian lamps and also lamps of its own manufacture, the last under the trade name "Ipco," and to have been infringing the patent in question by doing so. The court finds the Langmuir patent infringed and Judge Bodine's views are summarized in the closing paragraph of the opinion granting the injunction.

"The plaintiff," the opinion states, "having established its patent in other jurisdictions, and having shown a slavish imitation by the defendant of the product manufactured under its patent, is entitled to an immediate preliminary injunction."

Music Roll Company to Make Radio Apparatus

Arrangements for the manufacture of a complete line of radio sets and equipment are being made by the Q-R-S Music Company, Kimball Building, Chicago, Ill. A portion of the local plant as well as factories at New York and San Francisco will be converted for this production, with the installation of necessary equipment at an early date. Another plant now in course of erection at Toronto, Canada, will be partially given over to radio manufacture. To carry out the details of the expansion and provide funds for equipment, etc., the company is disposing of stock totaling $255,000. Lee S. Roberts is vice-president.

Consolidation of Fiber Interests

The Fibre Conduit Company, Orangeburg, N. Y., has acquired the plant of the American Fibre Conduit Corporation at Fulton, N. Y., and the conduit manufacturing business of the Johns-Manville Company at Lockport, N. Y., and has appointed Johns-Manville, Inc., as sales agent for its products, effective as of May 15, 1922.

The Broderick & Bascom Rope Company, St. Louis, manufacturer of wire rope, is planning to rebuild its plant, recently destroyed by fire with a loss of about $300,000. The St. Louis operations are temporarily suspended.

Pattison Brothers, consulting electrical engineers, have moved their offices to 304 Madison Avenue, New York.

The O. Z. Cable Support Company, through M. J. Cafiero, president, announces the new location of its factory and general office at 584 Decatur Street, Brooklyn, N. Y.

The Toronto Laundry Machine Company, Toronto, Canada, has sold the patents and good will of the "Jack-Frost" electric refrigerating business to the Jack-Frost Ice Machine Company, Ltd., Toronto. This newly formed company has a capital of $1,000,000.

The Beverly Lights Corporation, Providence, R. I., manufacturer of ornamental lighting fixtures, has appointed Travis Welch, 180 Montgomery Street, San Francisco, Western agent.

The Electrical Specialty Company, Inc., factory distributer, with offices in San Francisco, has removed its offices from the Underwood Building to 75 Fremont Street, where larger quarters will permit the company to handle its growing business.

Foreign Trade Notes

BRAZILIAN HYDRO-ELECTRIC CONGRESS PROPOSED.—The organization of a hydro-electric congress in connection with the centennial exposition has been proposed by Dr. Simoes Lopes, Minister of Agriculture of the Brazilian government, Commercial Attaché Schurz reports to the Department of Commerce from Rio de Janeiro.

EXPANSION OF ELECTRICAL INDUSTRY IN FORMOSA.—Seven electric Companies in Formosa, according to *Commerce Reports*, have a total output of 16,398 kw., with a total of 119,400 kw. under construction. The Taiwan Denryoku is the largest company, with an output of 14,525 kw. and a capital stock of 30,000,000 yen. It plans to increase its output by 111,000 kw.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

There is a market in India (No. 2,015) for electric lamps and all sorts of electric appliances, etc.

An agency is desired by a company in Sweden (No. 2,020) for the sale of technical novelties, electrotechnical material, machinery and other articles suitable for an agency firm.

The purchase is desired by a firm in England (No. 2,022) of steel tubes and electrical accessories in large quantities.

A government official in Mexico (No. 2,023) desires to secure the representation of firms for the sale of construction material (iron and steel), wire cable, etc.

Numerous inquiries for electrical goods have been received by the Bureau of Foreign and Domestic Commerce, Washington, D. C., of which detailed information may be obtained by referring to Nos. 2,067-2,072.

The purchase is desired by a business man in Canada (No. 2,158) of a 30-volt traveling motion-picture machine and generator for same.

A business man in Canada (No. 2,170) wishes to secure an agency for complete wireless-telephone receiving sets suitable for home entertainment.

A concern in Belgium (No. 2,175) desires to secure an agency or consignment for electrical high-tension material, including generators, motors, transformers, etc.

A mercantile firm in England (No. 2,185) desires to purchase electrical accessories and domestic electrical appliances.

An agency is desired by a firm in France (No. 2,189) for the sale of electrical mining machinery and supplies, mica and asbestos, fiber board and electrical medical appliances.

A commercial agent in Canada (No. 2,204) desires to secure an agency and purchase complete wireless-telephone receiving sets suitable for home entertainment.

TRANSFORMERS FOR AUCKLAND, NEW ZEALAND.—The Public Works Department of Auckland, New Zealand, will receive tenders until July 4, the *Electrician* states, for three 1,320 single-phase transformers, complete with accessories.

ELECTRIC EQUIPMENT FOR BUENOS AIRES, ARGENTINA. — The Municipal Council of Buenos Aires, Argentina, will receive bids until June 28, according to the *Electrical Review*, for equipment for a hydro-electrical generating station and a transformer station.

STORAGE BATTERY EQUIPMENT FOR AUSTRALIAN RAILWAYS.—Tenders will be received by the Victorian Government Railway Commissioners, Melbourne, Australia, until July 5, according to the *Electrical Review*, for storage-battery, truck and battery-charging equipment for the Victorian Railways.

PROPOSED HYDRO-ELECTRIC PLANT FOR FRANKFORT, SOUTH AFRICA.—The municipality of Frankfort, Orange Free State, South Africa, according to the *Electrical Review*, is asking for tenders for a proposed hydro-electric scheme. Particulars may be obtained from W. Ingham, consulting engineer, 101 Consolidated Buildings, Fox Street, Johannesburg, South Africa.

EQUIPMENT FOR ELECTRIC PLANT, MELBOURNE, AUSTRALIA.—Tenders will be received by the Victorian Electricity Commissioners, Melbourne, until Sept. 1, for furnishing five surface feed-water heaters, six surface vapor condensers and twelve feed-water evaporators.

EQUIPMENT FOR ELECTRIC PLANT FOR GRAHAMSTOWN, SOUTH AFRICA.—The Council of Grahamstown, Cape Province, South Africa, will receive tenders until Sept. 1, the *Electrical Review* states, for alternators, switchboard, transformers, cables, etc., for the electric power plant at Grahamstown. Specifications may be obtained from F. G. Clarkson, town clerk.

TELEPHONE EQUIPMENT FOR MELBOURNE, AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Melbourne, until Oct. 17, according to the *Electrical Review*, for furnishing automatic switchboards and accessories for two suburban telephone exchanges at Melbourne.

New Apparatus and Publications

WELDING RODS AND ELECTRODES.—The Page Steel & Wire Company, Monessen, Pa., has issued catalog No. 500, covering the "Page-Armco" welding rods and electrodes for oxy-acetylene and electric welding.

WIRE.—The American Insulated Wire & Cable Company, Twenty-first Street and Sangamon Avenue, Chicago, has recently put on the market a line of copper antenna wire and copper cable for radio use.

OIL ENGINE.—Bulletin No. 10,004, published by the Ingersoll-Rand Company, 11 Broadway, New York City, describes the Price type "PO" horizontal, single-cylinder, single-acting, direct-injection oil engine.

RENEWABLE FUSES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a small booklet entitled "Shurvent Protection," covering its "Shurvent" renewable fuses.

OUTLET RECEPTACLES.—Pass & Seymour, Inc., Solvay, N. Y., are distributing a leaflet calling attention to the "P & S" outlet receptacles for the modern bathroom.

BUFFING MACHINE.—The Van Dorn Electric Tool Company, Cleveland, has added a heavy-duty ball-bearing buffing machine to its line of electrically driven machines.

STOVE.—A new electric stove, known as the "Allmur grill," has been brought out by the Allmur Manufacturing Company, Marion, Ind. This stove is being distributed by the Standard Electric Sales Company, 105 West Monroe Street, Chicago.

RADIO SWITCHES.—The Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., is distributing a six-page folder describing its various types of radio switches.

New Companies

THE NORTH SHORE ELECTRIC COMPANY, Cocoa, Fla., has been incorporated with a capital stock of $10,000. The officers are: Frank L. Brown, president; N. B. Brown, vice-president, and William H. Berg, secretary.

THE WALMORE ELECTRIC COMPANY, Sanford, N. Y., has been organized by Edward Williams, and M. H. Wagner, of Wheatfield, and others, to supply electricity in Wheatfield, Niagara and Lewiston.

THE WESTON (PA.) LIGHT & POWER COMPANY has been organized to install and operate an electric light and power plant in Weston. George Puhak, Hazleton, Pa., is president.

THE MISSISSIPPI VALLEY POWER COMPANY, Fort Smith, Ark., has been incorporated with a capital stock of $1,700,000 to take over the property and holdings of the Commonwealth Public Service Company, Fort Smith. The officers are: D. C. Green, president; George Sengel, Jr., vice-president, and L. J. Noble, secretary.

THE LEBANON (VA.) LIGHT COMPANY has been incorporated with a capital stock of $10,000 to furnish electricity in Lebanon. T. A. Gilmer is president and J. R. Wham, secretary.

THE COOPER ELECTRIC COMPANY, Hilton, N. Y., has been incorporated with a capital stock of $50,000 to furnish electricity in the territory adjacent to Hilton. The officers are: John E. Cooper, president; John H. Cooper, vice-president; Orange Green, treasurer, and Corrine Kintz, secretary.

THE WALMORE (N. Y.) ELECTRIC COMPANY has been incorporated with a capital stock of $30,000 by E. L. Haseley, R. Hewitt and A. B. Aure. Tuttle, Rice & Stockwell, Niagara Falls, are attorneys. Walmore has not a post office.

Record of Electrical Patents

Notes on United States Patents

(Issued May 2, 1922)

1,414,373. Adapter for Calling Devices; Harry W. Pugh, New York, N. Y. App. filed Nov. 14, 1919. For sending automatic telephone impulse signals.

1,414,381. Humidor; John V. Sprague, Pittsburgh, Pa. App. filed Jan. 8, 1917. Moistening contents of tobacco cases.

1,414,391. Means for and Method of Testing Unbalance; Herman A. Affel, Brooklyn, N. Y. App. filed Sept. 23, 1919. On multiplex carrier transmission circuits.

1,414,397. Testing Apparatus; Fred H. Best, Westfield, N. J. App. filed May 14, 1920. For determining transmission efficiency of telephone and line.

1,414,401. Process for the Destructive Distillation of Coal and Other Material; Peder Farup, Slemdal, Norway. App. filed Nov. 4, 1920. Combination of direct and indirect electrical heating.

1,414,403. System of Control; Adolph A. Gazda, Wilkinsburg, Pa. App. filed Dec. 8, 1917. Utilizes a series field for dynamic braking upon failure of power.

1,414,408. Motor-Control System; Albert L. Harvey, Braddock Township, Pa. App. filed Nov. 4, 1918. For governing the operation of planers, etc.

1,414,409. Motor-Control System; Albert L. Harvey, Wilkinsburg, Pa. App. filed July 7, 1920. Control of one motor by several controllers widely separated.

1,414,413. Electrical Switch; Charles H. Hodgkins, Pittsburgh, Pa. App. filed Nov. 16, 1917. Remote control for reclosing air circuit breakers.

1,414,414. Lantern; Gustave Humber, Denver, Col. App. filed June 26, 1919. Trainman's lantern with red and white bulbs.

1,414,415. Electric Lantern; Gustave Humber, Denver, Col. App. filed Dec. 2, 1919. Framework for lantern.

1,414,422. Motor-Control System; Edwin S. Lammers, Jr., Wilkinsburg, Pa. App. filed Jan. 16, 1919. For several motors designed to run in synchronism.

1,414,423. Electrolytic Separation of Metals; Carl Langer, Woolhampton, England. App. filed April 11, 1921. Two or more metals recovered simultaneously.

1,414,442. Telephone Transmitter; Louis Steinberger, Brooklyn, N. Y. App. filed June 26, 1919. Construction of cap.

1,414,494. Electric Water Heater; Frederick S. Arntfield, Toronto, Ontario, Canada. App. filed May 17, 1921. For small amounts of water.

1,414,510. Storage Battery; Ralph H. Grant, Dayton, Ohio. App. filed Sept. 9, 1918. Relieves cover strains.

1,414,522. Magnetic Chuck and Method of Making the Same; Ralph L. Morgan, Worcester, Mass. App. filed May 15, 1918. Openwork of non-magnetic material with pole pieces in spaces.

1,414,548. Device for Restoring Trolley Wheels to Trolley Wires; Donald L. Chestnut, Seattle, Wash. App. filed Sept. 17, 1921.

1,414,612 and 1,414,613. Signal for Motor Vehicles; Emanuel Auflero, Brooklyn, N. Y. App. filed Feb. 26, 1921. Horn with motor-vibrated diaphragm.

1,414,629. Wireless Duplex Signaling System; Mihran M. Dolmage, Washington, D. C. App. filed July 15, 1918. Two-way wireless telephone.

1,414,652. Regulating System for Alternating-Current Circuits; Wallace B. Kirke, Schenectady, N. Y. App. filed June 10, 1920. For holding current or voltage constant.

1,414,658. X-Ray Stand; William Meyer, Chicago, Ill. App. filed Feb. 18, 1918. Adjustable to any desired point or angle.

1,414,659. Circuit Breaker; Benjamin M. Mooers, San Francisco, Cal. App. filed Sept. 19, 1917. For temperature protection.

1,414,676. Panelboard and Panelboard Construction; Henry F. Starrett, Chicago, Ill. App. filed May 15, 1918. All current and potential conductors inclosed.

1,414,677. Panelboard and Panelboard Construction; Henry F. Starrett, Chicago, Ill. App. filed May 15, 1918. Means for covering wire gutter.

1,414,686. Call Indicator for Automatic Telephone Systems; John G Blessing, Chicago, Ill. App filed July 10, 1916. Figures set up before operator.

1,414,709 Rheostat; Gustav B. Reisbach, Milwaukee, Wis. App. filed April 2, 1921. Drum-type controller.

1,414,710. Battery Plate; William Roberts, Akron, Ohio. App. filed March 17, 1921. Hard-rubber separators used.

1,414,741. Electrical Vacuum Discharge Device; Edwin W. Kelly, Oak Park, Ill. App. filed Oct. 6, 1919. Eliminates high break-down resistance of X-ray tube.

1,414,745. Electrolyte Indicator for Storage Batteries; Reginald W. Millard, Meridan, Conn. App. filed June 17, 1919. Contact gage for all cells of battery placed on dashboard.

1,414,773. Coil Retainer; Frederick C. Coseo, Columbus, Ohio. App. filed April 17, 1917. Field-pole construction of motors.

1,414,791. Controller for Synchronous Motors; Edwin W. Seeger, Milwaukee, Wis. App. filed Feb. 12, 1921. Autoatic plugging connections for motoring upon interruption of running connections.

1,414,822. Method of Electrically Welding Galvanized Metal Sheets or Parts; Joseph Ledwinka, Philadelphia, Pa. App. filed Jan. 28, 1919. By spot-welding.

1,414,874. Junction Box for Electric Supply Mains; Alexander Graf, Berlin-Hermsdorf, Germany. App. filed Nov. 28, 1919. All wires held by a clamping device using one screw.

1,414,900. Generator and Motor Support; Amato N. Sammarone, Akron, Ohio. App. filed May 29, 1920. Support made of pressed-metal sheets.

1,414,939. Stamping Machine for Signal Reading Ribbon; Wilfrid Dougall, Montreal, Quebec, Canada. App. filed March 13, 1920. For blind persons.

1,414,978. Computing Machine; Ralph W. Bumstead, Brookline, Mass. App. filed Aug. 23, 1917. Perform's multiplication in one operation.

1,415,001. Special Service Trunk for Automatic Telephone System; T. G. Martin. App. filed July 9, 1917.

(Issued May 9, 1922)

15,351 (reissue). Apparatus for Treating Articles by Disruptive Conduction; Franklin S. Smith, Philadelphia, Pa. App. filed April 6, 1922. For treating grains, furs, etc., by electricity.

1,415,012. Arc-Welding System; Alan M. Bennett, William B. Elliott and William O'Blenis, Westfield, N. J. App. filed March 14, 1918. Bucking series field to maintain arc resistence constant.

1,415,015. Electric Water Heater; Cyrus M. Bosworth, Cleveland, Ohio. App. filed Aug. 6, 1919. Attached to water tank in same manner as gas heater.

1,415,033. Battery; Harry T. Hipwell, Pittsburgh, Pa. App. filed Sept. 29, 1921. Container for dry cells and means for using all or each battery.

1,415,036. Charge or Block for Use in Practicing Processes Involving Chemical Reactions; William Hoopes, Pittsburgh, Pa. App. filed Sept. 19, 1919. For reactions between solid and gaseous bolies.

1,415,044. Percussion-Firing Mechanism; George W. Nusbaum, Takoma Park, Md. App. filed March 18, 1920. By straight electrical firing.

1,415,076. Insulating Composition; Robert R. Williams, Roselle, N. J. App. filed Dec. 26, 1919. Insulating material for submarine cables.

1,415,106. Ciphering Device; Lyman F. Morehouse, Montclair, N. J. App. filed July 23, 1920. For enciphering and deciphering telegraph messages.

1,415,139. Storage Battery; Gustave A. Baumetz, Cleveland, Ohio. App. filed Dec. 8, 1919. Separators hooked under successive plates.

1,415,159. Lighting System; George W. Daggett, North Girard, Pa. App. filed Dec. 22, 1915. Control for magneto-supplied lamps.

1,415,179. Radio-Controlling Device; Edward T. Jones, New Orleans, La. App. filed July 21, 1920. Sending and receiving transfer switch

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—A power house will be erected in connection with the proposed packing plant of the Confederated Home Abattoir Company, to cost about $500,000. William F. Gorman heads the company.

BURLINGTON, VT.—Plans have been approved by the Board of Aldermen for the installation of ornamental lamps on Church Street, to be maintained by underground wires. The plans call for forty-two standards, the cost not to exceed $13,000.

BARRE, VT.—The street-lighting committee of the Board of Trade is considering the installation of a new street-lighting system, to be maintained by underground wires.

CHICOPEE, MASS.—The Spalding Manufacturing Company is preparing plans for a power plant at its factory. Jackson & Moreland, 387 Washington Street, Boston, are engineers.

NEW BEDFORD, MASS.—Plans are under consideration for the erection of a double-circuit high-tension transmission line between New Bedford and Fall River, to be built jointly by the New Bedford Gas & Edison Light Company and the Fall River Electric Light Company to provide an interchange of service between the two systems.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company has made application to the Department of Public Utilities for permission to issue bonds to the amount of $650,000, part of the proceeds to be used for extension and improvements.

PEABODY, MASS.—The construction of a two-story addition to the power plant at the Danvers Bleachery is reported under consideration.

WEST HARTFORD, CONN.—The Water Board is considering the construction of power plant building.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company, Binghamton, has secured a franchise in Conklin and will extend its lines to that town, where a distributing system will be installed. A 40-mile high-tension transmission line will be erected from Johnson City to Sayre, Pa., to connect with the system of the Sayre Electric Company.

BRADFORD, N. Y.—The Niagara, Lockport & Ontario Power Company, Niagara Falls, is negotiating for the property of the Bradford Electric Company. Extensions and improvements are contemplated to the system.

GENESEO, N. Y.—The Livingston Light & Power Company plans to erect substations at Ossian, Dansville and West Sparta, N. Y., with local distributing systems.

KINGSTON, N. Y.—Plans have been completed by the Kingston Gas & Electric Company for improvements to its system, including rebuilding its transmission and distribution system, placing the wires underground on O'Reilly Street and rerouting the high-voltage primary lines from the main street of the city.

MIDDLETOWN, N. Y.—The Orange County Hydro-Electric Company, recently organized, has applied to the Public Service Commission for permission to construct a hydro-electric plant on the Monagaup River to develop an ultimate capacity of 6,585 hp. The company plans to sell energy to the Orange County Public Service Corporation, Middletown, which now serves Middletown, Port Jervis and other communities with electricity.

NEW YORK, N. Y.—The New York Edison Company is planning to erect a substation on East Thirty-second Street, near Madison Avenue, to cost about $200,000 with equipment. William Whitehill, Forty-first Street and Sixth Avenue, is engineer.

NORTH CHILI, N. Y.—The Rochester Gas & Electric Corporation plans to erect a transmission line from Gates Center to North Chili, a distance of 7 miles, to supply electrical service to farmers and residences in that section. A new company has been formed to handle the project. The cost of the extension is estimated at $11,000.

WHEATFIELD, N. Y.—The Walmore Electric Company, Sanborn, recently organized, has applied for franchise to supply electricity in Wheatfield, Niagara and Lewiston. The company is negotiating with the Niagara Falls Power Company for energy. Edward Williams and M. H. Wagner, Wheatfield, head the company.

MILLBURN, N. J.—The Millburn Electric Company will abandon its power plant and will secure power from the New Jersey Power & Light Company, Dover, for distribution. The generating plant will be held for reserve service. New lines will be constructed.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, until June 6 for electric lamps and other electrical and mechanical equipment for use in the city schools. R. D. Argue is secretary.

NEWARK, N. J.—The Park Avenue Coal Company, 389-91 Park Avenue, is planning to install three new coal trestles at its yards, which will be equipped for electrical operation.

NEWTON, N. J.—An electrically operated pumping plant will be built on High Street, in connection with extensions and improvements to the waterworks, to cost $246,500. Tribus & Massa, 15 Park Row, New York, are engineers.

TRENTON, N. J.—The Board of Freeholders contemplates installing an electric power plant at the County Workhouse.

VENTNOR, N. J.—An electrically operated pumping plant will be installed in connection with extensions in the municipal waterworks, to cost about $200,000.

ENOLA, PA.—The Pennsylvania Railroad Company will build a power house in connection with its proposed repair shops in Enola, to cost about $500,000.

HARRISBURG, PA.—Bids will soon be asked by the Board of Education for the construction of a one-story power plant, to cost about $150,000. D. D. Hammelbaugh, 121 Chestnut Street, is secretary.

IRONVILLE, PA.—The Farmers' Electric Company, Oxford, will extend its system to Ironville, Silver Spring and Chestnut Hill.

LEWISTON, PA.—The Penn Central Power Company, recently organized, will build a large electric power plant at Saxton, with initial capacity of about 20,000 hp. The company is operated by Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia.

McCONNELLSBURG, PA.—S. B. Jackson and J. W. Homer, both of Greencastle, are organizing a company to furnish electrical service here. Electricity will be secured from the Kauffman's station of the Chambersburg, Greencastle & Waynesboro Traction Company.

MOWRY, PA.—The Pennsylvania Power & Light Company, Allentown, is planning to rebuild its local substation, recently destroyed by fire.

PHILADELPHIA, PA.—The Philadelphia Electric Company will increase the output of its different generating stations to 336,200 kw. Work will soon commence on a new sub-station at Sixth and Federal Streets.

PHILADELPHIA, PA.—Plans have been filed for the erection of a one-story power house at the plant of the Gotham Silk Hosiery Company, Second and Norris Streets.

READING, PA.—A power house will be erected at the waterworks pumping station, to cost about $60,000.

UNIONTOWN, PA.—The Nicholson Coal Company is planning to rebuild the power house at its Patrick mine, recently destroyed by fire.

WEATHERLY, PA.—The Lehigh Valley Railroad Company will build a steel tower transmission line from its plant at Ashmore to Weatherly, for power service at its local shops, to replace the present steam plant.

CUMBERLAND, MD.—The Cumberland Edison Power Company, recently organized, has applied to the Public Service Commission for permission to take over the Edison Electric Illuminating Company and the Cumberland Electric Railway Company. Authority has also been asked to issue $150,000, in capital stock, and $1,700,000 in bonds, the proceeds to be used to finance the merger, including extensions and improvements. Thomas B. Finan is president of the new company.

EASTON, MD.—The New Brick & Tile Company, recently organized, will build a power house in connection with its proposed brick and tile manufacturing plant, to cost about $50,000

OXFORD, MD.—Bids will be received at the office of the Oxford Utilities Commission until June 1 for furnishing and installing an additional electric generating unit, complete. Separate bids are asked on a 25-hp. Fairbanks-Morse type "Y" alternator, with exciter and switchboard; a 37½-hp. unit and a 50-hp. unit.

WEYER'S CAVE, VA.—The Weyer's Cave Light & Power Company contemplates the installation of a 500-kw. auxiliary oil-engine-driven generating unit.

North Central States

LANSING, MICH.—Preliminary plans are under way for a new industrial and vocational school building at the Industrial School for Boys, Lansing, to cost about $1,000,000. L. W. Fryer, University of Michigan, Ann Arbor, is architect.

ROCHESTER, MICH.—The Council has approved plans for the installation of an ornamental lighting system in the business district.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until June 2, for ornamental whiteway and parkway lanterns.

OTTAWA, OHIO.—The Paulding Electric Service Company, Defiance, is having plans prepared for local power plant, to cost about $200,000. O. S. Shepfer is president.

PORT CLINTON, OHIO.—The Northwestern Ohio Railway & Power Company, Toledo, will construct a new 22,000-volt transmission line in this district.

DANVILLE, KY.—An addition will be built to power plant at Kentucky School for the Deaf. Augustus Rogers is superintendent.

MORGANFIELD, KY.—The Kentucky Utilities Company, Louisville, is planning to erect a 33,000-volt transmission line from Clay to Morganfield, to cost about $75,000.

WHITESBURG, KY.—The Kentucky & West Virginia Power Company, Hazard, has purchased the property of the W. C. Daniel Light Company, Whitesburg, and will erect a high-tension transmission line from Dalna, via Ice, Whitco, Caudill and Sandlick to Whitesburg. From Whitesburg it is planned to penetrate the main Elkhorn coal fields and on into the Big Sandy Valley. Connection will be made at Pikeville, the center of the Big Sandy Valley, where a large substation will probably be erected. From Pikeville transmission lines will be extended to Welch and Spriggs, W. Va.

DIXON, ILL.—The Illinois Northern Utilities Company contemplates extensions and improvements, including the installation of a 6,000-kw. generator, in its local generating plant, and extending the transmission system to Waukegan to connect with the lines of the Public Service Company of Northern Illinois. The cost is estimated at $500,000.

TAMMS, ILL.—The Tamms Light & Power Company, recently organized, will install a power plant. F. H. Stanton and Charles E. Hinz are interested in the project.

NEW LONDON, WIS.—Plans are being prepared by H. R. Albert, engineer, Green Bay, for the installation of an ornamental lighting system, to consist of from sixty to seventy-five steel standards.

PRAIRIE DU CHIEN, WIS.—F. Heer & Sons, B. & I. Building, Dubuque, Iowa, have been engaged to prepare plans for a new central heating and power plant, for the Campion College, to cost including equipment, about $50,000.

AMES, IOWA.—The Council is considering extensions to the municipal electric plant. P. F. Hopkins is city engineer.

MARSHALLTOWN, IOWA.—The Council contemplates the construction of a municipal hydro-electric plant. Alvord & Burdick, 8 South Dearborn Street, Chicago, are engineers.

LIBERTY, MO.—The installation of a municipal electric plant is under consideration. The Chamber of Commerce is interested in the project.

GROTON, S. D.—A franchise has been granted to the Aberdeen (S. D.) Light & Power Company for light and power service. A transmission line will be erected from Aberdeen to Groton.

BELLEVUE, NEB.—Citizens have approved bonds for $25,000 for extensions and improvements to the electric lighting system.

HUMBOLDT, NEB.—The Cooper Mill & Light Company is planning to rebuild its power plant at once, recently destroyed by fire. The loss is estimated at about $50,000.

LAWRENCE, NEB.—Plans are being prepared for the installation of a municipal electric lighting system, to cost about $13,000. The Hollister Engineering Company, Bankers' Life Building, Lincoln, is engineer.

EMPORIA, KAN.—The Kansas Electric Power Company, Topeka, is planning extensions to its local power plant.

LIBERAL, KAN.—The Council has authorized plans for the construction of a municipal power plant. The Ruckel Engineering Company, Interurban Building, Hutchinson, is engineer.

Southern States

GREENSBORO, N. C.—The Southern Power Company has been ordered by the United States Circuit Court, Richmond, Va., to furnish power to the North Carolina Public Service Company for distribution at Greensboro and High Point, N. C.

EASLEY, S. C.—The Council is considering calling an election to vote on the proposal to issue $75,000 in bonds for improvements to the lighting and water systems and for street improvements.

AUGUSTA, GA.—Plans are under consideration by the Board of City Directors for a municipal hydro-electric plant on Rae's Creek, to cost with transmission and distribution system about $1,000,000. W. P. White and C. D. Carr are members of the board.

JOHNSON CITY, TENN.—The Tennessee Eastern Electric Company will begin work at once on a hydro-electric power plant on the Watauga River, to develop about 5,000 kw., to cost, including transmission line, about $300,000.

NASHVILLE, TENN.—The Hermitage Portland Cement Company, Chattanooga, will establish a power plant in connection with its proposed cement mill, on the Old Hickory property, to cost about $1,500,000.

ROGERSVILLE, TENN.—The Smith-Sanders Power Company contemplates the construction of a hydro-electric plant on the Holston River in Hawkins County.

FORT SMITH, ARK.—The Mississippi Valley Power Company, recently organized, with a capital stock of $1,700,000, will take over the property and holdings of the Commonwealth Public Service Company. Extensions and improvements are contemplated. D. C. Green is president.

RUSSELLVILLE, ARK.—The Council is considering a bond issue of $250,000 for the construction of a municipal electric plant.

DE QUINCY, LA.—The Chamber of Commerce is making surveys for the installation of a new lighting system in all parts of the city.

NEW ORLEANS, LA.—Bids will be received by the Sewerage and Water Board of New Orleans until July 19 for furnishing one 6,000-kw. turbine and accessories. George G. Earl is general superintendent.

PLAQUEMINE, LA.—Plans are being prepared for improvements to the municipal electric light plant and waterworks system, to cost about $150,000. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

DUNCAN, OKLA.—A. L. Mullergren, Gates Building, Kansas City, Mo., has been engaged to prepare plans for the installation of an electric distributing system, in Duncan, to cost about $80,000.

FAIRLAND, OKLA.—The Council will receive bids until June 20 for the construction of a transmission line. H. G. Olmstead & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

GAGE, OKLA.—The Council will receive bids until June 1 for extensions to the electric system, including the installation of two 100-hp. oil engines. H. G. Olmstead & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

MUSKOGEE, OKLA.—The Royal D. Salisbury Company, 233 Broadway, New York, engineer, has tentative plans under consideration for the construction of a hydro-electric generating plant on the Grand River, to develop about 125,000 hp.

OKEENE, OKLA.—The Council will receive bids until June 1 for extensions and improvements in the municipal power plant and system to cost about $40,000. V. V. Long & Company, Colcord Building, Oklahoma City, Okla., are engineers.

CORPUS CHRISTI, TEX.—The Gulf Coast Power Company contemplates extensions and improvements to its power plant, to cost about $50,000.

FORT WORTH, TEX.—The Lighting Department is considering the installation of an ornamental lighting system on several streets in the city. R. A. Hunter is light commissioner.

TEXAS CITY, TEX.—The United States-Mexican Oil Corporation will build a power plant in connection with its new oil distributing works on the dock property leased from the Texas City Terminal Company.

Pacific and Mountain States

CARLISLE, WASH.—The Carlisle-Pennell Lumber Company is planning to equip its plant throughout for electrical operation, including a new Monorail conveying system, to cost about $250,000.

OLYMPIA, WASH.—The city lighting committee has been authorized to call for bids for the installation of an ornamental lighting system in the business district. Service will be furnished by the Olympia Light & Power Company.

SPOKANE, WASH.—Arrangements have been completed by the Washington Water Company for lighting the towns of Ephrata, Wilson Creek, Marlin, Adrian, Stratford and Neppel, which will require the erection of a 14-mile 13,000-volt transmission line from Stratford to Marlin. The company has taken over the plant in Wilson Creek, which will be dismantled.

WALLA WALLA, WASH.—The Water Commission will make surveys for the construction of a municipal hydro-electric plant.

BAKERSFIELD, CAL.—Plans are being prepared by the Di Giorgio Farms Company for a new ice-manufacturing, refrigerating and pre-cooling plant, to cost about $1,200,000.

FULLERTON, CAL.—The Board of Education is preparing plans for the erection of a new power plant at the Union High School, to cost about $100,000. Carleton M. Winslow, Van Nuys Building, Los Angeles, is architect.

HEMET, CAL.—The Lake Hemet Water Company has applied to the State Water Commission for permission to construct a hydro-electric plant on Strawberry Creek, to develop 5,200 hp.

LOS ANGELES, CAL.—The Public Service Commission is preparing plans for a power house on the San Fernando Road, to cost about $90,000.

RIVERSIDE, CAL.—The Southern Sierras Power Company has been granted permission by the State Water Commission to construct a hydro-electric plant on Snow Creek, to develop 12,350 hp. Another plant will be built later in the same vicinity with capacity of 5,500 hp.

SACRAMENTO, CAL.—Surveys will be made by the City Engineering Department for the construction of three municipal hydro-electric plants in the Silver Creek section, about 60 miles from the city, to develop about 100,000 hp. The cost, including transmission system, is estimated at about $5,000,000. Albert Given is city engineer.

BONNERS FERRY, IDAHO.—Work will soon begin on the construction of a new municipal hydro-electric plant at Moyie Falls, to develop about 550 hp. H. H. Hughes is manager of the municipal electric water and light department.

ARRIBA, COL.—E. A. Brown, 715 Minnesota Avenue, Kansas City, Kan., has been awarded a contract to erect a transmission line to Flagler, about 10 miles. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

DENVER, COL.—The Denver Gas & Electric Company contemplates the construction of a hydro-electric plant on Grand River, near Kremling, with an initial capacity of 57,000 hp.

PUEBLO, COL.—The Southern Colorado Power Company has been organized to take over the plants and property of the Arkansas Valley Railway, Light & Power Company.

Canada

DRUMHELLER, ALTA.—Steps have been taken by the Drumheller Land Company to replace the generator in the power plant at the Callie Mine, recently destroyed by fire.

HANNA, ALTA.—The Town Council is considering the establishment of a municipal electric light plant.

ST. JOHN, N. B.—The Council has adopted a resolution authorizing a bond issue of $900,000 for the installation of a civic hydro-electric distribution system.

NIAGARA FALLS, ONT.—The installation of five additional generating units at the Queenston power station, to develop from 250,000 hp. to 300,000 hp., is under consideration by the Hydro-Electric Power Commission of Ontario.

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Secrecy in Manufacturing

OLD superstitions die hard, and while they linger some of them do harm. Such a superstition, for instance, is the idea still prevalent among many manufacturers that each must maintain a set of secrets, mysteries alike to their customers and to their competitors. The influence is hurtful past all calculation.

It is a matter just now worth the attention of the manufacturers of the electrical industry because it offers an obstacle to the development of that very program of promotion in which all have become so interested. It is another public relations problem no less important than that which marks the contact of the utility with the local public.

TIME was when each manufacturer made his goods in his own way. His line was individual and different. His methods and his processes he guarded jealously. But those were other years, before the mail, the telephone, the express and the traveling salesmen had knit the world into a unit and each manufacturer had become an element in a common industry with a national distribution and influence.

The days of the close mouth have passed. The era of publicity and frank sincerity is here.

Behind each manufactured product lies a human story of vision, ingenuity, persistent skill and enterprise. The manner in which that product was conceived, designed, perfected and then evolved through further gradual improvement is of interest to each customer. The method of manufacture, the quality of materials and workmanship are clear to every competitor who investigates.

For as long as employees change jobs and talk, as long as salesmen gossip, the facts will be known. Only once in a thousand times is such a secret possible or necessary; for personal contact, confidence and understanding are still the greatest influence in business.

THE manufacturing executive should be as accessible to the man of his industry as the central-station manager should be to his community. He should encourage his customers, their trade and his competitors to visit his factory and see what his goods are made of and how. He should talk freely to these friends and put behind his products all the strength of the human story that they represent. He should make his problems and his achievements known, because, after all, they are not his alone but the concern of all his industry.

Electrical men of all branches of the industry have proclaimed a national movement for the development of business. It must carry the message of electricity to all men. But if the work is to be done in any big and satisfying way, complete co-ordination must be realized within our own ranks. And to accomplish this we must all lay secrecy aside and understand each other.

Owen D. Young

A lawyer and executive whose ability in the realm of corporate organization has had an important effect on the progress of electrical development.

IN SUCCEEDING C. A. Coffin as chairman of the board of the General Electric Company O. D. Young stands at the head of the largest electrical organization in the world, an organization whose ramifications take it into almost every place of electrical endeavor. By training Mr. Young is a lawyer. His practice has all been in corporation cases, and in this connection he has for years stood among the leaders of his profession. In the last ten years, during which he has been a vice-president of the General Electric Company at the head of its legal department, his great ability in corporate organization has had a wonderful manifestation in the electrical industry. In not a few cities where the utilities had been unable to make any progress because public sympathy had been alienated Mr. Young has been able to heal the breach and once more bring about order. He has been an apostle of friendly relations with the public and employees and an advocate of the London sliding scale of rates, modified in each instance to fit the local situation.

His latest corporate triumph, and what by many is considered his greatest effort in the electrical field, was the creation of the Radio Corporation of America, of which he became chairman of the board. Here he amalgamated divergent factors and reconciled opposing factions and as a result built an organization which stands as a monument of national and international progress in the field of communication. It might be noted that had the Radio Corporation of America not been formed as and when it was, radio communication, instead of remaining in the hands of American interests, might have become another British monopoly owing to the governing influence of the British Marconi Telegraph Company interests in the American Marconi Company

During the past year Mr. Young has given attention to the building of an international radio system with a comprehensive and adequate scheme of standardization, the results of which are bound to have a profound influence on the progress and development of radio communication.

His happy faculty of getting individuals and organizations to co-operate is finding expression in the counsels of the joint committee on telephone interference. The progress already made by this committee has given heart to both the telephone and the light and power interests because it is showing a way whereby this problem can be handled in a friendly manner.

As a member of both of President Wilson's industrial conferences Mr. Young served ably to bring capital and labor into more harmonious relations with each other. As permanent chairman of the committee appointed by Secretary Hoover, he is studying ways and means of minimizing the effects of non-employment.

Mr. Young is a comparatively young man to hold such an important position. He was born in Vanhornesville, N. Y., Oct. 27, 1874. At the age of twenty he was graduated from St. Lawrence University and in 1896 from Boston University, where he studied law. That year he started to practice and later became a member of the firm of Tyler & Young of Boston. His work with this firm was of such a high order as to attract unusual attention. Among his clients were Stone & Webster, for whom he solved many complicated problems. Since his association with the General Electric Company he has naturally been closely identified with the direction of its many subsidiary and affiliated companies.

Editorial Comment

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Money Again Under 6 per Cent

CONFIDENCE in electric light and power company securities is still growing. A year or more ago 7 per cent would have been a low yield on a good bond. Many excellent issues came out at a rate of 8 per cent or higher, and even then a ten-year to fifteen-year non-callable period was required. Now, it is seldom that the yield goes above 7 per cent, and some issues are under 6 per cent. In the last two weeks two issues, one for more than $12,000,000 and the other for $7,500,000, have been offered at under 6 per cent, the former on a 5.70 per cent basis and the latter on a 5.53 per cent basis. What is more surprising, a 5 per cent issue came out last month at a substantial premium so that the yield was down to 4.70 per cent. This bond happens to be a legal investment for Massachusetts savings banks, but even so it is indicative of the future.

With money becoming so reasonable in price, it seems about time for those companies that floated 7½ and 8 per cent issues to begin figuring on some refunding. Just at present the investment market is hungry for electric light and power company securities.

Railroad Rate Reduction an Expedient of Doubtful Value

THE order of the Interstate Commerce Commission effective July 1 cutting freight rates 10 per cent will mean a saving of from 10 to 30 cents per ton of coal consumed by electric light and power companies. Nevertheless, unless the reduction is justified by an increase in railroad business it would be better if it had never been made. No public utility seeks to profit at the expense of some other utility, nor can any utility acquiesce in a rate reduction predicated mainly on hope. When it can be shown that the railroads are earning too much money it will be time enough to cut rates. Business must be in a bad way when it will stoop to accept gratuities from the Interstate Commerce Commission.

The financial condition of the railroads is none too good though they are said to be making some money now. If they can operate and grow under the rate reduction, so much the better, but it is idle to expect any great demand for railroad securities paying perhaps 5¾ per cent and perhaps not, when better bonds paying more are procurable. It would have been far wiser to enable the railroads to get on their feet first than to curtail their incomes at this critical time. We want transportation, and, as Herbert Hoover has said, we want it with the values of private initiative and clean public service. To shake the confidence of the public in railroads as an investment, therefore, can mean only a dearth of funds, and if the railroads lack funds, business will discover that they will fail it when it needs transportation. High commodity and labor costs still plague the railroads, and to expect them to absorb any great loss in revenue due to lower freight rates is to expect the impossible. Our railroads have been kicked about and experimented with enough. It is about time that those skilled in transportation be given a freer hand and a little encouragement.

Reorganizing for Business

IT HAS taken some time for the manufacturing branch of the electrical industry to arouse itself to a full appreciation of the necessity for fighting for business. While every one has agreed for a long while that goods will no longer be purchased but that they must be sold, few have had the courage to take the plunge into reorganization which the situation demanded.

During a period of seven years many organizations and many men went to seed, principally because the stimulus of competition was lacking. A good housecleaning therefore is necessary. It is very unpleasant to shelve men and replace old with new—to put on the pension list men with whom you have been associated for years but who have neglected to keep in fighting trim. Still, with a great many concerns, it's that or the graveyard for the company. There is a tremendous amount of business to be had, but it must be developed.

Some manufacturers have already done their reorganizing and they have been the first to feel the effects of returning business confidence. It is a pleasure to note that others are now getting on the band wagon. However, the great mass of manufacturers have neglected to take the human inventory. If they delay too long, they will wake up some fine day to find a reorganized competitor picking all the plums. The sad part is that frequently those concerns which wait until business is lost before they put their forces in fighting trim suddenly seem to go insane. Without weighing men or stopping to find out where individuals can function best, the whole force is dispensed with and a new lot put in their place. Sometimes this produces business, but more often it loses business through the bad relations which it engenders.

There is an old saying that "Time and tide wait for no man." This might well read, "Business waits for no reorganization."

Engineering Courses and Our Secondary Schools

THE action of the deans and other representatives of fourteen engineering faculties in the Middle West in recommending the addition of a fifth year to technical courses of study for the benefit of ambitious students, those who complete it to gain a degree outranking that conferred on four-year graduates, is quite in line with the theories of modern educationists, who, alike in arts and in technology, are far from satisfied with the attainments of the average college graduate.

The deans desire to "remodel the present four-year engineering curriculum, substituting a substantial proportion of humanistic and fundamental subjects in place of an equivalent amount of advanced technical work," and deferring the student's choice of his special branch of technical study until the end of his second year. Like the professors of other subjects, they are, if not dismayed, at any rate perturbed by the immaturity of the freshman and his sometimes amazing ignorance of what he is supposed already to have learned.

It is impossible to quarrel with the educators for their insistence on a longer course. Probably this is the only way to turn out reasonably well-rounded men. Yet the tendency constantly to prolong the time of preparation for the work of life forms in itself a problem. The normal elementary-school, high-school and college courses consume sixteen years, or a quarter of a reasonably long span of existence. It would not be necessary to add to this period of waiting were the work of our secondary schools done better. Far too often the high-school graduate is only where the grammar-school boy should be. Were the former possessed in fact, as he is in theory, of the fundamentals of culture, were his taste for literature or for philosophy or for languages developed, as it might be, so that he could and by self-compulsion would pursue further these pleasant and little arduous studies, with or without the stimulus of college discipline, is there any reason why, at eighteen or nineteen years of age, he should not bend his main energies to engineering studies if through these lies the path to his individual goal? A hundred years ago men knew little of modern science, but at the age our sons enter college they often left it walking epitomes of the subjects that cause so much twentieth-century despair.

Path to Higher Plant Economy Leads Through Refinement of Details

NO RADICAL departures from mechanical practices are apparent in Calumet station—the latest plant of the Commonwealth Edison Company—but every effort has been made to refine equipment which has given satisfactory service in the past and to insure the highest economy of operation by careful attention to the smallest details. The most striking feature of the boiler plant is the use under one boiler of a forced-draft chain-grate stoker of unusual proportions in place of the two grates per boiler that have been employed under the other boilers of the plant. The use of these stokers will be watched with interest.

Another thing of interest is the fact that experience so far with the new plant has indicated that three 15,089-sq.ft. boilers are amply able to serve one 30,000-kw. turbo-generator.

The steam pressure and superheat adopted—namely, 350 lb. and 250 deg.—show the present tendency toward higher pressures, although the pressure cannot be called radical even though it is above the pressures in present use in the majority of cases.

Every effort to conserve heat that might be lost through drips and other paths has been made in addition to careful provisions for maintaining the heat balance and preventing the larger losses of heat. To assure proper feed-water temperature under all loads facilities are furnished for bleeding the low-pressure stages of the prime movers. That the provisions have been successful is evidenced by the fact that, with the plant as yet not fully completed, it has been possible to put a kilowatt-hour on the switchboard with a fuel consumption equivalent to 18,000 or 19,000 B.t.u.

Present conditions indicate that the path toward greater economy in steam-plant design and operation lies in the direction of refinement rather than totally new things although it may be recalled that this station is also noted for being a pioneer in isolating its phases.

The Optics of the Electric Sign

THE paper which we published last week by C. A. Atherton regarding the legibility of electric signs is one of the neatest pieces of practical investigation which we have had the pleasure of presenting for some time. In a general way the electric sign has been pretty well exploited and its principles have been in a measure understood. But the questions of brightness, spacing of lamps, size of letters and nature of background have not until now been correlated with reasonable precision. The great fundamental principle of design is that legibility at a distance depends in the last resort chiefly on the size of the letters, assuming that they are of reasonably normal proportions. It is somewhat conventionally assumed that details lying closer together than one minute of arc cannot be separated but merge in a common blur. From a practical standpoint one minute is a considerable understatement of the facts, and in practice, even where the intense brilliancy of the electric lamp is not concerned, the distance is much nearer two minutes than one, and in most circumstances details separated by even three minutes are likely to be indistinguishable to the average eye. Under ordinary conditions, moreover, the phenomena of irradiation operate adversely in increasing this critical distance so far as legibility of a distant letter is concerned. Irradiation causes lights in the same line of the sign to blend at a lesser angle of separation than the normal. This may be helpful, but it also causes blending of the details of the letters at an abnormally short distance.

Mr. Atherton has done extremely good work in obtaining a well-defined empirical relation for the apparent size of the spot of light furnished by a lamp as a function of its distance and brightness, giving thus a good measure of the irradiation of an intensely brilliant object like an electric lamp. The effect of this is startlingly great, as some of the data given by him show. At an approximately given degree of contrast the legibility is a fixed quantity determined by angular extent. White on black and black on white differ very little in legibility if the relative contrast is the same, but black on white paper and electric light on the black background of sign or sky disclose an entirely different situation, and irradiation comes in at its full value. This is the reason why it frequently happens that decreasing the candlepower of the lights in the sign increases the legibility in a very notable degree.

At extremely long distances, where the irradiation is relatively very conspicuous, the atmospheric absorption may be great and may actually help out legibility, as Mr. Atherton's experiments show. Surrounding illumination furnishing an illuminated background, particularly in the case of haze, generally cuts down the distance of legibility, other things being equal, just as the lights of a city cut down the clear brilliancy of the stars. On the whole, it is wise in designing a sign for ordinary conditions of visibility to assume a greater quantity than one minute of arc as the critical distance of separation, to make the letters as big and open as possible and to use rather small individual lamps. If the location is such that there is not likely to be trouble from a background conspicuously luminous or from the glare of neighboring lamps, there is not likely to be any trouble from lack of brilliancy in the lamps. The contrast between a line of lamps spaced under the critical distance on the background of night is sufficient to carry legibility very far even if the lamps are individually of small candlepower. It is only in thick weather that the light of powerful lamps is sufficiently dimmed by the atmosphere to make escape from this serious trouble from irradiation possible.

There are many interesting theoretical points brought up in Mr. Atherton's admirable paper, but its fundamental value lies in the very plain information given to the designer of signs for obtaining the best results with the material at hand.

Guide to Maximum Utilization of Transformer Rating

THE accurate indication of the maximum temperature of oil-immersed transformer windings presents an interesting problem in that the temperature of the windings depends not only on the load but also on the temperature of the surrounding ambient air. In those installations in which the ambient temperature does not change greatly and in which the load is known, either by instruments or otherwise, the load itself may be a sufficiently close indication of the temperature of the windings. However, in out-of-door installations in which the ambient changes over a wide range, and in the cases of isolated transformers including those of ordinary low-voltage distribution, dangerous temperatures may arise, and it has become of importance that a temperature indicator or hot-temperature signal be available. Considered alone, the temperature of the oil in the case may not be relied on, although, as L. L. Elden pointed out in these columns recently, a point can be formed in the surface oil where the temperature does follow the hot spot temperature at an approximately fixed differential. To obtain a reliable indication of the true hot-spot temperature, the temperature of the surface oil must be corrected.

Two devices with the above-mentioned object were described in the report of the electrical apparatus committee of the National Electric Light Association, presented at the Atlantic City convention. One consists of an indicating-dial-type thermometer with its bulb placed inside a small heating coil immersed in the hot surface oil. This heating coil carries current proportional to that in the main winding. Its windings are worked at the same current density and its insulation is proportioned to give the same elevation in temperature of the heating-coil windings above the surrounding oil as of the windings of the main transformer.

The second device corrects the oil temperature in its relation to the ambient temperature by means of interlinked bimetallic strips, one immersed in the hot oil and the other outside the case. Differences between the temperatures inside and outside result, through the motion of the linkage, in the tripping of an indicator which may be adjusted for different values of limiting internal temperature.

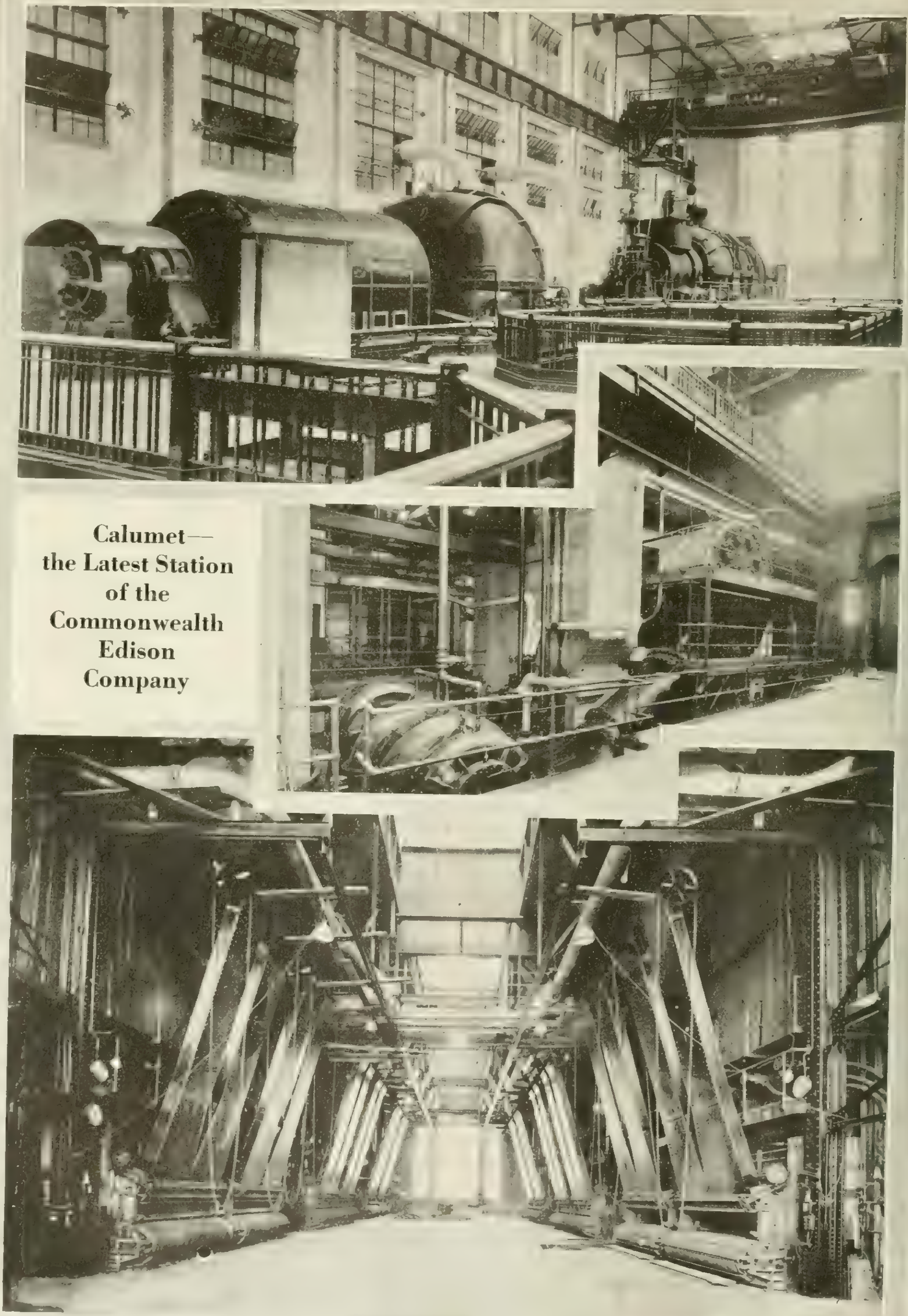
The indications of each device are obviously approximate only, but they are very satisfactory substitutes for coils and thermocouples located within the structure of the transformer itself, in that they avoid the complication and dangers attendant upon the use of the latter methods.

Compensated Spark Gap an Important Improvement

FOR the major equipment of a power system—namely, generators, transformers, conductors and similar apparatus—it is possible to predetermine and control the load demands. Consequently close design and accurate anticipation of performance are also possible. Another class of equipment, however, embraces machines for which it is impossible completely to estimate the service requirements and which, moreover, are expected to withstand attacks of unexampled suddenness and violence from unseen and unknown foes.

The lightning arrester is the object of the widest variety of these obscure attacks. In neither of its chief functions, that of discharging promptly over the entire prevalent voltage range and that of suppressing the resulting dynamic short circuit, has it yet reached a stage of development which can be called satisfactory when compared with the stage or stability of development of most other types of electrical equipment. The ideal arrester would be one that would discharge for any voltage rising slightly above the normal line value. Unfortunately, the ordinary spark gap, an indispensable adjunct of all high-voltage arresters so far developed, discharges at varying values of voltage for the different frequencies arising in line disturbances and suffers a further difference in performance as between wet and dry conditions. The gradual recognition of these influences has resulted in a progressive change of design, beginning with simple points and cylinders, passing through the horn gap and various modifications, and culminating in the protected impulse sphere gap. The special feature of the impulse gap is that its setting is approximately constant for all frequencies under dry conditions, but it must be protected from wet weather.

An admirably ingenious effort at a further improvement of the spark gap was described in the article by C. E. Bennett which appeared in last week's Electrical World. In this new form effort is made in the design to compensate for the variations in the two disturbing factors, namely, lightning frequency and wet conditions. The principal feature is a porous porcelain disk, non-conducting in dry and conducting in wet weather, just back of each of the central discharge points. This disk when wet has the effect of increasing the radius of curvature of the discharge points and hence of offsetting the reduction in sparkover value ordinarily experienced in wet weather. At the same time, the gap retains the desirable characteristics of the impulse sphere gap as regards varying impulse frequency. The reports of tests on the new gap are still, of course, comparatively meager. Further performance data to answer individually the many questions which must be answered before a general acceptance will be accorded to it are desirable. A natural question, for example, is what happens when the porcelain shields become saturated in sustained drenching rain. However, both principle and performance so far quoted appear to indicate an important improvement in spark-gap design.



Calumet—
the Latest Station
of the
Commonwealth
Edison
Company

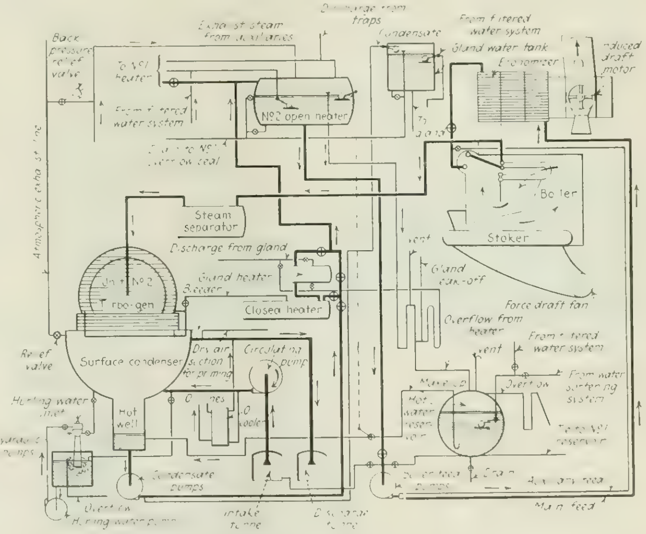
Calumet to Reinforce Industrial Section of Chicago System

This New Station of the Commonwealth Edison Company Has 15,089-Sq. Ft. Boilers with Integral Economizers and Forced-Draft Chain Grates —Steam Is Bled from Prime Movers for Heat Balance

SITUATED in the southeastern section of Chicago on the Calumet River, the new Calumet station of the Commonwealth Edison Company is on a site where it may be expanded to mammoth proportions and where it will also reinforce the portion of the system which is undergoing considerable industrial growth. Its position with relation to the other major stations on this system—namely, Fisk and Quarry Streets stations and Northwest—assures Chicago of a very dependable supply of energy. As originally planned, the new station was to contain six 30,000-kw. units, aggregating 180,000 kw., but already there is talk of eight units, and possibly more, if conditions warrant, and there is a possibility that later units may be of larger capacity. Two 30,000-kw. generators have been in operation for the last few months and the installation of two more units is under way. Though the station is chiefly of interest because of the phase isolation in the electrical part of the plant (discussed at length on page 761 of the April 2, 1921, issue of the ELECTRICAL WORLD), there are a number of mechanical features which differ from those in other plants built recently. For example, boilers with integral economizers are employed and designed for 350-lb. (24.5-kg. per sq.cm.) pressure and 685 deg. steam temperature. Large forced-draft chain grates are employed, and some departures have been made in furnace construction. The coal-handling arrangement is somewhat unusual, a coal breaker being used instead of the customary roll crusher. The heat balance is maintained by operating enough steam auxiliaries to heat the base load feed-water requirements and by bleeding the prime mover for additional steam.

To afford plenty of room for coal storage and future extensions to the plant a site of 43 acres (17.4 hectares) was selected. Of this space enough will be reserved for an ultimate storage of 150,000 tons of coal. Tracks will be provided with a steam locomotive to handle the cars and a locomotive crane to transfer the coal to and from storage.

As may be observed, over 70 per cent of the plan area of the building is devoted to the boiler house and coal-handling equipment, and if heights are considered, the relative volumes show a still larger ratio for the steam-generating end of the plant. Reduced to floor area per kilowatt installed, the boiler room occupies 0.52 sq.ft. (0.04 sq.m.) per kilowatt, the turbine room 0.195 sq.ft. (0.018 sq.m.), the transformer house 0.057 sq.ft. (0.005 sq.m.), and the switch house 0.13 sq.ft. (0.01 sq.m.), making a total of 0.9 sq.ft. (0.08 sq.m.) per kilowatt installed for the building.



FEED-WATER HEATING ARRANGEMENT AND METHOD OF MAINTAINING HEAT BALANCE

As may be seen from the sectional elevation of the plant, the boilers are set on the second floor. Below the central firing aisle are the train sheds for unloading coal and a storage pit having a capacity of 350 tons per boiler. On either side are the stoker ash hoppers, from which ashes are dumped directly into railway cars without intermediate handling. The forced-draft fans are on the boiler-room floor back of the respective boilers, and the induced-draft fans are at either side of the boiler house on a level with the economizers. They discharge upward into a smoke flue on the roof leading to a self-supporting steel stack placed centrally so as to serve four boilers on the same side of the firing aisle.

Originally it was planned to have four boilers per turbo-generator, but the seven boilers now installed have given such excellent results, operating up to 300 per cent of nominal rating without the least difficulty, that three boilers per generating unit of 30,000 kw. are now considered ample. Since each boiler contains 15,089 sq.ft. (1,388 sq.m.) of steam-making surface,

Calumet Station

of the

Commonwealth Edison Company

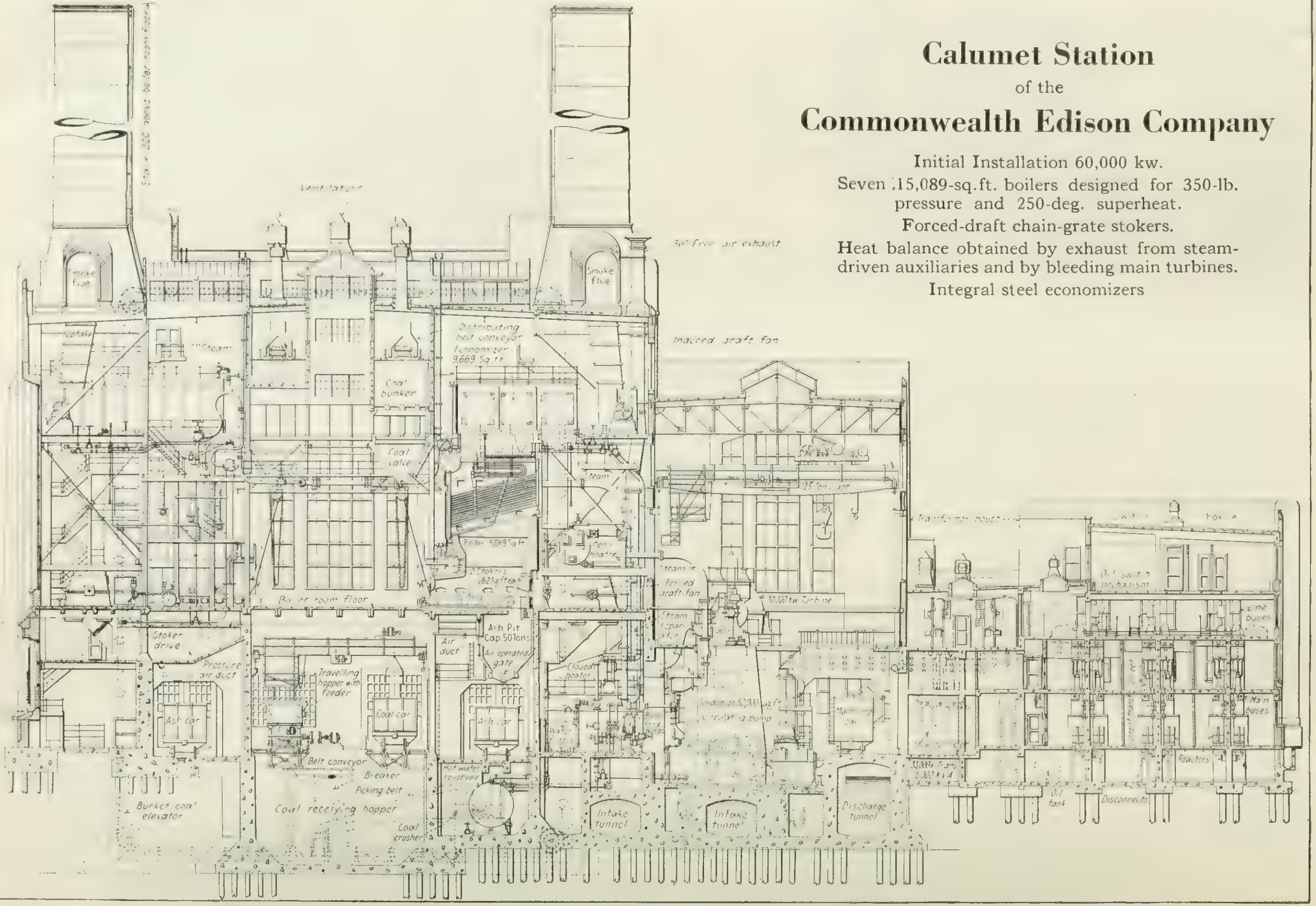
Initial Installation 60,000 kw.

Seven 15,089-sq.ft. boilers designed for 350-lb. pressure and 250-deg. superheat.

Forced-draft chain-grate stokers.

Heat balance obtained by exhaust from steam-driven auxiliaries and by bleeding main turbines.

Integral steel economizers



the allotment of three boilers to a generating unit would provide 1.5 sq.ft. (0.13 sq.m.) of heating surface per kilowatt of generator rating. Superheater surface and economizer surface are provided equivalent to 20 per cent and 64 per cent of the boiler heating surface respectively. The arrangement of the baffling, the location of the superheater and the division of the economizer into three sections, with the tubes running crosswise of the boiler tubes, are also clearly shown in the sectional elevation.

FORCED-DRAFT CHAIN GRATE HAVING 444 SQ.FT. OF AREA

Six of the boilers are served by forced-draft chain-grate stokers, two per boiler, set under the low end. Each stoker has an effective area of 182 sq.ft. (16.7 sq.m.), giving 364 sq.ft. (33.4 sq.m.) per boiler, which gives a ratio of one to forty-one to the steam-making surface. Under the seventh boiler of the present installation is a mammoth chain-grate stoker measuring 24 ft. 7.3 m.) in width by 18½ ft. (5.6 m.) in length and having 444 sq.ft. (40.8 sq.m.) of effective area, as compared with 364 sq.ft. (33.4 sq.m.) (aggregate) for the double stokers under the other boilers. Although the grate surface is continuous, the stoker is made of two separate chains, with the driving shafts coupled at the center and a motor at either side, the two being under common control. Approximately 7 per cent air space has been provided. To prevent clinker adherence, water boxes are placed on the ledge plates at the sides of the furnace and a 10-in. (25-cm.) waterback protects the rear wall. All three are connected into the boiler circulation. The stoker has six zones to which air is supplied by motor-driven fans.

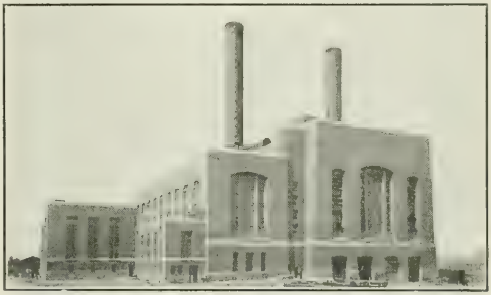
Air for combustion may be drawn from the boiler room or from the train shed immediately below, but the turbine-room basement will be the normal source of air supply. From a Y discharge on each multivane fan an air duct leads to each side of the stoker windbox. Admission to the air chamber of each zone is effected through sliding dampers controlled by levers at the side of the setting, their position determining the volume and pressure of air for each zone. Cross-connection between the inner ducts makes it possible for either fan to supply both stokers of the unit or to equalize the pressure between the two.

The absence of bridge walls and the use of waterbacks, ventilated side-wall tile and radial-end arches characterize the furnaces which are used. With the bottom of the front tube header 15⅓ ft. (4.6 m.) above the floor and the boiler tubes at the entrance to the first pass approximately 20 ft. (6 m.) above the grates, a furnace volume of 6,700 cu.ft. (189.7 cu.m.) is secured, giving 18.4 cu.ft. of volume per square foot (5.5 cu.m. per sq.m.) or grate area, or roughly 0.3 cu.ft. per pound of coal (0.017 cu.m. per kg.) burned at a combustion rate of 60 lb. per hour per square foot of grate surface (290 kg. per sq.m.).

Radial-end arches are used to protect the steel supports at the heel of the arch. The ignition arch extends 23 in. (58.4 cm.) into the furnace, allowing a gate opening of 20 in. (50 cm.). The main arch, which is 7 ft. (2.1 m.) long also has the radial or "fan"-end construction, which eliminates sharp corners and gives less opportunity for the hot gases to start disintegration of the arch. At the front of the furnace the main arch is 4 ft. (1.2 m.) above the grate, and in its length it has a rise of 6 in. (15 cm.).

Ashes are discharged from the rear end of the stokers into 50-ton hoppers placed directly underneath. These hoppers are protected against the action of the hot ashes and are provided with a sprinkler system for wetting them down before they are discharged through pneumatically operated gates into railway cars below.

Coal is unloaded in the train shed immediately under the central firing aisle of the boiler room by means of a traveling crane which discharges its load either into the large storage pit previously mentioned or into a traveling hopper. From the hopper the coal is fed on to a belt conveyor and delivered to a coal breaker similar to that used in the by-product coke industry. However, this is the first time that an installation of this kind has been made in a central station. The breaker has a capacity of 200 tons per hour. When the extension of the plant is made another breaker of equal capacity will be installed. Refuse, like tramp iron, mine props, etc., which is separated by the breaker, passes out one end on to a belt conveyor, from which it is picked off, allowing any good coal that may have been carried out of the breaker to pass on to another conveyor feeding two roll crushers. The latter discharges into a pivoted bucket conveyor carrying the coal to the top of the boiler house.



60,000-KW. NOW INSTALLED IN CALUMET STATION

Coal passing through the breaker discharges into the traveling hoppers previously mentioned and is fed on to a short belt conveyor which is reversible and may be discharged onto either one of two pivoted bucket conveyors elevating the coal to the overhead bunker level. Only one of these pivoted buckets has been installed, but when the addition to the plant is made the other will be added. From the conveyor the coal passes into either one of two receiving hoppers which discharge directly on to belt conveyors running above the coal bunkers.

As previously stated, two generating units have been installed, each having a capacity of 30,000 kw. at 85 per cent power factor. Unit No. 1 is a tandem compound machine having a speed of 1,200 r.p.m., and unit No. 2 develops the entire capacity in a single casing, the speed being 1,800 r.p.m. The condensers have 1.73 sq.ft (0.161 sq.m.) of cooling surface per kilowatt of generator rating.

Unit No. 1 has two condensate pumps, one motor-driven, the other turbine-driven. The air pumps are of the hydraulic type. For unit No. 2 hydraulic air pumps are also employed. Four units are installed, although normally two will take care of the requirements. The installation includes hurling-water pumps and a tank to store the water circulated through the air nozzles. The hurling-water pumps are mounted on the same shafts as the condensate pumps.

Circulating water for the condensers is taken from the Calumet River through four revolving screens backed up by a double set of stationary screens which will be replaced ultimately by traveling screens. From the crib house to the intake tunnels under the turbine-room basement the water is carried in an open flume. A common discharge tunnel carries the water to another open flume leading back to the river.

Prime Movers Bled to Maintain Feed Water Temperature

The feed-water heating system and the method of maintaining the heat balance are particularly interesting. Temperature of the feed water will be maintained about 175 deg. F. to prevent condensation of the sulphurous acid in the flue gases on the economizer tubes and thus reduce the external corrosion that would otherwise take place. Briefly, this is accomplished by introducing a closed heater between the condenser hotwell and the usual open feed-water heater. Sufficient steam is bled through the closed heater from the main turbines at about atmospheric pressure to maintain the water in the open heater at the temperature previously given. A recording thermometer guides the operator in varying the amount of steam bled from the turbines.

To heat the condensate, a certain amount of exhaust steam from auxiliaries as well as the discharge from steam traps is available. This is afforded by three turbine-driven boiler-feed pumps, one turbine-driven service pump and the steam-driven condenser auxiliaries. With the exception of the circulating pumps the condenser auxiliaries are in duplicate, one set being driven by turbines and the others by motors. As many of the auxiliaries as the heat balance will permit will be electrically operated.

An open heater to heat the feed water from 85 to 175 deg. F. is provided for each unit, the two being connected in parallel. The use of steam seals in turbine No. 1 made it desirable to recover the heat in this steam by passing it through an additional closed heater. The condensation from both closed heaters is returned to the hotwell of the condenser. The condensate pump draws from the hotwell of the condenser and forces the feed water through the closed heaters to the open feed-water heater. It then passes down to the feed pumps, which are cross-connected on the discharge side to give flexibility, and is forced up through the economizers to the boilers. Another path is through the auxiliary feed or wash line which bypasses the economizers and leads directly to the boilers. Feed-water regulators control the supply entering each boiler.

Makeup water is carried in a hot-water reservoir which receives the overflow from the open heater and the gland leakage. To maintain the level in this reservoir treated water is admitted under float control. An additional source of supply is the filtered-water system installed principally for gland cooling.

As the level drops in the open heater, a float opens a valve in the line from reservoir to the condenser hotwell and the vacuum draws over a supply of makeup water. If the level in the open heater should continue to fall, a second float at a lower level admits filtered water directly to the open heater.

In providing ventilation for the generators, a closed system has been employed, the cooling air being passed through a spray of water taken from the circulating-water tunnel. There is an alternate provision for carrying the hot air from the generators into the boiler room and drawing in fresh air through the air washer. In this event the water may be recirculated.

Oil strainers are installed at the main units, but no oil filters are employed. In the base of each unit sufficient storage has been provided for 1,000 gal. (3,780 l) of oil. This oil is pumped to the bearings and returned to storage in the usual way. To keep it at the proper temperature, the storage supply is constantly circulated through an oil cooler connected across the inlet and discharge of the condenser.

As much of the auxiliary apparatus in the station is motor-driven, elaborate provision has been made to insure the continuity of the electric supply. All auxiliary motors larger than 100 hp. are on 2,300-volt service, and those below 100 hp. are designed for 440 volts, with the exception of the stoker motors, which are 220-volt direct-current machines. To supply these services step-down transformers are connected to a special 12,000-volt bus placed in the transformer house.

For the 2,300-volt auxiliary service three buses have been provided—a 1,200-volt starting bus, a 2,300-volt running bus and a transfer bus, the last being an alternate to the running bus and supplied by an emergency transformer from the opposite section of the main auxiliary bus. The 2,300-volt auxiliary power center is located in the transformer house at the turbine-room floor level. All service switches for the large motors are installed in this location and arranged for remote control from the motors. Compensating starters are employed only on the 440-volt motors. When the starting push-button at the motor is closed, the motor is connected to the 1,200-volt starting bus fed from half taps on the transformer through a starting switch which remains closed until the starting current has dropped to a predetermined value, at which time an accelerating relay operates and opens this switch. Auxiliary contacts on the starting switch complete the closing circuit on the running switch after the starting switch is open, thus automatically throwing the motor over from the starting bus to the 2,300-volt running bus.

The design and construction of the steam plant was carried on under the general direction of Sargent & Lundy, consulting engineers, while the electrical installation was designed and installed by the engineering department of the Commonwealth Edison Company.

Public Service Company of Northern Illinois Ranks Twenty-seventh

The Public Service Company of Northern Illinois reports an output of 415,940,095 kw.-hr. in 1921. This report, just received, indicates that the company should have been included in the tabulation of generating and distributing companies having an output of more than 100,000,000 kw.-hr. in 1921 which was published in the April 29 issue of the Electrical World. This company would have ranked twenty-seventh in the tabulation. Of its total output, 359,410,664 kw.-hr. was generated in the company's plants and 56,529,431 kw.hr. was purchased. The peak load was 80,563 kw. and took place on Dec. 30, 1921.

Some Economic Phases of 40-Degree and 50-Degree Ratings

Two Ratings Have Increased Number of Frame Sizes and Confused the Buyer—50-Deg. Rating, to Be Justified, Must Afford Benefits Which Will Quickly Offset Cost of Introduction

By **CLARENCE L. COLLENS, 2d**
President Reliance Electric & Engineering Company, Cleveland

MANY articles and letters have appeared in the technical press during the past two years on the relative merits of 40-degree and 50-degree ratings, but these have dealt with the subject almost entirely from the engineering technical standpoint. This unfortunately has tended to becloud the real issue, which is very largely commercial and economic.

For years the 40-degree rating was the only recognized rating for many classes of electrical machinery. During this period there was no loud outcry of protest from any quarter against this rating, but, judging from the statements now made against the 40-degree rating, this period might properly be compared to the Dark Ages, in which the manufacturers and the consuming public were blindly groping in the dark and were with great difficulty and with costly errors endeavoring to use electrical machinery of uncertain and indefinite capacity. To bring order out of chaos and to satisfy a bewildered purchasing public, the 50-degree rating was finally offered as an "advance in the art."

Any claimed advance in the art in order to justify itself must possess some economic benefits to the consuming public. For purposes of illustration in discussing this situation from the economic standpoint, I will limit myself to industrial power motors in sizes of from 1-hp. to 50-hp. capacity, which is where the question of the relative advantages of the 40-degree or 50-degree rating has largely centered.

It is an acknowledged fact that with the same closeness of design the 50-degree ratings give frame sizes whose inherent capacities measured by the same yardstick are intermediate between the 40-degree frame sizes, or vice versa. Thus a 15-hp., 50-degree motor may be given approximately a 12.5-hp., 40-degree rating and be intermediate between a 10-hp. and a 15-hp., 40-degree rating. Similarly a 10-hp., 40-degree motor can be given a higher 50-degree rating which places it intermediate between a 10-hp. and a 15-hp., 50-degree rating. Reducing either one or the other to a common basis, we then have twice the number of frame sizes, or have, roughly, 1, 1.2, 1.5, 1.8, 2, 2.5, 3, 3.6, 5, 6, 7.5, 8.3, 10, 12.5, 15, etc., horsepower ratings instead of the previous standards of 1, 1.5, 2, 3, 5, 7.5, 10, 15 hp., etc. Many companies are building merely the 40-degree ratings, but the majority of companies building 50-degree ratings are also building the 40-degree ratings. These may either be distinct frame sizes or changes in winding specifications to give proper operating characeristics. I believe that this practice will be extended rather than curtailed, because the purchasing public is gradually being educated and there are ardent partisans in each camp. In fact, one company which replaced its 40-degree ratings with 50-degree ratings is now offering both as a distinct proposition instead of merely a de-rated 50-degree motor in cases where a 40-degree motor is called for. There can be no economic justification for the injection into an industry of twice the number of sizes previously found satisfactory, and it is diametrically opposed to the principles of simplification so admirably advocated by Secretary Hoover as an absolute necessity in the economic and industrial welfare of the nation. Some engineers rejoice in the dilemma in which the electrical apparatus industry now finds itself, as these engineers in buying have twice the number of frame sizes from which to select to meet various conditions of load.

The commercial confusion at the present time due to the two ratings is exactly the same as if two units of length both called a rod were commonly used in this country, one being the old standard of 5½ yards and the other being a new standard of 5½ meters. Whether it is measured with one or the other, the true length of some article offered to the public has not changed, but in making a purchase the buyer may not always know that a difference exists, or from lack of technical knowledge may be incapable of comprehending the significance of the difference even if told.

ECONOMIC AND ENGINEERING CONSIDERATIONS CANNOT BE SEPARATED

The economic consideration of the present two ratings cannot be divorced from application engineering. If all the operating conditions for which motors are to be selected were 5 hp., 7½ hp., 10 hp., etc., continuous, steady, fixed loads without any variation whatsoever, then there would in reality be no field for the application engineer, and 5-hp., 7.5 hp., 10-hp., etc., 50-degree motors could be applied to these operating conditions instead of 5-hp., 7.5-hp., 10-hp., etc., 40-degree ratings with a saving of from 5 to 7½ per cent in first cost, but with an acknowledged 10-degree less margin of safety in temperature to meet the many operating conditions which tend to increase temperature rise, such as clogging with dirt and dust, low voltage, etc. But all the operating conditions are not fixed, constant, steady loads corresponding in magnitude with arbitrarily chosen units of load rating standardized for the industry, namely, 5, 7.5, 10 hp., etc. There are just as many 5.3, 6.1, 6.5, 7-hp. loads and there are infinite variations in duty cycle, all of which must be taken into account by the application engineer in determining the motor to be selected.

Assuming one application engineer A offering a line of 40-degree ratings to meet all the operating conditions in the United States, and another application engineer B offering a line of 50-degree ratings to meet those same conditions, I maintain that because one is offering intermediate frame sizes as compared with the other, the first cost of a complete 40-degree installation is no higher than the first cost of a complete 50-degree installation, because under the infallible law of averages there are just as many cases where the 40-degree man can effect a saving by using a smaller 40-degree frame size as where the 50-degree man can effect a similar saving by using a smaller 50-degree frame size. This assumes the same margin of safety for temperature in each case, which is the only basis on which the two can be economically compared. Naturally the purchasing public is willing to pay more for a greater margin of safety in temperature, although under the premises no matter what margin of safety is selected by the public the same conclusion would have been reached. Where, then, is the economic advantage to the purchasing public in the 50-degree ratings?

To say that an intelligent purchasing public neglects the difference in inherent capacity between a 10-hp., 40-degree motor and a 10-hp., 50-degree motor, and that a qualified application engineer ignores this difference in selecting a motor for a given load and duty cycle, is absolutely contrary to what a careful investigation of the facts would reveal. The economic advantage is often in favor of the 40-degree motor because there are many engineers who always select a 50-degree motor of the next larger regular horsepower rating for a given job as compared with the 40-degree rating; for example, they select a 10-hp., 50-degree motor where they are willing to use a 7.5-hp., 40-degree motor.

SHOULD NOT PLAY ON CONFUSION OF BUYERS

There are, of course, some purchasers who know nothing about the difference in the methods of rating motors, know nothing about application engineering, and have no accurate knowledge of the load conditions and duty cycle for which the motor is being purchased. Such a purchaser is simply in the market for say a 7.5-hp. motor and finds that he is able to buy one 7.5-hp. motor for what to him is a price advantage as compared with another 7.5-hp. motor. To such a purchaser the vendors of the 50-degree rating appear in the position of giving a cut-price product as compared with the vendors of the 40-degree rating, for such a purchaser judges the two products as equal. An "advance in the art" which derives its economic benefits because of ignorance on the part of any of the purchasing public is on an exceedingly doubtful ground for its economic justification and enjoys merely a temporary advantage.

It is like the man who is in the market for bread and has no knowledge of the significance of the units of weight. He knows there are whole-sized loaves and half-sized loaves. All he wants is a half loaf of bread, and a half loaf marked 11 ounces has equal merit in his eyes with the half loaf marked 12 ounces. He buys the 11-ounce loaf at a lower price and goes on his way rejoicing. Unfortunately in many cases his hunger is satisfied by part of the half loaf purchased, the rest being thrown away, so that he never has an opportunity to learn by actual experience that the nutritive content, or inherent capacity, of the one is less than the other. The vendors of the 11-ounce loaf have an advantage without giving a real economic benefit.

Not only must an advance in the art give an economic benefit, but the economic benefit must be sufficient to absorb within a reasonable length of time all the cost of its introduction. It would cost the industry many millions of dollars to redesign completely all makes, types and sizes of electrical machinery from the 40-degree ratings to the 50-degree ratings. It is costing the industry other millions in the commercial confusion which results from a change of this character, the additional sales effort which is necessary to educate the purchasing public to the differences in the two standards, and in the inevitable and harmful price war which results where two standards are striving for supremacy in a highly competitive market. This is all in addition to the increased inventory cost and the additional manufacturing cost of manufacturing and offering, as is often done, both ratings, with the resulting division of a given volume of production into more individual varieties, sizes, etc. In the end the purchasing or investing public must pay this cost, but it presents a stupendous debit balance against "an advance in the art" of such doubtful economic value as the one under discussion.

If the change had been prompted by an advance in the quality or kind of insulating materials used, permitting higher temperature values with the *same factor of safety*, a real economic advantage could have been shown, but no such claims are presented. The result has simply been the introduction of intermediate frame sizes, which, if the customer applies the same factor of safety to each and reduces each to the same yardstick, gives under the law of averages no economic benefits where either the one or the other is used exclusively.

We all acknowledge that in the past there has been unnecessary overmotoring and little attention paid to application engineering. Had the same amount of time, money and effort been spent in educating the purchasing public and all sales organizations to a proper conception and more general use of the fundamental principles of application engineering and common sense in the choice of motors, even greater economic benefit could have been obtained without the resulting commercial demoralization which now exists. If the overload guarantee on the 40-degree rating confused the buying public and gave an "indefinite rating" with "only a general idea of its capacity," this could have been eliminated and a 40-degree single rating offered as a single standard without the tremendous development cost and attendant commercial confusion of the present two standards. As already explained, the 40-degree rating offers the same economic benefits where application engineering is properly applied.

No solution of the present exceedingly costly and uneconomical situation is as yet in sight, and the introduction of the 50-degree rating as an economic advance in the art has yet to be proved.

Energy Consumption by Various Types of Consumers

IT HAS been only within recent years that the complete adoption of metering devices has made it possible to make an intelligent investigation of the consumption of central-station energy by various types of consumers. Such an investigation has just been completed by A. C. Hall of the Southern Illinois Light & Power Company, covering the wide territory served by this company.

The accompanying table gives the average connected load and average annual consumption of various kinds of commercial customers as shown by this survey. The large connected load and energy consumption of the motion-picture industry are probably the most striking figures in the tabulation, which, it will be noted, goes back far enough to take in saloons.

TABLE OF CONNECTED LOADS FOR VARIOUS TYPES OF SERVICE

Kind of Business	Average Active Consumers	Average Connected Load, Watts	Average Kw-hr Per Year Per Consumer
Saloons and poolrooms	23	1,128	1,318
Restaurants	5	437	1,516
Stores	80	1,397	999
Dentists	6	342	97
Livery and feed stables	8	513	406
Picture shows	4	4,641	7,335
Photograph galleries	3	1,262	348
Lodge rooms and halls	12	1,163	362
Printing shops	4	1,520	1,574
Hotels and rooming houses	6	1,692	2,117
Hotels and saloons combined	4	3,019	3,801
Offices and banks	40	766	402
Schools	3	1,663	219
Churches	13	3,810	413
Club rooms, halls and skating rinks	2	643	201
Blacksmith shops, machine shops and garages	11	1,056	419
Factories	2	2,150	901
Plumbers	1	150	64
Miscellaneous*	26	787	681

* Includes bakeries, greenhouses, tailor shops, post offices, barber shops, railroad depots, laundries, gymnasiums and hallway lights.

Power Projects on the Colorado River

APPLICATIONS have been filed with the Federal Power Commission covering twelve projects on the Colorado River. The accompanying map shows the location of the various projects. Preliminary permits have been issued for a large portion of these projects, and surveys and estimates are now being made under these preliminary permits. James B. Girand has recently submitted to the commission the results of the surveys under preliminary permit No. 121 for a development at the mouth of the Diamond Creek and has applied for a license. This is the only development on the Colorado River for which the preliminary work has been completed.

Utility Securities as Investments for Life Insurance Companies*

Honest and Prudent Management and Fair Treatment by the Public and by Regulating Officials Necessary to Confidence and Financial Support

By Haley Fiske
President of the Metropolitan Life Insurance Company

I HAVE been asked to address you on the general subject of investment in light and power securities by life insurance companies. I can see the importance of the matter to your association, first because of your necessities, and second because of the enormous accumulation of life insurance assets amounting at the end of 1921 to eight and one-third billion dollars, and the large part of these assets invested in public utilities. Two years ago, that is at the end 1919, out of six billions of assets of American life insurance companies, about two billions were so invested.

As to your necessities, I am told that the total investments in light and power companies amount to five billion dollars and the financial division of my company, the Metropolitan Life, estimates that a billion dollars a year for the next five years will be required for refunding purposes, constructing generating stations, transmission lines, distribution systems, equipment, etc. This seems reasonable, for your present investments have doubled in the last ten years, and the business as years go on shows an accelerated growth. During the last seven years the companies have doubled the number of customers, and those years of course include the war years. Moreover, as the business develops, the uses of electricity are being multiplied and the localities covered are constantly extending.

No longer can it be said that electric light and power are restricted to city uses; the farming population is

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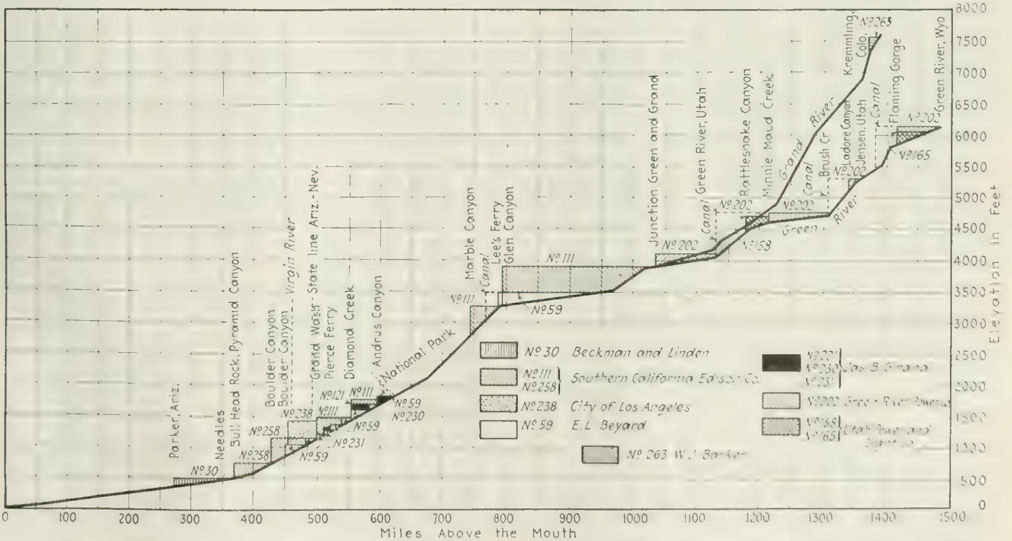
*Speech delivered before National Electric Light Association at Atlantic City, May 17, 1922.



MAP SHOWING LOCATION OF WATER-POWER PROJECTS ON THE COLORADO RIVER calling for modern conditions of living, and there are none more pervasive than the facilities afforded by electricity. Already the light and power companies reach two million farms, and as this fact becomes known and appreciated the demand among the non-provided is sure to increase. Thus this figure should be doubled within a few years.

INSURANCE COMPANIES SEEK SAFE INVESTMENT

Life insurance companies are constantly and eagerly looking for safe investments. Their assets must necessarily rapidly increase by reason of the principles on which the business is carried on. When I speak of life insurance companies, I am referring to the level-premium companies which build up reserves. The companies must invest the reserve at such a rate that the interest added to the reserves themselves and future premiums will produce the full amount of the insurance when it becomes due. The increase or reserves by life insurance companies in 1920 was $536,000,000. In 1921 my own company alone added $109,000,000 to reserves; I have not the figures for the other companies. You can therefore see how alert the executives must be to find good investment securities.

On what principles are those investments made? The first principle obviously is safety, for upon this depends solvency. Within this limit we may mention three other principles, though these are not all. One, very naturally, is to get the highest return, but this is modified by others, one of which concerns the needs of the general public and another the needs of the localities in which policy holders reside.

First, then, as to safety. This is a matter which *you* must control. The bondholder is interested primarily in having substantial equities back of the securities he buys, and insurance companies will not buy these bonds unless there are such equities. The obligation rests upon company management to maintain them; that is, there must be such a relation between values and mortgage bonds that the margin shall be kept ample. This margin should be at least 25 per cent. The Massachusetts law restricts the issuance of bonds to an amount not in excess of the paid-in capital. The companies must not rely upon borrowing on bonds and notes but must raise money by stock. Lately there has been a tendency in the wrong direction. From 1906-08 utility financing consisted of 76 per cent bonds and notes; in 1918-20 this percentage had increased to 88 per cent. It therefore devolves upon the management to make liberal provision for depreciation and keep up a high standard of maintenance. Unless this is done the credit of the companies is sure to become impaired. We have only to look at the traction situation to see the importance of these principles of management.

GOOD PUBLIC RELATIONS NEEDED

As public utilities, light and power companies are subject to public supervision and regulation, and these include rate fixing, there are therefore two directions in which investors must look. One is to the companies. Now, if you will allow me to say so, without any idea of boasting, I believe the great success of the Metropolitan Life Insurance Company, which in a generation has grown from one of the smallest to much the largest life insurance company in the world, is due to a constant policy of trying to sense and if possible forestall what the public has wanted on the one hand, and on the other giving loyal submission to the laws and endeavoring to keep in sympathetic touch with supervising authority to offer and even court full publicity in every detail of the business. It is your duty to satisfy the public as to service and charges. Self-interest requires the full performance of this duty. If your customers are satisfied, you have gone a long way toward business and corporate success. And full publicity of your operations and accounts is a necessary element in giving satisfaction. Extortion and inordinate profits must not be thought of. Fair returns must be insisted upon. Adequate facilities must be constantly offered. Your customers must always be made friends. Enlarge your opportunities to accomplish this. Get stock subscriptions from as many people as possible in the localities in which you operate. Encourage stock ownership among your employees. Convince them that they are fairly treated. Give them full information as to costs of plant, operation and maintenance.

On the other hand, investors have a right to fair treatment of your corporations by regulating authorities, and none has more right than life insurance companies. The Metropolitan Life Insurance Company has in force 26,000,000 policies, insuring 19,000,000 or 20,000,000 individual lives—one-sixth of the population. Thus it is not an abstract corporation that owns light and power securities amounting to $18,000,000. Our nearly a billion and a quarter of assets belong to them. This huge sum of money is their savings held for their protection. This is true not only of the mass but in separate localities. In ten of the largest cities of the country, with a combined population of 13,799,000, where we have light and power investments, our policy-holders number 4,612,982—or one-third of the population. The 251 life insurance companies doing business in the United States at the end of 1921 had 70,672,959 policies in force, insuring probably over fifty millions of individuals. They have the right of fair treatment on the part of supervising and regulating officials. When a light and power corporation is unfairly treated it is the people of the community, the voters and their dependents who suffer. It is their savings that are depleted.

DUTY OF UTILITIES, PUBLIC AND REGULATING BODIES

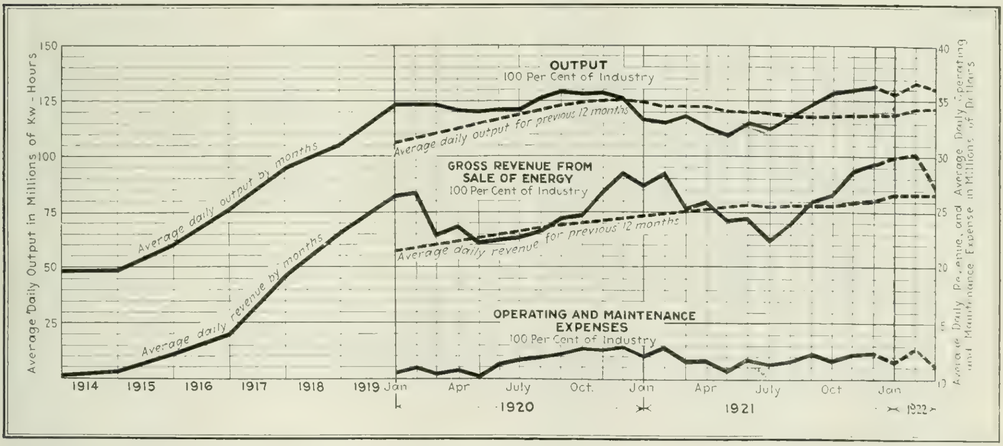
There must be public recognition of the tremendous part life insurance companies have played in the development of the country. Life insurance companies do not speculate. They make investments to keep. There can be no doubt that light and power distribution is a most important element in our life, in community life, in household life, in neighborhood life. In following out our principles of investment there should be a promising future for capital investments in light and power companies. I am here to advocate that these investments shall be studied by the management of life insurance companies, for a great service to community life can be rendered by furnishing needed capital on the principles and practices I have described. This gives me the right to say two things:

1. We have the right to insist upon honest, wise, prudent administration on the part of the companies; that there shall be no exploitation of population or investors; that ample equities shall always be continued by attention to depreciation and maintenance; that customers shall be fairly and generously treated; that there shall be offered full co-operation with regulating officials in right treatment of communities and customers.

2. We have a right to insist upon fair treatment of

light and power companies by the public and by supervising officials. It must be recognized that not corporate abstractions but the American people are the owners of the bond capital of the companies. Every policy holder is *ipso facto* a capitalist. An attack upon capital investments is an attack upon the wage earners of the country. Not only the regulating authorities but the people themselves must be taught this. The policy holders need this fact to be brought home to them. It is important to teach the working people that *they* are the capitalists and that attack on capital investments is an attack upon themselves. Overtaxation, confiscation, failure to help public utilities by refusing to permit adequate rates, are robbing *them*, not the rich. It is the working people who suffer first when there is lack of the service afforded by public utility corporations, because it is they who are chiefly dependent upon such service. It is important that legislators and members of public commissions should realize these elemental facts. And they should remember that injustice done or permitted by them is injustice not to the wealthy, but to their own constituents who put them in office. It is not the rich who own the steam railroads, the trolley lines, the telephones, the light and power companies; it is the poor and the people of moderate means, whose savings are invested in these enterprises.

Output More than Four Billion Kilowatt-Hours During March



REPORTS received by the ELECTRICAL WORLD for the month of March indicate that for the second time in the history of the electric light and power industry the monthly output of electrical energy exceeded four billion kilowatt-hours. From all reports the industrial energy requirements increased during March, but a large decrease in the lighting load brought the average daily output below the record reported in February and the total output for the month slightly below the record figures reported in December of last year. These statements are based on reports received from generating and distributing companies representing 78 per cent of the installed rating of the industry. A large decrease in the high-revenue load was reflected in the drop in the average daily gross revenue, which was about 10.1 per cent below that reported for February. It must be noted, however, that the output reported for March is 13.6 per cent in excess of that reported for March of last year and that this is the largest yearly increase since September, 1920.

Economically also the March returns are most encouraging to the electric light and power industry, especially when this industry is compared with other primary industries of the country. The electric light and power industry, while reporting a gross revenue 9.2 per cent in excess of that reported in March, 1921, also reported operating and maintenance expenses during March 3.9 per cent below those of March, 1921. Very few industries can report a large increase in revenue and for the same period a material decrease in operating expenses.

The output of electrical energy during March reflected a pronounced increase in industrial activity throughout the country. This was particularly noticeable in the metal-working industries and in the iron and steel industry.

Strikes in a large number of the New England textile mills during March resulted in considerable curtailment of energy requirements in that industry. In Massachusetts, for instance, almost one-third of the energy sold by central-station companies to industrial customers is consumed by the textile mills. A considerable curtailment, therefore, in textile-mill operations is keenly felt by central stations of that state and section. Practically all the other primary industries in this section, however, called for additional energy during March, with the result that, in spite of materially decreased lighting requirements, the electric light and power com-

TABLE I—CENTRAL STATION RETURNS FOR TWENTY-FOUR MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1921 Thousands	Kw.-Hr. Output 1920 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1921 Thousands	Revenue 1920 Thousands	Per Cent Increase		Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	Operating Ratio Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined 1920
April	77	2,675,949	2,895,067	-7.0	72	$55,326	$49,064	12.8	April	52	17,815	16,641	7.1	53.0	56.5	23.9	19.8	41.4	43.3
May	77	2,668,457	2,889,174	-7.6	72	53,901	47,932	12.6	May	52	17,274	16,727	3.1	55.4	56.8	24.2	22.9	40.6	44.8
June	77	2,686,479	2,872,900	-6.4	70	52,385	47,977	9.3	June	53	18,836	19,089	-1.3	56.2	62.5	20.4	21.6	45.0	50.9
July	77	2,706,016	2,949,132	-8.2	70	50,747	49,195	3.4	July	52	18,633	20,964	11.1	56.8	65.9	20.6	20.2	43.0	52.6
Aug.	77	2,839,498	3,041,927	-6.7	70	51,931	50,848	2.1	Aug	53	19,301	20,900	-7.6	56.2	63.8	22.3	22.2	44.5	52.3
Sept	77	2,848,212	2,937,339	-3.0	70	54,501	52,955	2.9	Sept.	53	19,765	21,359	-7.5	54.1	60.3	20.8	22.1	47.3	54.7
Oct.	76	2,997,133	3,045,696	1.5	71	57,340	55,599	3.1	Oct	54	19,828	22,231	-10.8	51.6	60.8	21.3	20.9	45.6	50.8
Nov	77	3,006,349	2,969,175	1.3	71	61,059	58,381	4.6	Nov.	55	19,692	21,773	-9.0	49.9	58.9	23.1	23.3	43.4	50.5
Dec	77	3,124,073	3,024,374	3.3	71	64,088	61,420	4.4	Dec.	55	21,065	22,347	-5.7	47.8	55.9	26.9	29.3	46.1	49.2
		1922	1921			1922	1921				1922	1921		1922	1921	1922	1921	1922	1921
Jan.	78	3,102,046	2,843,179	9.1	71	65,666	61,364	7.0	Jan.	55	20,069	20,387	-1.6	45.7	52.7	23.0	23.9	41.2	42.3
Feb.	77	2,857,692	2,556,563	11.7	72	61,027	57,163	6.8	Feb.	54	18,984	19,330	-1.8	46.1	51.7	26.6	27.1	41.2	42.3
Mar.	78	3,142,317	2,766,503	13.6	72	60,675	55,538	9.2	Mar.	55	18,959	19,728	-3.9	48.3	54.6	27.1	21.0	40.7	42.8

panies of the New England States distributed daily more energy during March than during February, a condition which did not exist in any other section.

In the North Atlantic States increased activities were reported in the iron and steel industry, which was operating at about 70 per cent capacity; in the metals industry and in the railroad repair shops. All industries dependent upon building activities were unusually busy, with an increased call for electrical energy.

While activity in the textile mills of the South Atlantic States during March was below that of February, almost one million more cotton spindles were being operated than during March, 1921. This is directly contrary to conditions existing in the textile mills of the Northern States, where more than one million fewer spindles were operating than in March, 1921. Very few industries in this section reported operations under those of February.

Taking the Atlantic section as a whole, therefore, it appears that in the aggregate industrial energy requirements were slightly increased over those of February. The advancing season, however, served materially to lessen the lighting load of virtually all distributing companies in spite of new customers having been added during the month. The net result of these opposing tendencies was a decrease in the average daily output of this section of about 750,000 kw.-hr. under that reported for February.

A steady increase in the operation of the iron and steel mills in the North Central States and the record activity of the automobile industry of that section called for additional electrical energy from central

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWENTY-FOUR-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States 1921 Thousands	New England States 1920 Thousands	New England States Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1921 Thousands	Atlantic States 1920 Thousands	Atlantic States Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1921 Thousands	North Central States 1920 Thousands	North Central States Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1921 Thousands	South Central States 1920 Thousands	South Central States Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1921 Thousands	Pacific and Mountain States 1920 Thousands	Pacific and Mountain States Per Cent Increase
KW HR OUTPUT	April..	80	196,680	227,008	-13.3	79	963,659	1,052,716	8.4	71	828,457	894,028	7.3	59	132,075	135,421	-2.5	89	555,048	586,894	-5.4
	May..	81	191,141	219,298	-12.8	78	934,973	989,408	-5.5	71	819,506	899,657	-8.9	59	136,573	138,416	-1.3	91	586,264	642,495	-8.7
	June	80	192,007	219,476	-12.5	78	940,443	1,003,727	6.3	71	806,270	880,934	8.5	60	136,011	129,120	5.3	92	611,128	639,637	-4.5
	July...	80	187,622	218,995	-14.3	77	934,822	1,026,390	8.9	71	804,009	884,572	9.1	60	140,795	141,450	-0.6	92	639,768	678,725	5.7
	Aug	79	205,351	224,324	8.5	78	992,681	1,054,124	-5.8	71	848,803	923,210	-8.1	60	147,967	154,353	-4.1	93	644,696	685,916	-6.1
	Sept..	79	221,364	223,269	0.8	78	1,004,252	1,051,268	4.5	71	851,671	886,370	3.9	60	149,758	151,680	1.2	93	621,167	624,752	0.5
	Oct....	79	49,202	221,929	12.1	78	1,103,525	1,121,676	-1.6	71	919,514	930,236	-1.1	60	154,266	156,713	1.5	94	570,626	615,142	-7.2
	Nov...	79	247,119	215,565	14.6	77	1,128,453	1,112,914	1.4	71	913,142	908,121	0.5	60	154,125	150,976	2.0	94	563,510	580,124	-3.1
	Dec	79	253,206	216,717	16.8	78	1,196,724	1,150,695	4.0	71	948,909	925,346	2.2	61	153,549	150,920	1.7	93	571,685	580,696	-1.6
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan....	81	253,009	203,937	24.2	81	1,181,850	1,071,876	10.2	71	946,181	859,193	10.1	60	156,540	141,937	10.3	93	564,466	566,236	-0.3
	Feb....	82	232,008	184,854	25.6	81	1,077,350	956,896	12.1	68	859,852	776,106	10.8	60	143,040	131,970	8.4	93	545,442	506,737	7.7
	March	82	258,047	210,142	22.8	81	1,174,039	1,020,604	15.0	70	961,333	853,158	12.7	60	153,793	142,004	8.3	94	595,105	540,595	10.1
REVENUE			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	April..	80	$5,665	$5,554	2.0	72	$21,504	$18,609	15.8	58	$15,506	$13,822	12.2	58	$3,744	$3,312	13.2	89	$8,817	$7,767	13.6
	May.	81	5,362	5,342	0.4	72	20,795	17,613	18.0	58	14,866	13,558	9.8	59	3,516	3,179	10.7	91	9,362	8,240	13.7
	June..	80	5,285	5,397	-2.4	72	20,058	17,438	15.0	58	14,485	13,519	7.1	59	3,536	3,152	12.2	92	9,021	8,439	6.9
	July....	80	5,180	5,121	1.1	72	18,798	17,155	9.2	58	14,158	14,689	3.6	60	3,509	3,145	11.3	92	9,101	8,733	4.3
	Aug....	79	5,297	5,483	3.3	72	19,050	17,926	6.2	58	14,465	14,594	0.8	60	3,612	3,536	2.2	93	9,507	9,309	2.1
	Sept...	79	5,694	5,857	-2.7	72	19,992	18,750	6.6	58	15,324	15,192	0.8	59	3,811	3,673	3.7	93	9,680	9,482	2.0
	Oct....	79	6,332	6,072	4.2	71	21,520	20,115	6.9	58	16,098	16,175	0.4	60	3,920	3,903	0.4	94	9,470	9,334	1.4
	Nov....	79	6,806	6,238	9.1	71	23,282	21,541	8.1	58	17,123	16,954	0.9	60	4,139	4,158	-0.4	94	9,745	9,489	2.7
	Dec...	79	6,987	6,573	6.3	72	25,168	23,519	7.0	58	17,748	17,535	1.2	61	4,234	4,149	2.0	93	9,942	9,644	3.1
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan....	81	7,202	6,581	9.5	75	25,986	23,859	8.9	58	17,822	16,745	6.5	60	4,366	4,222	3.4	93	10,224	9,912	3.2
	Feb....	82	6,771	6,165	9.8	75	23,802	22,011	8.2	55	16,838	16,054	4.9	60	4,090	3,970	3.0	93	9,526	8,963	6.3
	March	82	6,363	5,947	7.0	75	23,914	21,545	11.0	57	16,879	15,556	8.5	60	4,050	3,797	6.7	94	9,469	8,693	8.9
OPERATING EXPENSES			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	April....	44	$1,418	$1,479	-4.1	56	$7,590	$7,168	5.9	34	$4,347	$4,112	5.7	48	$1,567	$1,403	11.6	80	$2,893	$2,479	16.8
	May....	48	1,548	1,577	1.8	53	6,921	6,660	4.0	36	4,274	4,292	-0.4	49	1,563	1,486	5.2	83	2,969	2,713	9.5
	June....	45	1,737	1,862	6.7	53	6,916	6,878	0.5	38	4,843	5,152	-5.9	56	1,835	1,678	9.4	86	3,565	3,519	1.3
	July.....	46	1,712	2,077	-17.6	50	6,772	7,111	4.8	37	4,940	5,800	-14.8	58	1,870	2,039	8.2	86	3,339	3,937	-15.1
	Aug	47	1,861	2,088	-10.8	50	6,871	7,131	3.6	37	5,028	5,793	-13.2	58	1,892	2,003	-5.5	92	3,648	3,884	6.0
	Sept.....	47	2,049	2,262	9.4	51	6,851	7,294	6.0	38	5,353	5,687	5.8	59	1,949	2,184	-10.7	92	3,563	4,032	-11.6
	Oct	47	2,141	2,095	2.1	54	7,175	7,927	-9.5	37	5,011	6,126	-18.2	59	1,990	2,192	-9.2	93	3,511	3,891	9.7
	Nov	49	2,040	1,964	3.8	54	7,103	7,790	-8.8	38	4,992	5,972	-16.4	59	1,931	2,262	-14.6	92	3,626	3,785	4.2
	Dec	50	2,075	1,901	9.1	54	7,993	8,378	-4.6	37	5,216	6,205	-15.9	59	1,968	2,161	-8.9	92	3,814	3,705	2.9
			1922	1921			1922	1921			1922	1921			1922	1921			1922	1921	
	Jan.....	51	2,038	1,802	13.1	55	7,386	7,391	-0.0	37	5,049	5,675	-11.0	59	2,007	2,153	-6.8	92	3,589	3,366	6.6
	Feb.....	52	1,944	1,639	18.6	55	7,020	7,179	-2.2	36	4,772	5,196	8.2	59	1,887	2,066	-8.7	92	3,361	3,250	3.4
	March...	53	1,798	1,741	3.2	56	7,096	7,352	-3.5	38	4,818	5,201	-7.4	59	1,954	2,108	7.3	93	3,293	3,326	-1.0

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
April	59.4	63.5	57.3	62.7	50.9	54.3	52.8	53.8	54.8	61.2	59.3	60.2	54.1	52.8	54.7	52.1	53.7	53.7	61.8	58.6
May	63.2	69.1	58.3	63.8	56.2	58.6	53.4	54.5	54.7	63.3	58.5	60.8	53.3	56.0	54.4	53.0	55.0	57.0	59.9	58.3
June	60.1	71.2	58.7	64.9	55.8	59.5	53.8	55.3	56.6	68.3	68.3	61.8	55.3	60.0	54.6	53.8	53.4	56.2	58.6	57.8
July	60.7	77.3	59.0	66.7	57.2	62.7	54.1	56.1	56.9	70.6	58.1	63.0	55.1	62.4	54.7	55.3	53.3	59.3	57.8	58.0
August	67.3	72.3	60.1	67.3	55.8	61.3	54.2	56.6	56.0	70.0	57.8	63.9	53.3	57.3	54.3	55.7	51.8	59.8	57.0	58.3
September	57.7	71.2	59.8	68.1	52.7	59.4	54.1	56.8	56.9	60.3	57.8	63.6	52.9	60.3	54.2	56.1	46.2	55.7	55.8	57.9
October	57.5	68.5	59.6	67.9	51.3	60.9	53.8	57.3	57.1	63.5	57.0	63.4	51.8	59.2	54.0	56.4	47.8	57.5	54.7	58.0
November	55.5	68.9	59.1	68.0	49.0	59.3	53.3	57.5	56.1	58.8	57.0	63.2	45.8	54.3	53.3	56.2	44.9	52.7	53.8	57.4
December	57.0	62.8	58.8	67.5	46.2	53.1	52.8	57.0	49.3	62.3	56.5	63.1	46.0	55.1	52.6	56.2	40.8	48.5	52.8	56.0
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.8	57.7	58.3	67.5	46.2	52.4	52.2	57.2	45.3	55.5	55.3	62.7	41.8	45.6	51.6	55.4	47.5	47.8	51.8	56.4
February	58.6	54.8	58.7	66.9	44.1	48.9	51.6	57.1	45.9	55.8	53.9	62.5	45.8	54.6	50.7	55.7	43.7	48.0	50.5	55.3
March	54.6	62.1	58.9	66.6	48.0	52.0	50.9	56.8	47.8	57.5	52.8	62.4	47.2	52.7	50.3	55.8	47.3	56.3	49.0	55.0
Hydro Plants:																				
April	24.6	34.7	26.5	35.2	18.2	18.8	20.2	20.3	24.8	20.8	24.2	20.7	22.4	25.0	26.8	21.2	27.3	19.2	26.0	24.2
May	26.5	25.6	26.5	34.3	15.5	17.4	19.2	19.7	21.5	20.1	22.5	20.5	27.9	21.2	27.1	21.2	29.8	22.9	26.6	24.0
June	29.2	21.5	26.6	33.8	17.6	18.8	19.0	19.6	21.1	19.5	22.8	20.2	27.3	18.3	27.1	20.7	30.3	27.4	27.6	24.2
July	29.2	29.6	26.6	33.9	15.9	21.1	18.6	19.8	19.4	19.7	22.3	20.2	27.3	18.3	27.7	20.7	24.2	19.9	26.3	23.7
August	31.4	36.5	26.8	33.9	16.7	20.9	18.3	19.8	20.7	21.6	22.0	20.4	33.7	23.1	28.5	21.0	25.1	24.3	26.2	23.6
September	31.4	32.2	26.8	33.4	16.0	19.9	18.1	19.9	20.8	21.1	21.9	28.7	27.6	20.2	28.4	20.9	23.4	22.8	25.9	23.6
October	32.0	32.0	26.8	33.4	17.8	22.9	18.1	20.2	20.3	18.1	21.6	20.2	30.0	21.0	28.4	20.9	26.4	23.6	25.9	23.6
November	31.0	31.4	26.8	33.4	16.4	22.1	17.9	20.5	20.9	19.2	21.6	20.1	33.7	26.3	29.0	21.5	25.6	24.6	25.8	23.7
December	30.8	34.3	29.2	33.4	23.4	29.9	18.4	21.8	16.5	27.2	21.3	27.5	33.8	28.3	28.9	21.5	27.9	29.1	26.2	24.6
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	25.0	19.3	30.0	49.7	16.7	21.4	18.0	21.8	28.9	25.6	22.0	21.1	33.8	28.3	29.2	22.2	26.6	25.9	26.1	24.3
February	29.7	32.8	30.0	47.9	17.2	20.8	17.8	20.8	26.7	23.8	22.4	21.4	37.4	37.7	35.2	33.8	37.8	36.5	26.7	24.2
March	36.3	34.1	31.3	45.0	23.9	27.8	18.2	22.4	26.0	25.6	22.7	21.8	37.0	37.3	35.6	34.2	28.6	36.0	27.0	25.5
Combined Systems of Steam and Hydro Plants:																				
April	46.6	48.5	47.1	53.5	42.9	43.9	41.9	44.8	45.0	48.3	42.7	47.5	43.6	48.6	40.7	42.8	37.0	36.8	37.0	41.0
May	49.2	48.5	47.6	52.3	39.8	44.2	41.4	44.7	47.0	52.8	43.7	48.8	40.7	39.6	40.6	42.2	35.0	38.3	36.4	40.3
June	58.5	56.5	49.6	53.2	42.3	45.8	41.6	44.9	50.1	62.2	45.0	51.6	45.1	44.8	41.3	42.7	38.8	44.3	37.0	41.1
July	56.1	63.2	50.5	54.7	42.6	51.3	41.7	45.8	51.6	64.4	46.0	53.9	53.6	45.3	41.4	42.8	35.4	43.1	36.8	41.5
August	60.6	62.7	51.9	55.8	46.5	49.0	42.3	46.2	51.2	64.5	46.6	55.5	45.3	50.0	41.9	43.8	36.8	43.5	36.7	41.8
September	62.9	65.5	53.4	57.3	47.4	50.6	42.9	46.7	51.2	62.6	46.9	56.3	45.0	47.3	42.2	44.2	38.3	47.7	36.9	42.5
October	59.3	67.9	54.2	57.4	47.5	47.8	43.4	46.8	47.3	60.5	47.3	56.9	46.3	52.5	42.7	45.3	37.4	42.7	37.0	42.5
November	51.6	51.6	53.9	56.7	42.9	51.6	43.3	47.5	42.3	57.0	47.2	57.0	48.3	51.3	43.3	45.9	41.9	44.6	37.3	42.8
December	52.4	43.8	53.8	55.8	44.3	53.4	43.4	48.1	43.6	57.6	46.9	57.0	48.0	44.3	43.8	45.8	47.0	43.1	37.9	42.8
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
January	48.7	43.1	53.4	54.6	39.9	44.7	43.0	47.8	38.8	43.9	46.2	56.1	40.1	38.6	43.8	45.2	33.5	32.2	38.0	42.3
February	45.3	46.5	53.2	53.3	46.5	50.0	43.6	48.4	44.7	46.6	46.4	55.8	38.6	43.0	43.7	45.7	34.6	34.7	37.7	41.5
March	46.7	46.0	52.8	52.7	49.3	52.4	44.5	49.0	43.3	49.3	46.7	55.8	41.6	38.4	43.8	45.4	32.6	34.1	37.2	40.8

stations during March. Conditions in the zinc and lead industries improved materially during the month, and coal mining reached the highest point of activity in several months. These improved industrial conditions and new lighting and industrial customers added during the month, while calling for more central-station energy, were more than offset by a materially decreased lighting load. The average daily energy output during March was 44,300,000 kw.-hr., as against 45,160,000 hours during February.

In the South Central States 70 per cent of the textile mills were running on full time, 25 per cent on part time and 5 per cent were shut down. The lumber industry was operating about on a par with February, and most of the other primary industries were operating slightly above February. The advancing season served to decrease the lighting load, and the resultant energy output of all the central stations of this section was slightly below that reported for February.

Material improvement was reported from the mining districts of the Mountain States, particularly in the copper industry. For the entire Mountain section it is estimated that employment increased about 15 per cent over February, largely owing to increased agricultural activity. In the Pacific States the lumber industry continued active, but most other industries were operating materially below normal. Taking the Mountain-Pacific section as a whole, the industrial energy required was probably slightly above that during February, and a number of new customers were undoubtedly added to the lines during the month. But the decreased lighting requirements here again resulted in a total energy output for the central stations below that of February.

It is encouraging to note that in the Mountain-Pacific Section especially the yearly percentage gain in gross revenue is rapidly increasing and that at the same time the operating expenses are decreasing. Probably no other industry of the West can make such economic claims.

Safety Standards for Mine Telephones

THE ordinary, innocent-appearing telephones used in the underground depths of coal mines are, according to an investigation just conducted by the United States Bureau of Mines at its experiment station at Pittsburgh, capable of igniting gas and thus bringing about disastrous mine explosions. The danger of gas ignition and explosion does not exist in the employment of such current as is necessary for talking over telephones, but results from the ringing of the magneto.

Actual tests on an ordinary mine telephone were made in a large testing gallery of approximately 400 cu.ft. capacity used by the Bureau of Mines for investigation of all types of electrical equipment in gaseous atmospheres. Tests were made by ringing the telephone inside the gallery when filled with gas but not connected to the external circuit; by ringing the inside telephone when connected to the external circuit, and by ringing the outside telephone while the receiver circuit of the inside telephone was being opened and closed. As the results of several series of trials made under varying conditions numerous ignitions and explosions of the gas in the gallery were obtained.

The results of the investigation indicate that the ordinary type of mine telephone, while designed to have a certain measure of dust and moisture tightness, is not an explosion-proof device and is, therefore, not safe in gaseous atmospheres. The Bureau of Mines stresses the need of the establishment of safety standards for mine telephones required to operate in such atmospheres.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

40-Degree and 50-Degree Motor Ratings

Contends that a 40-Degree Rating Expresses Definite Limitation

To the Editors of the Electrical World:

In an editorial in the March 18 issue of the Electrical World, entitled "A Machine Rating Should Express a Definite Limitation," we note your statement that "It is not to be wondered at that the conception of a single rating of electric generators and motors has found many manufacturers and users strongly opposed to this modification, as most advances in electrical design and construction which have been made by the slow process of standardization have encountered considerable opposition." Is this opposition really to the 50-degree single-rated machine, or to an attempt to substitute this single rating for the older rating of the 40-degree machine with an overload capacity?

The writer is in perfect accord with the title of your editorial—"A Machine Rating Should Express a Definite Limitation." However, your editorial conveyed the impression to me that this is the case only with 50-degree single-rated machines, which is not correct. A 40-degree machine is defined as one which will deliver its rated capacity at a rise in temperature not to exceed 40 degrees above the surrounding atmosphere, and which will carry an overload of 25 per cent for two hours at a temperature rise not to exceed 55 degrees above the surrounding atmosphere. This definition of a 40-degree rating expresses a very definite limitation. It very definitely defines the limit of temperature rise for a continuous load at the name-plate rating; it also definitely defines the limit of temperature rise at a definite load for a definite short-time rating.

I do not believe the designing engineer or the application engineer of today wants the latitude of 100 per cent error you have referred to. But there is a very definite demand and a very definite need for a motor with a combination of continuous-duty rating plus a short-time rating. This demand comes from the practical engineers and the men who have to use the motors and are responsible for their maintenance and for the production from these motors. Forty-degree motors can be applied as intelligently as 50-degree motors, without so great a limitation.

The real reasonable limit of capacity of a 40-degree rated machine is stated as definitely as is that of the 50-degree machine, and the application engineer can make his allowance for factor of safety as well in one case as in the other; only, as asserted above, in the case of the 40-degree machine he has a real definitely stated short-time rating which he can use, in addition to the continuous name-plate rating, and it does not mean that the engineer's allowance will be added to the manufacturers' allowance, "thus piling one margin of safety on another."

If desired to operate at a point of slightly lower efficiency, as in the case of the 50-degree motor, 40-degree motors can be loaded to a point where they will have a 50-degree temperature rise. The additional load will be about 20 per cent, and a 40-degree motor operated in this manner at 20 per cent overload will be just as satisfactory as a 50-degree motor. The application of motors is not an exact science. The field of application is too varied. In many applications the duty cycle is such that the motor needs a small excess capacity for a short duration of time.

It is true, as you state, that the Electric Power Club has indorsed the 50-degree rating without overload capacity; however, it is only fair to say that the Electric Power Club has also indorsed the 40-degree rating with an overload capacity. The club has also indorsed many other standards of temperature ratings for various purposes. The 40-degree motor has a very definite purpose and a very definite demand. We have learned of its uses and applications through years of experience. The Electric Power Club undoubtedly felt the need of another rating, and the 50-degree motor without overload capacity was added to its other standards. The 50 and 40-degree ratings as they stand today are two distinct ratings and should not be confused.

It is true as you have stated that a foot rule is meant to measure lengths within one foot and is not intended to be stretched. However, the rating of an electric machine and the standard of length are hardly comparable. If one were purchasing a piece of rubber by the standard of length, it might be advisable to know whether this was the length of the piece under normal contraction or its length when stretched to its elastic limit. It would be still better to know both lengths.

I have not attempted to bring out the many facts that can be adduced in favor of a machine rated at 40 degrees. This subject was very thoroughly covered in your issue of April 30, 1921, by Prof. F. B. Crocker; also in one of your editorials published some time prior to Professor Crocker's article. Charles F. Norton.

Howell Electric Motors Company,
Howell, Mich.

Give the Consumer Some Consideration

To the Editors of the Electrical World:

I have read with interest your editorial on the subject of motor ratings in the issue of March 18, page 519, together with the comments of two motor manufacturers found on page 882 of the May 6 issue.

As is usually the case in industrial controversies, the ultimate consumer is the one who foots the bill, although he does not have a voice in the proceedings. After having spent twenty years on the central-station and manufacturer's side of the fence, I now find a very different viewpoint as the representative of motor purchasers and central-station power consumers.

The change from 40-degree to 50-degree rating has had the tendency to increase the cost of motors per unit of actual capacity and also to increase the cost of purchased power to run them. Manufacturers of 50-degree motors have not frankly stated that they merely took a standard 40-degree motor, gave it a new 50-degree rating of the next high horsepower size, and fixed the price somewhat higher than had been charged for the 40-degree rating. For example, a 20-hp., four-pole, 60-cycle motor of prominent manufacture sold for $220 as a 40-degree motor, but after receiving its christening as a 50-degree machine it was rated at 30 hp. and sold for $262. Moreover, the injustice to the ultimate consumer does not stop with the purchase of the motor, for he must now and forever after pay the central-station demand charges, which in most cases are based on the horsepower rating stamped on the motor name plate. The consumer is the loser, furthermore, in the matter of efficiency, for motor performance sheets generally show a lowering of efficiency after the three-quarters load point is passed. Marking up to the 50-degree basis and operating full rating is the same as operating the motor rated at 40 degrees at 25 to 50 per cent overload, with consequent lowered efficiency.

It is perhaps significant that the most faithful exponents of the 50-degree ratings appear to be the central-station companies and the syndicate controlling manufacturing interests. It would be refreshing to the consumers of motors and central-station power to have some consideration given to their interests by the manufacturers, the central stations and the technical press.

Selig & Wilson, Engineers, E. T. SELIG.
Harrisburg, Pa.

Economics as Well as Engineering Considered

To the Editors of the ELECTRICAL WORLD:

In an editorial in the March 18 issue of the ELECTRICAL WORLD entitled "A Machine Rating Should Express a Definite Limitation," by inference or omission the presentation of the facts relating to the 40-degree rating is open to misunderstandings. That editorial purports to compare an older way of rating electrical machinery with a new advanced method, an older indefinite, arbitrarily chosen rating with a new definite, accurately chosen rating, finally specifically referring to what is known as the 40-degree rating as the "older conception." By inference the 50-degree rating must be the other.

For their own guidance, the readers of the ELECTRICAL WORLD should be specifically advised by you as to what factors in connection with the 40-degree rating are "indefinite limitations," give merely "a general idea of its capacity," are more "arbitrarily chosen" than the corresponding factors in the 50-degree rating, or do not permit of as intelligent, accurate and scientific application of the machine to any known conditions of load or duty cycle as the 50-degree rating.

I do not believe that any advocate of the 50-degree rating would state that it expresses the absolute limit of safe temperature rise and provides no manufacturers' allowance or margin of safety. Compared with the 40-degree rating it is merely 10 degrees nearer that limit, but it is just as arbitrarily chosen as the 40-degree rating. It might just as well have been 49 degrees or 51 degrees, for no one would attempt to claim that the maximum temperature to which class A insulation can be heated indefinitely without deterioration has been scientifically determined within one degree of accuracy, or that there is no manufacturers' margin in the temperature gradient used from the hot spot to the point of measurement, or in the arbitrarily chosen ambient temperature.

It is stated that the Electric Power Club has indorsed the 50-degree rating, and one unfamiliar with the facts might naturally infer that the 40-degree rating, which was the original standard, is no longer a standard of the Electric Power Club. This is not the case. Both are standards of the Electric Power Club, both express definite limitations under accurately stated conditions, and both are arbitrarily chosen in the sense that all engineering standardization necessarily represents the selection of the fittest, with a relatively wide range of choice, as distinguished from the scientific measurements of some absolute fixed standard such as a weight or measure. In the field of engineering standardization it is always possible to select something else which would meet equally well the specified conditions, whereas in the determination of some scientific fact there can be but one accurate result.

The 40-degree rating is termed a "double rating" as certain definite limitations of overload performance are guaranteed. The 50-degree rating also carries an overload guarantee. Why is it not also a "double rating"? What you term a "double rating" is a standard of the Electric Power Club, and in the last sentence of your editorial the effect of such a standard is stated as "the obliteration of all conceptions of genuine standardization and the subordination of principles of accurate measurement to considerations of commercial expediency." This, for the editorial pages of the ELECTRICAL WORLD, is a rather serious indictment against the motives which prompt the standardization work of the Electric Power Club.

The whole controversy regarding the relative merits of the 40-degree or 50-degree rating is purely a matter of technique and of engineering judgment. Knowing the yardstick with which it is measured, a properly designed 50-degree rating can be applied to any known condition of load safely and successfully, and it is equally true that, knowing the yardstick with which the 40-degree rating is measured, it can be as safely and successfully applied to those same conditions. Under unknown, uncertain or changing conditions the engineer may choose to measure with the 40-degree yardstick, or, as he often does, get even a greater margin of safety in temperature by selecting a 50-degree rating of a larger capacity, although the latter course may mean sacrificing desirable operating characteristics because of underloading.

Any claimed advance in the art in order to justify itself must possess some economic benefits to the consuming public, and it is desirable that this controversy be discussed from its economic standpoint and not purely from an engineering technical standpoint. I, therefore, refer the reader to page 1115 of this week's issue of the ELECTRICAL WORLD, where the economic phases of the situation are discussed.

CLARENCE L. COLLENS, 2D,
Reliance Electric & Engineering Co., President.
Cleveland, Ohio.

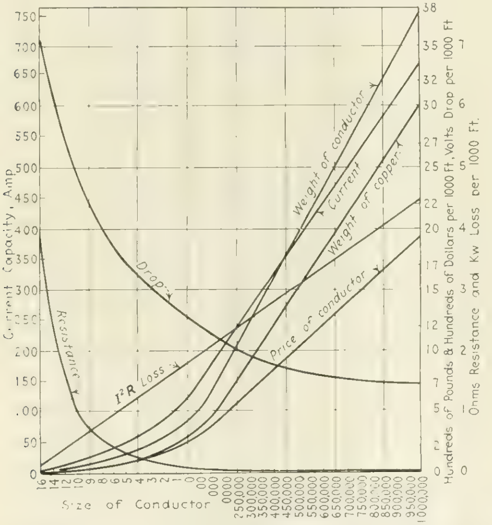
[In the editorial to which reference is made we did not aim to criticise the so-called "double rating" of the 40-degree motor, but to emphasize the need for a *single standard* of rating. The term "double rating" in the last paragraph of the editorial should be so interpreted. This Mr. Collens has also emphasized by his example of multiplying frame sizes, in the fourth paragraph of his statement on page 1115. A single standard of rating of electrical machines, whether it be a 40-degree basis or a 50-degree basis, we believe to be the only practical solution of the motor-rating dilemma. And it will matter little in the course of any reasonable period of adjustment, say twenty years, which of these bases is adopted, if it is made plainly evident that one only is the standard.—EDITORS.]

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Method of Obtaining Most Economical Size of Conductor

IN RUNNING wiring around a plant it is sometimes economical to use a conductor larger than that required by the National Electrical Code. The resistance loss in the larger wire will be less. This will mean an energy saving which may more than pay for the extra cost of the larger wire. In determining just which wire size will be the most economical the accompanying chart will be of use. The curves indicate the relationship between the size of copper and (1) weight of conductor, (2) weight of conductor with rubber insulation, (3) maximum current based on the code rulings, (4) resistance, (5) I^2R loss with maximum current, and (6) the voltage drop with maximum current.



VARIATIONS OF CONDUCTOR CHARACTERISTICS WITH THE SIZE OF THE CONDUCTOR

An example of the way to determine the most economical size of wire will indicate one of the uses of the characteristic curves. With a 500,000-circ.mil cable, the drop is about 8.5 volts per 1,000 ft. and the I^2R loss about 3.1 kw., with the maximum current as determined by the code. The price of this cable, based on copper at 15 cents per pound, is about $1,050. At 2 cents per kilowatt-hour for a period of ten years the cost of the I^2R loss will be $5,400. Now if a 1,000,000-circ.mil cable were used in place of the above, it would not be loaded to capacity. The drop in this case is 4.2 volts. The price of the conductor would be $1,945. But as the current would be the same in each case and the resistance is reduced by one-half, the corresponding cost of the I^2R loss would be about $2,700. At the end of ten years the cost would be $6,450, against $4,645 for cables of 500,000-circ.mils and 1,000,000-circ.mils respectively. These figures, of course, do not take into consideration difference in erection costs nor do they allow for interest and depreciation.

Interest at ten per cent, compounded annually, on the difference in first costs would be about $1,426, and the additional depreciation could be taken at $444, making a total of $1,870 at the end of ten years. At that time the costs would be approximately equal. This indicates the possibility of an ultimate saving by the use of a larger conductor than necessary for the current if a decreased drop in voltage might be permitted and if a reduction in the resistance would not endanger the generating plant equipment in the event of a short circuit.

D. W. BLAKESLEE,
Electrical Engineer.
Jones & Laughlin Steel Co.,
Pittsburgh, Pa.

Average Cost of Trimming or Removing Trees Is $1.84 Each

THE cost of tree trimming along transmission lines is a subject on which very few data are available. This is due to the fact that it is engaged in only for a few days each year, generally in the spring, and is hurried through with and forgotten until it looms up again the next year. The following data and information were collected in order to gain a more accurate knowledge of the average time and cost of trimming the shade trees commonly met with in towns or cities.

To obtain a good average, trees most commonly used for shade, and therefore the ones generally encountered along the transmission or service lines, were selected. Of the total number so taken the greater majority were South Carolina poplars, these being very numerous because of their fast growth, which gives them wide popularity as shade trees. Other varieties selected were elm, maple, locust and buckeye.

The trees trimmed varied in height and spread from young ones that could be trimmed from the pavement with trimmers to those that necessitated climbing and the lowering of the severed limbs with a hand line. A few of the trees were merely topped, but the majority were closely trimmed, several being entirely removed. A separate record was kept of the ones removed so that a comparison could be made between them and the trees which were only trimmed.

COST DATA FOR TRIMMING TREES ON TRANSMISSION SYSTEM.

	Trimmed	Removed	Total
Number of trees ..	87	16	103
Number of hours required.	285	86	371
Number of hours per tree.	2 96	5.37	3.34
Average labor cost per hour	$0 55	$0.55	$0.55
Cost per tree............	$1 63	$2 94	$1.84
Total cost	$141 90	$47.30	$189.20

The trimming was done by two linemen. One groundman was kept busy piling the brush in piles for loading, while another groundman and the truck driver piled the brush on the truck on which it was hauled to a dump heap for burning. Two groundmen remained at the dumpheap to see that the brush was entirely consumed and also that the fire did not spread.

The accompanying table gives a summary of the data. The average cost of labor per hour was calculated by adding the hourly rate each man received, including the line foreman, and dividing by the number of men. C. N. HARMAN.

Wellsburg Electric Light, Heat & Power Company,
Wellsburg, W. Va.

Costs of Heat-Treated Parts Reduced to Minimum by Electric Furnace

AS THE higher-priced, improved heat source obtained with the electric furnace has successfully withstood the competition of existing fuels, there must be other factors of greater importance in the heat treatment of steel than the furnace operating costs, a fact not commonly recognized by the average furnace user. The most prominent among these other factors are reduced costs of subsequent operation, reduction in the number of rejections, increased life of products, with more satisfactory service.

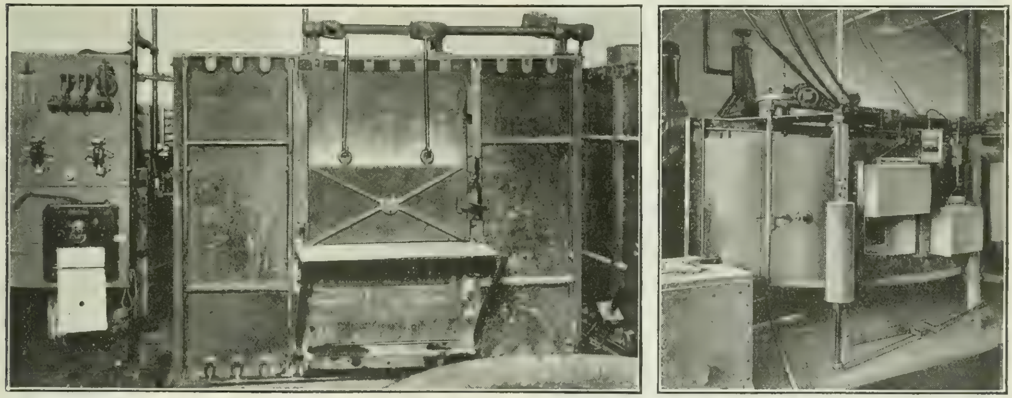


FIG. 1—ANALYSIS OF OVER-ALL COST OF HEAT-TREATED PARTS INDICATES THAT POWER COST IS ONLY ONE-THIRD OF 1 PER CENT OF TOTAL COST OF DIES

Left—Electric resistance furnace with panel and instruments for automatic temperature control. Right—Rotary annular electric furnaces designed for maintaining a temperature of 1,650 deg. Fahr. and used for heat treating gears.

To determine to what extent these factors will overcome higher furnace operating costs, an accurate cost analysis is necessary which will show the influence of furnace operating costs on the cost of the finished product. The actual ultimate costs of several heat-treated parts, together with the costs of heat-treating and electricity used, are given in the accompanying table. Attention is directed particularly to the last column, in which is shown the part that electricity plays in the ultimate cost. The power rate for all items is taken at 1½ cents per kilowatt-hour.

The six dies listed in the table were heated in the resistance furnace shown on the left in Fig. 1. A similar furnace was used for preheating and an electrically heated oil bath used for drawing. These furnaces and the oil tempering bath are maintained at constant temperature throughout the day, and the cost of power thus used is apportioned among the dies treated over a certain period. If the furnace could be operated at full capacity constantly, the cost of the electricity would be much below the values given.

During the twenty-five months that this furnace has been in operation there have been no interruptions of service, and the only expense incurred has been the replacement of a relay coil on the control panel. No deterioration in the metallic resistor heating element is apparent after the twenty-five months' continuous service. The only attendance necessary is occasional oiling of the automatic control apparatus and putting in a roll of record paper. The controlling of the temperature and the throwing on and off of the power are entirely automatic.

The total cost of electricity in heat-treating these dies amounts to one-third of 1 per cent of the ultimate cost of the dies. Subtracting from this the cost of other kinds of fuel will give the amount that must be offset by the other factors, such as the reduction of rejections, etc. In the case of this die-heating furnace the cost of electricity is virtually the same as the cost of oil. Extensive tests were run on similarly constructed oil and electric furnaces to determine the policy of the General Electric Company on future tool-treating furnace installations. The cost of operating the oil furnace was 23 cents per hour with oil at 13 cents, and the cost of the electric furnace was 10 cents per hour. With oil at its present level the costs are about equal.

In certain localities this would not be the case, and we must then look to the other features to justify the use of electric furnaces. In the case of these dies the most prominent of the factors are the reduction of rejections, lower costs of subsequent operations and longer life of the dies. Unfortunately, accurate data are not available on these factors, but in the opinion of the foreman in charge of the work they amount to several per cent, the rejections alone being reduced over 1 per cent, or more than the total cost of electricity.

The items in the table from 7 to 12 for gears and die blocks are at present treated in an oil furnace, the cost of the electricity having been calculated on the basis of experience with electric furnaces handling similar work. Electric furnaces are contemplated for these parts, as a cost analysis indicates that the increased cost of electricity will be more than offset by the improvement in quality.

A furnace with a rotating annular ring hearth, shown on the right in Fig. 1, was used for heating the gears tabulated in the last item of the table. This is one of the three-phase, 220-volt furnaces installed at the plant of the Standard Equipment Company, Cleveland, Ohio. The cost of electricity for heating these gears is based on a thirty days' operation. The number of gears heated during that time was 9,510, weighing 39,107 lb.

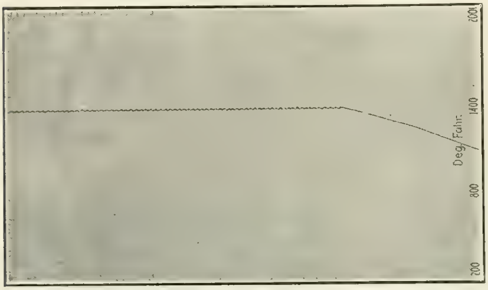


FIG. 2 — AUTOMATIC CONTROL MAINTAINS CONSTANT TEMPERATURE IN RESISTANCE FURNACE (FIG. 1)

The cost of oil used in heating these same gears is approximately ½ cent, or about one-fifth the cost for electricity. Here again the increased cost is offset by the reduction of rejections and lower cost of subsequent operations.

The features of the electrically heated furnace of the metallic resistor type, which make possible this improvement in quality, are: (1) Low temperature of heat source; (2) accurate and reliable automatic temperature control; (3) uniform and unvarying temperature distribution; (4) absence of the severe oxidizing and corroding common to some fuel-fired furnaces.

COST FIGURES FOR HARDENING AND DRAWING STEEL SHOW THAT SUBSEQUENT OPERATION MUST BE CONSIDERED

Item	Part	Factory Cost of Parts	Cost of Heat-Treating	Cost of Electricity for Heat-Treating	Electricity in Percentage of Total Cost
1	Segment combination die	$1,380	$13.50	$4.16	0.3
2	Segment combination die	1,138	12.00	3.70	0.32
3	Round blanking die	638	5.03	1.50	0.23
4	Segment blanking die..	782	9.45	2.92	0.37
5	Die	795	10.53	3.43	0.43
6	Die	875	8.66	2.67	0.3
7	Gear	234	13.00	3.70	1.5
8	Gear	263	15.00	4.44	1.7
9	Gear	338	21.00	6.25	1.8
10	Gear	391	26.00	7.60	1.9
11	Gear	455	30.00	9.06	2.0
12	Die block	110	1.75	0.65	0.6
13	Gear*..	†5		0.03	0.6
	Total of all above .	$7,404	$165.92	$50.11	0.68

* Hardening only, without drawing. † Estimated.

The large area of the heat source permits it to operate at a temperature only slightly higher than that of the parts being heated and renders overheating of any part impossible. In the fuel-fired furnace, except where a muffle is used, the heat source or flame is several hundred degrees hotter than the work; consequently there is always the danger of overheating portions of the charge, especially parts having thin sections. This overheating results in distortion and excessive scaling.

Automatic control of temperature insures constant conditions in the furnace and makes possible the duplication of results from day to day. A typical temperature control chart for a resistance furnace operating at 1,400 deg. Fahr. is shown in Fig. 2. It can be seen that the maximum temperature variation is about 5 deg. Fahr., and since the air changes temperature much more rapidly than the charge, it is apparent how accurately the temperature is maintained.

The problem of choice of steel-treating furnaces is chiefly the problem of determining the effect of the various furnaces on the over-all cost of the heat-treated part. A careful analysis along the lines outlined may in many cases reveal that furnace-operating costs are of secondary importance.

C. L. Ipsen,
Designing Engineer,
Industrial Heating Department.
General Electric Company,
Schenectady, N. Y.

Recent Unit Costs of Central-Station Distribution Material

From the 1921 cost sheets of a Massachusetts central-station company the following material has been selected as of value to engineers engaged in estimates.

COST OF DISTRIBUTION MATERIAL IN A MASSACHUSETTS CENTRAL STATION

		Unit Cost In Dollars
Material wires, cables and attachments:		
427	lb. No. 2/0 weatherproof wire, per lb.	0.28
4,330	ft. No. 8 weatherproof wire, per lb.	0.12
7,644	ft. No. 6 weatherproof wire, per lb.	0.226
279	ft. No. 2/0 three-conductor, 7,000-volt, lead-covered cable, per foot	0.25
5	lb. ¼-in. stranded-steel guy wire, per lb.	0.116
48	lb. ⅜-in. stranded-steel guy wire, per lb.	0.105
15	No. 2/0 copper lugs, each	0.446
9	lb. lead sleeves, per lb.	0.118
7	three-conductor flanged-cable end bells, each	21.85
36	T-connectors for ½-in. pipe, each	2.94
3	250,000-circ.mil connectors, for ½-in. wire, each	5.88
Switches, cutouts, etc.:		
3	60-amp., 3,000-volt oil switches, each	43.96
1	150-amp., 3,000-volt, two-pole oil switch	41.40
1	150-amp., 3,000-volt oil switch	46.94
9	600-amp., 13,200-volt Delta-Star No. 37,613, type U-141 switches (2⅝-in.), each	69.17
16	300-amp., 15,000-volt, indoor-type, disconnecting switches, each	19.30
2	100-amp., 2,500-volt disconnecting switches, each	6.67
2	300-amp., 600-volt disconnecting switches, each	9.58
3	100-amp. cut-out boxes, each	17.99
1	30-60-amp., 250-volt porcelain cut-out	4.25
15	G. E. primary cut-out boxes, each	1.54
Meters, instrument transformers, etc.:		
40	5-amp., 110-volt, two-wire watt-hour meters, each	8.16
181	10-amp., 110-volt, two-wire watt-hour meters, each	9.57
10	50-amp., 110-volt, two-wire watt-hour meters, each	17.80
240	5-amp., 220-volt, three-wire watt-hour meter, each	9.35
116	10-amp., 220-volt, three-wire watt-hour meter, each	9.67
6	15-amp., 220-volt, three-wire watt-hour meters, each	11.79
40	25-amp., 220-volt, three-wire watt-hour meters, each	13.02
2	5-amp., 500-volt watt-hour meters, each	112.00
2	200-amp. current transformers, each	17.60
2	300-amp. current transformers, each	18.70
2	50-watt, 220-volt potential transformers, each	22.00
1	60-cycle, 13,200-volt potential transformer	77.00
5	50-amp., 110 220-volt ammeters, each	19.32
1	three-phase, 60-cycle, 110-volt power-factor meter	60.45
3	Thermometers with centigrade scales, for transformer installation, each	4.00
Miscellaneous:		
1	46-kva., 200-amp. feeder voltage regulator—	
	Regulator in station	$1,359.00
	Wiring cost	10.06
		$1,369.06
11	lb. asbestos cloth, per lb.	2.96
3	No. 8,216 Thomas "F" bushings, 13-in., each	8.25
40	Schweitzer bus supports for ½-in. pipe size, each	5.34
1	20-amp., 1,000-cp. tungsten lamp	4.12
15	ft. arc lamp chain, per foot	0.62
1	Brady mast arm	32.34
5	Cross-arm braces, each	1.65

In general, these costs represent actual prices charged the company f.o.b. factory.

Boston, Mass. **Field Editor Electrical World.**

Adequate Protection Essential on Station Auxiliaries

SPECIAL precautions should be taken to inclose the electrical equipment used in the supply and control of motors driving auxiliaries in boiler and turbine rooms, it being probable that those employed there will not be familiar with such equipment. Present practice, as outlined by H. C. Albrecht, electrical engineer of the Philadelphia Electric Company, in a recent paper presented at a joint meeting of the New York Section of the A. I. E. E. and the Metropolitan Section of the A. S. M. E., usually includes one or more of the following provisions to give reliability of service and ease and simplicity of control:

1. Remote control of those auxiliary motors so located that manual control would complicate and increase the difficulty of operation.
2. Arrangement of important auxiliary motors so that after failure of supply they will automatically restart and come back to speed immediately upon restoration of service, without requiring any attention on the part of the operator.
3. Differential-relay scheme of protection of individual 2,300-volt motors and their supply cables which provides for automatic disconnection upon failure but prevents disconnection from any other cause.
4. Lock-out features on certain motors normally handled by others than the electrical operating force, particularly in boiler rooms, so that upon failure it will be impossible for the attendant to throw this equipment back on the line.

In considering the extensive use of electric drive it is necessary that, because of the importance of the service, the selection and layout of the equipment should be such as to give a high degree of reliability. In case of trouble defective equipment must be immediately isolated with a minimum effect on other apparatus.

New York, N.Y. FIELD EDITOR ELECTRICAL WORLD.

Coal Pile Fires and How to Prevent

THE secret of preventing coal piles from catching fire by spontaneous combustion lies in the manner of building up the piles. Two simple rules that, if followed, will go a long way to prevent fires are: (1) In unloading coal with buckets drop the load in a bulk. Don't let it trickle out into cone form. (2) Build the pile in flat layers.

In building up the layers of coal proceed as if building a brick wall. Drop the first load flat in a bulk, lay the next load close to the sides of it, the next to the side of that, and so on until one layer is completed with a flat top. This keeps the mixture of fine and coarse coal together.

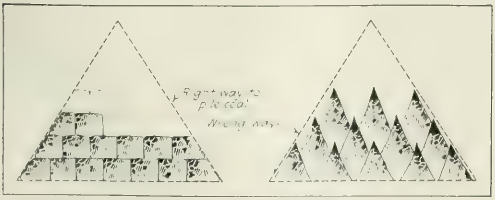


FIG. 1—METHOD OF STORING COAL

Right—Coal piled in shape of cones separates the fine and coarse. Left—When piled in layers the mixture is kept together, preventing air filtering through

If the coal is dropped from the bucket in cone shape, the heavier coal rolls down the sides of the pile, leaving the fine coal in the peak. The cones that are formed will have the heavy coal at the bottom and sides, through which air will enter and may set the whole pile on fire. By building the coal pile in layers this separating of the fine coal and of the larger pieces of coal is prevented, and the air will not filter through so easily. The right and the wrong ways of coal piling are shown in Fig. 1, where on the left, the coal is dumped quickly, thus preventing it from separating with the large coal at the bottom and the fine coal at the top. On the right is shown the formation of internal cones produced by improper piling.

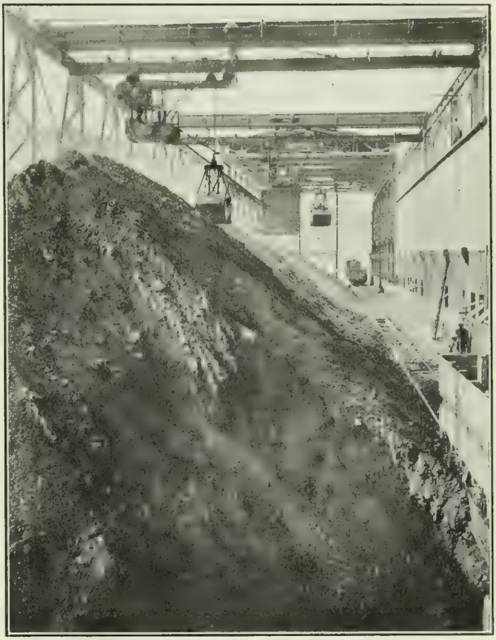


FIG. 2—COAL PILED IN SUCCESSIVE LAYERS PREVENTS FIRES

Some coal will catch fire no matter what precautions are taken. This indicates excessive sulphur and iron. The writer has seen a ray of sun through the roof ignite this kind of coal, but fortunately there is very little of it on the market.

Once the coal pile is built for storage, rehandle the coal as little as possible. For use take a layer off the top and build up as before, not forgetting that the secret lies in keeping the surface flat and avoiding internal cones.

A storage pit of about 7,000 tons of coal is shown in Fig. 2. The pile is 500 ft. long by 60 ft. wide. It is in the form of a pyramid or cone with the internal cones carefully avoided. In another pile next to this 10,000 tons is stored. With this amount of coal in contact it is important to know how to prevent it from catching fire, and the secret is to build the pile in layers.

The Chase Companies, J. E. WILLIAMS,
Waterbury, Conn. Chief Engineer.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies. Advertising. Selling and Service Methods

House-to-House Appliance Selling

From a Paper by O. R. Hogue, Commonwealth Edison Company, Before the Recent Joint Convention Illinois Utility Associations

DOOR-TO-DOOR canvassing does not mean the front door; it means the back door, where we find the lady of the house who does her own work and who above all others appreciates labor-saving devices of all kinds. I shall endeavor to explain somewhat in detail our plan of handling this class of business.

We have found from experience that there is an enormous turnover in salesmen doing this class of work, and in order to maintain a force of one hundred men who can properly sell electric appliances, it is necessary to give them at least an initial knowledge of the appliances which they are to sell, to instruct them in the policy of the central-station company and to get them started on salient selling talks. We have connected with the Commonwealth Edison Company the Central Station Institute, where they are taught the merits and value of the appliance, and how to give this information to the prospective customer. They also receive briefly the mechanical and electrical knowledge that is just as necessary a component in their general knowledge as how to convince the "prospect" that the appliance is something that will be of value to her in her every-day life. After this instruction the men are turned over to the campaign captains, with a concrete foundation on which to start.

O. R. HOGUE

Our policy is to sell from door to door. We use electric trucks capable of holding a fair quantity of appliances of various kinds, which is supervised by a captain who has under him a crew of from ten to fifteen or sixteen salesmen, never more than that number. These wagons are loaded at one of our warehouses each morning at about 8 o'clock, under the direct supervision of the wagon captain, as he is called, and goes immediately to a designated location where the crew has been instructed to meet the captain. The city is divided into districts, with definite boundary lines, beyond which any one wagon is not permitted to sell. The captain allots districts within his district to each man, and the work of the day is begun at 8:30 at the latest. Each member of the crew has a sample of the appliance, whatever it may be—an iron, a toaster, a lamp, etc.—and he proceeds to the district allotted to him. If he sells his goods, he leaves the article and returns to the wagon for another.

There are only certain lines of goods that can be sold satisfactorily in this way—the smaller articles, easily handled and which sell for sums within the reach of the moderately situated citizen. We originally figured that this back-door campaigning was only a summer proposition, but for the past year we have maintained our campaign force during the entire year with exceedingly satisfactory results. We shift from irons to heaters, to portable lamps and to a combination iron and ironing board at a special price, of which we have recently sold about eight thousand. These, together with percolators and toasters, warming pads and many other similar articles, seem to be in demand.

The selling of portable lamps is an especially new idea with us and we expect to continue this line indefinitely. We are also developing a line of smaller articles such as fuse plugs and twin sockets which the men can carry in their pockets.

Compensation of Salesmen

Many schemes have been tried to compensate the salesmen on an equitable basis, such as a guaranteed sum per week and a salary and commission basis; but we have found from long experience that the only satisfactory way is the commission basis, and the commission must be large enough to attract a good salesman. A dollar per iron we feel should be the minimum, and $1.50 for a portable lamp selling at various prices up to $15. The captain of the crew is paid a straight salary. If to this salary a bonus on sales made by his crew is added, he will work that much harder to increase his wagon's sales, not only increasing his own earning capacity, but incidentally the earning capacity of the men in his crew. A prize system for the wagons with the largest sales over and above a stipulated sum works wonders. An extra bonus for the men selling over a certain number on some particular article during any given week also adds zest to the selling.

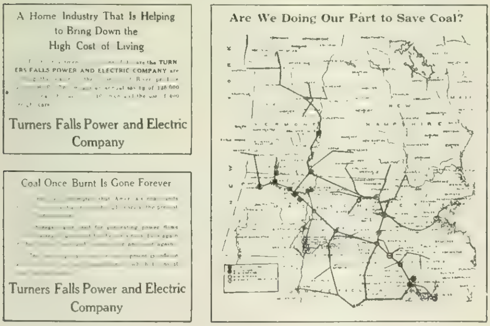
In conclusion, I wish to emphasize that this class of merchandising can only be sold in large quantities by this door-to-door canvass, and it is a profitable business from the standpoint of merchandising. Moreover, it is a very essential line of business for the central station, as it is the very best means of increasing the customers' use of central-station service. The customer first becomes interested, perhaps, in the electric iron; then a percolator or a toaster is added to the list, and finally the greater labor-saving devices, such as the washing machine, mangle and vacuum cleaners, are installed in the home. Each appliance adds something to the customer's bill for energy for the month; multiply this by the vast number of customers using these appliances, and the income to the central station for additional energy is quite considerable.

Value of Hydro-Electric Development Featured in Company's Advertising

FOR more than a year at frequent intervals the Turners Falls (Mass.) Power & Electric Company has been "carrying" a series of advertisements in the local press featuring various phases of public utility development and emphasizing the value of hydro-electric plants, the meaning of electrical service to the public and the fundamentals of electrical investment as a field for putting savings at work. Many interesting points have been included in these advertisements relative to the magnitude of the company's service and its constructive influence upon industrial and domestic life within its territory.

Emphasis upon the fuel-saving characteristics of the Turners Falls system was made in an early display which showed that one day's operations of the company's hydro-electric plants saves twenty carloads of coal. This company supplies energy to nearly every community in three counties of west-central Massachusetts and is interconected with the New England Power Company to the mutual advantage of the two utilities and the public. One of the advertisements, reproduced herewith, called attention to the value of this interconnection, showing the two systems in map form and indicating the desirability of further coal savings by future steam railroad electrification supplied through co-operative service.

Reductions in the cost of living through the use of hydro-electric service, the recurring cycle of water-power utilization and the interest of such a development from the standpoint of the home investor have also been stressed in these advertisements.


A Home Industry That Is Helping to Bring Down the High Cost of Living

Turners Falls Power and Electric Company

Coal Once Burnt Is Gone Forever

Turners Falls Power and Electric Company

Are We Doing Our Part to Save Coal?

TYPICAL ADVERTISEMENTS REFLECTING MODERN PUBLIC POLICY IDEAS

Efficiency of Electric Heat Control Makes Industrial Window Display

TO DEMONSTRATE by a window display the accuracy of electric temperature control now available in industrial heating, the Worcester (Mass.) Electric Light Company recently assembled a heating unit, an automatic cut-off switch and a recording thermometer as shown in the accompanying photograph, arranging the apparatus for close inspection from the street outside the main offices. The heating element, which was taken from a standard electric radiator, was mounted in a box, the temperature of which was automatically recorded on a moving circular chart at the left front. As the temperature fell below a predetermined point an automatic switch restored the energy supply, a pilot light in the box showing when current was on and off. An even temperature line with a variation of approximately only one degree resulted, and this required the consumption of energy only about half the time. The demonstration attracted the interest of passers-by, especially those following manufacturing pursuits.

FEATURING AUTOMATIC TEMPERATURE CONTROL

What Other Companies Are Doing

Salem, Mass.—Ten thousand letters descriptive of the sales service of the Salem Electric Lighting Company were distributed in one day recently to commuters of the Boston & Maine Railroad at the Salem station between 5:45 a.m. and 9:45 p.m. A pocket-sized time-table was inclosed with the letter. Only ten letters were picked up after the distribution, showing that they were well received by the commuters. Already several good prospects for electric service have been reported.

Louisville, Ky.—The energy consumption of eighty-one industrial establishments in Louisville for the month of March, 1922, totaled 2,204,198 kw.-hr. This is an increase of 32.7 per cent over the same month in 1921. Since the first of the year the Louisville Gas & Electric Company has connected more than 6,000 hp. in motors and other power equipment to its lines. Of this equipment, 3,450 hp. represents the aggregate load of seven customers, and only one of these, with a connected load of 400 hp., is a new customer. The six others represent additions to existing installations or replacements of isolated steam plants with central-station service.

Salt Lake City, Utah.—The Utah Power and Light Company is conducting a very aggressive campaign on the sale of its 7 per cent preferred stock, and the results up to the present time have been highly satisfactory. Features of the campaign are newspaper advertising, window displays and poster advertising. The employees of the company are taking an active part in selling the stock.

Reading, Pa.—The Metropolitan Edison Company is offering its preferred stock to the amount of $1,805,830 to the public. The company has announced that the additional funds are to be used in improvements to its plant and system. E. L. West is president of the company.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Stabilizing the Radio Equipment Market

By Frank S. Price

President Pettingell-Andrews Company, Boston, Mass.

THE present demand for radio material by the public can be likened to a stampede of the old days to the gold fields. The dealer in electrical supplies who obtains a small stock of this apparatus finds no difficulty in making quick sales, and it is no exaggeration to say that at this time it is well-nigh impossible to build up stocks of such material for distribution purposes. It is clear that for some little time to come the demand will continue to exceed the supply. Eventually, however, we may expect an abrupt change in these conditions, and some morning the trade will awaken to find that the supply exceeds the demand. There is good reason to believe that the radio business has a substantial future, provided it is built on a sound basis. But such a basis cannot be built while there is a wild scramble for business, pyramiding of orders and a general repetition of the mistakes of the inflation period during and after the war.

F. S. PRICE

In the stampede to the gold fields thousands of men neglected their regular business for a vision of wealth, and history tells us that only a small percentage of these thousands came back with gold. It is time for a word of warning against the neglect of the "bread-and-butter" trade by the dealer. There is grave danger of a serious reaction later if he now permits himself to be swept off his balance by the great demand for radio apparatus. This is said without any intention to discredit the future of the radio industry, but we should not permit our optimism to blind us to existing facts.

Some manufacturers, in their efforts to secure business during this early rush, are making inferior material, and not a few distributers are making definite promises of delivery to dealers and taking orders for radio material on the basis of these promises. In reality, no definite, trustworthy promises of delivery of dependable material can be made at this time.

I believe that the best service and the most economical distribution of radio material can be had at present if the manufacturers of high-grade apparatus will arrange to distribute stock in each case through a limited number of wholesalers, and it would appear that the electrical supply jobber who is properly equipped to handle such distribution on a wholesale basis is the one best qualified to function in this way. On his part, I believe that the jobber should refrain from retailing this equipment in his own establishment, and that he should sell radio material to a limited number of retailers who are qualified to do this class of business and not to those who are unprepared to furnish the service required by a rapidly developing and extremely technical branch of the electrical industry.

A radio man technically qualified is at present more important to the distributer than a man with sales ability. The retailer, on his part, must see to it that the ultimate consumer receives absolute satisfaction. The marketing of radio material under present conditions by many stores which do not employ a man equipped with the requisite technical knowledge of the product and the merchandising of equipment of inferior design and construction are most undesirable. The time may come when the development and standardization of radio material will permit its sale to the public by music stores or other non-electric retailers, but that time is still far off.

By making the arrangements above indicated the manufacturer, distributer and dealer will take a step toward the stabilization of the market greatly to be desired. Economically, the volume of business to be handled will enjoy the same advantages that accrue to a well-co-ordinated system of distribution in other electrical fields. The public will be "serviced" in a way scarcely possible during a wave of general inflation, and to the extent that the public receives full satisfaction will the foundations be established for permanent business in this branch of electrical development.

The Relation of Trade Discount, Turnover and Profit

By J. J. Keith

CRITICISMS of the discounts on electrical appliances and supplies are frequently made by dealers because, as they say, there is not sufficient spread. Their costs of doing business are almost as great as the discount, and the spread is not sufficient to leave any margin of profit after the overhead charges are paid. Profit, however, depends largely upon the rate of turnover of any article. That is, the more rapid the rate of turnover of an article, the smaller is the amount of annual overhead expense chargeable to it.

As an illustration, consider a small dealer whose stock on hand runs about $25,000, whose annual sales are $50,000 and overhead charges $10,000. With annual sales of $50,000 from $25,000 stock the whole stock is turned over twice a year. An overhead of $10,000 on sales of $50,000 means that the average overhead charge per sale is 20 per cent. Therefore on any article that it takes six months to sell there should be allowed 20 per cent of the selling price as the cost of doing business.

Some articles, of course, move faster than the average turnover of twice a year; still there are others on which the rate of turnover is not more than once a year. Taking as correct the 20 per cent overhead on an article that it requires six months to sell and dividing 20 per cent by six, there results 3⅓ per cent a month overhead which should be charged against every article in stock. If an article is turned over once in nine months, multiply 3⅓ per cent by nine, which is 30 per cent, and the selling price of that article should include this 30 per cent for overhead charges. If it takes twelve months to sell it, 40 per cent overhead charge should be included, or if an article takes only three months to sell, 3⅓ per cent times three equals 10 per cent, or the overhead chargeable against this particular item. In determining whether the discount allowed on a purchase is enough to cover the cost of doing business and leave a fair profit, a table such as the following can readily be used:

Number of Months Required for Turnover	Per Cent of Overhead on Article	Number of Months Required for Turnover	Per cent of Overhead on Article
1	3⅓	7	23⅓
2	6⅔	8	26⅔
3	10	9	30
4	13⅓	10	33⅓
5	16⅔	11	37
6	20	12	40

The above table is, of course, applicable to a business where the stock is turned over on an average twice yearly. However, a dealer can readily figure up his average stock investment, total up his year's sales, add up his year's overhead and make up a table of monthly overhead percentages which will apply to his own particular business.

By applying this table of overhead charges to the rate of turnover a dealer can determine whether the spread or discount is sufficient to take care of the overhead charges on any item in stock. This method gets away from the practice of applying average figures to individual items which have different rates of turnover. It may be found that fast-moving articles are carrying most of the business, while the slow movers on which the overhead charge should be from 30 to possibly 40 per cent eat up the entire margin of profit and in reality are being sold at a loss.

Causes of Business Failures

EVERY year *Bradstreet's* issues a tabulation of business failures in the United States and classifies them by causes. Eleven causes are given and these are divided into two general groups—those due to the fault of the person failing and those arising from circumstances beyond his control. As might be expected, in a year such as 1921 the proportion of causes falling within the latter group is higher than normal, but even then the causes due to the fault of the person failing make 75 per cent of the total.

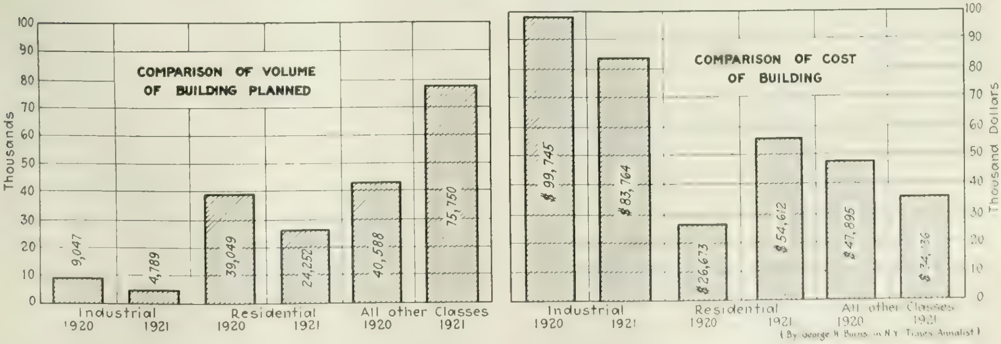
Of all failures, 32 per cent were due to incompetence. Lack of capital follows, the percentage from this cause being 29.3. But lack of capital is only one particular manifestation of incompetence, and the same thing is true of inexperience, which accounts for 5.7 per cent of the business wreckage for the year. Other causes falling under faults of the person are fraud, neglect, unwise extension of credits, personal extravagance and speculation outside of the business.

That a year when economic causes were operating so adversely as to raise the proportion of failures from specific causes to the highest figure since 1897 should still see three-quarters of the failures due to personal reasons possesses one striking significance. That is the importance of the human factor in business. Inexperience, lack of knowledge of fundamentals, insufficient preparation for responsibilities are all reflected in the personal causes of failure. And this goes still further, for the victim of "specific" causes is often engulfed through lack of knowledge or judgment that would enable him to foresee adverse developments.

FAILURES IN UNITED STATES DURING 1921

Fault of Person Failing:	Number	Per Cent
Incompetence	6,404	32.0
Lack of capital	5,855	29.3
Inexperience	1,142	5.7
Fraud	931	4.7
Neglect	257	1.3
Unwise credits	230	1.1
Extravagance	82	0.4
Speculation	66	0.3
	14,967	74.8
Causes Beyond Control of Person Failing:		
Specific conditions	4,638	23.2
Failures of others	226	1.1
Competition	183	0.9
	5,047	25.2

Comparisons of the Volume and Cost of Building



(By George H Burns in N Y Times Annalist)

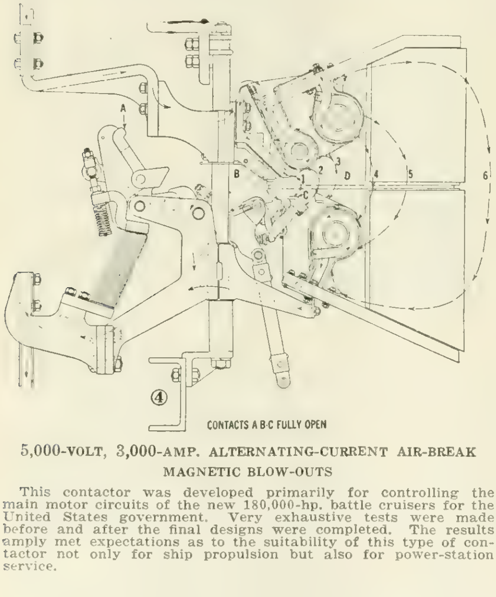
These two charts show an interesting relation between the decrease in cost of building and the increase in volume of new construction planned. The renewed activity which is now so apparent in nearly all classes of building is largely the result of lowered costs and is quickening business for the whole electrical industry.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Air-Break Magnetic Blow-Outs.—J. F. Tritle.—While there are many different types of magnetic blow-outs, this paper deals largely with the "individual" type, in which a blow-out coil is connected in series with each pair of current-rupturing contacts. It is with this type that most of the progress and studies have been made in recent years. Recently the use of magnetic blow-out contactors on alternating-current circuits has been extended to moderately high voltage and capacity. Short-circuit tests with these contactors on a 6,600-volt, 26,700-kva. alternator are described. During the three-phase tests the air-break magnetic blow-out contactors successfully ruptured 17,500 amp., the full short-circuit current at 5,500 volts, which is equivalent to 170,000 kva., three-phase. Oscillograph records of the voltage and current in each phase are shown and also illustrations of the arcs. The arrangement of a typical 5,000-volt breaker is shown in the illustration.—*Journal of the A. I. E. E.*, April, 1922.



5,000-volt, 3,000-amp. alternating-current air-break magnetic blow-outs

This contactor was developed primarily for controlling the main motor circuits of the new 180,000-hp. battle cruisers for the United States government. Very exhaustive tests were made before and after the final designs were completed. The results amply met expectations as to the suitability of this type of contactor not only for ship propulsion but also for power-station service.

Lamps and Lighting

Flashlight Characteristics.—T. Spooner and C. F. Royce.—Flashlamps were obtained from eleven manufacturers and tested in general as a unit; that is, each flashlamp was tested with its own battery and the battery judged on a basis of its life when used with the lamp for which it was designed. Some of the conclusions drawn from the tests were: (1) The long two-cell or three-cell flashlamps should be used to obtain the most useful light per dollar. (2) Seamless battery cases are superior for long shelf life. (3) Large-diameter lenses and reflectors should be avoided except possibly for illumination at a considerable distance. (4) Conical reflectors usually give the better light distribution. (5) More attention should be given to the uniformity of construction of the lamp bulbs for flashlamps. (6) As many flashlamp manufacturers purchase their bulbs from electric lamp manufacturers, a closer co-operation between the manufacturers is desirable.—*Electric Journal*, April, 1922.

Generation, Transmission and Distribution

High-Tension Insulators.—Borgquist.—The author reviews insulator development in Sweden during the last twelve years, describing and discussing different types of chain insulators employed on lines of 55,000 volts to 132,000 volts. A very early type, assembled with plaster of paris and ground marble, gave an average loss of 0.4 per cent per year during the years 1910-1921. In 1914 the Royal Swedish Board of Waterfalls designed a standard insulator unit, with rounded porcelain section, plastic compound on iron and porcelain surfaces and short-circuiting devices in the cement layers. Of this type 73,000 units were ordered for the Porjus and Alvkärleby projects, and during six to seven years of service these insulators have given a loss of only 0.005 per cent per year. Some Hewlett insulators of different manufacture are in use on the board's lines, but this body has felt that in its present state of development this type of unit unduly increases the cost of installation, at the same time not giving the same protection against arcing as the cap-and-pin type does. For a 132,000-volt line built last year cemented insulators were therefore used exclusively. One-half of the line is equipped with nine-unit chains of Ohio Brass standard with 10-in. units, the other half with eight-unit chains of ball-head insulators of German manufacture. Both types of chains have combined arcing and grading horns, which lower the dry flashover voltage by 7 per cent and reduce the maximum unit stress from 22.5 to 16.2 per cent of the total voltage for the American chain, and from 23.1 to 19.8 per cent for the German chain.—*Teknisk Tidskrift*, Jan. 7, 1922.

The New Power Plant of the H. H. Franklin Manufacturing Company.—A complete description is given of this 2,000-kw. plant, which is in Syracuse, N. Y. Its main feature is the manner in which the generating equipment was designed to satisfy the demands for exhaust steam for heating and process work.—*Power Plant Engineering*, March 15, 1922.

Development of 220-Kv. Transmission Lines in California.—A. W. Copley.—The problem of using voltages as high as 220 kv. for transmission purposes involves special study of the generators, transformers, circuit breakers for switching, insulators for supports and condensers for regulation. All of these points are very well covered by the author in his discussion of the developments being made by the Southern California Edison Company in its proposed 220-kv. circuit. The Pacific Gas & Electric Company is also considering a transmission line of this voltage.—*Electric Journal*, March, 1922.

Traction

Electrification of Chilean State Railways.—D. C. HERSHBERGER.—A complete description is given of this electrification, including the route over which the railway passes, the various weather conditions encountered, the electric locomotives with the tonnage and train weights they haul, sources of power supply and a description of all switching equipment employed.—*Electric Journal*, March, 1922.

Electric Motor Drives in Railroad Shops.—BERTRAM S. PERO.—The author discusses the selection, type and application of motors on different kinds of machine tools. Several illustrations are given showing the individual drive on machine tools.—*Railway Electrical Engineer*, March, 1922.

Installations, Systems and Appliances

Hydraulic-Automatic Electrode Regulation for Electric Furnaces.—J. RITZ.—An electro-hydraulic regulating system has been developed which is already in use in several electric foundries for adjusting furnace electrodes. Instead of contact-making relays, a revolving-field instrument similar to an alternating-current meter motor is used. This actuates a valve, which in turn admits water pressure above or below a piston in a pressure cylinder, thus raising or lowering the electrodes in the furnace. For a three-phase furnace three current transformers are required for the three regulating valves, as well as three electrode cylinders. The valve instruments may be arranged to regulate either for constant current or for constant wattage. A great many advantages are claimed for this new system. Of interest is a kilowatt-graph showing the great difference in uniformity of load between hand regulation and the automatic method.—*Brown-Boveri Mitteilungen*, March, 1922.

Electrophysics and Magnetism

The Motion of Electrons in Argon.—J. S. TOWNSEND and V. A. BAILEY.—An account is given of the motion of electrons in argon, showing that the loss of an electron in colliding with a molecule and the mean free path of the electron may be found from the experimental determinations of the velocity of the electron in the direction of the electric force and its velocity of agitation. Results show that the molecules of this gas are very different from those of nitrogen, hydrogen and oxygen.—*Philosophical Magazine (London)*, March, 1922.

Properties and Uses of Micas.—A partial report of the Electrical Research Association (England) on this subject. Great difficulty was met in the investigations owing to the non-uniformity of nomenclature for the different kinds of mica. Considerable attention was therefore given to classification, which is given in tabular form. The article continues with specifications for mica, identification tests, the use of mica and micanite for commutators, and finally its use in ring and cone forms.—*Journal of the (British) Institution of Electrical Engineers*, March, 1922.

Electrochemistry and Batteries

Electromagnetic Motions in Electric Furnaces.—CARL HERING.—In a paper presented before the society a year ago the author described some of the more recently discovered forces of electromagnetic origin in those types of electric furnaces in which the current passes through the molten material. In the present paper he explains how a proposed law given in the former paper may be applied to the production by the current of certain desired motions, such as those for circulating or stirring liquid conductors in a furnace. Guides are given to aid one in determining whether such motions can probably be produced by the current. It is maintained that the former restrictions to only one such motion-producing force were not justified, and that many others formerly not accepted are possible.—*Paper presented before the American Electrochemical Society at Baltimore*, April 27, 1922.

Units, Measurements and Instruments

Sparkover Voltages Through Oil.—W. S. FLIGHT.—When considering the sparkover voltages through air it has been shown that the sparkover voltage varies directly with the barometric pressure. It has sometimes been considered that the sparkover voltage through oil depends on the pressure of the oil, but tests carried out by the author to investigate this point showed that there was no difference between the sparkover voltage of the gap employed whether immersed two inches or two feet below the surface.—*Beama*, March, 1922.

Measuring of Temperature of Electric Machines.—G. KEINATH.—A general review is given of the present status of measuring the internal temperatures of machines and transformers. The great importance of a reliable method for such measurements is emphasized, but at the same time it is stated that up to the present none of the existing methods gives fully satisfactory results.—*Elektrotechnik und Maschinenbau*, Feb. 26 and March 5, 1922.

Telegraphy, Telephony and Signals

Amplification of Weak Alternating Currents.—H. BARKHAUSEN.—The third installment of a series, this part dealing with the amplification and multiple amplifiers. The author discusses the efficiency of the connection of radio tubes for amplification, back-coupling circuits, limits of amplification and practical performance of vacuum tubes.—*Radio Review*, March, 1922.

High-Power Radio Station at Saïgon, Indo-China.—The great economic importance of the French colonies of Indo-China, which exported, for example, during 1919 about 3,000 tons of rubber and 950 tons of coffee, warranted a direct radio communication with the French capital. A high-power radio station was therefore erected recently and was inaugurated in the presence of Marshal Joffre at the city of Saïgon. A description of this station is given.—*Radioélectricité*, March, 1922.

Simple Generator of High-Frequency Current for Measurement Purposes.—Emphasizing the importance of high-frequency measurements in modern radio researches, the author goes on to detail the requirements of the generator of high-frequency current for this class of work and to describe apparatus which has actually been used for this purpose. Examples of the measurements that have been undertaken are also given.—*Electrician (London)*, April 14, 1922.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Indianapolis Seeks Lower Electric Rates

THE city of Indianapolis and a group of central-station customers have petitioned the Indiana Public Service Commission to rehear the complaint against the electric rates of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company and to order a further reduction. The commission issued an order in March establishing new rates for the companies, which became effective April 1. The primary domestic rate was reduced, and the commission announced that the whole effect was to put the charges considerably below the rates previously authorized.

The petitioners now say that the new rates "have resulted in a very material increase in the rates and charges for both power and light to a very large proportion of consumers in Indianapolis." Commissioner Glenn Van Auken, who had charge of the original hearing, announced that the commission will order further reductions, but that no change will be made in the larger power rates or in the primary domestic rate.

Canadians Refuse to Negotiate St. Lawrence Treaty Now

THE desire of the United States to negotiate a treaty looking to the deepening of the waterways which will enable oceangoing ships to reach the Great Lakes has been formally communicated to the Canadian government. The Canadian government, however, because of a local political situation does not consider the time opportune for negotiations on a St. Lawrence waterway and power project. Prime Minister King on Monday in bringing the matter up in the Canadian House of Commons said that the United States government had been informed of the attitude of the Canadian government. This, however, it is understood is not to be taken as a flat rejection of the proposition but only as a desire by Dominion representatives to withhold negotiations until the time is more opportune.

Upon receipt of the news in Washington there was little surprise expressed. In fact, prior to the presentation of the United States' note the feeling was freely expressed in official circles that the Canadians might not be eager to consider a treaty at this time largely because of the Montreal opposition. The Canadian government, it is known, needs the support of the Quebec representatives to carry through its program.

Secretary Hughes in his note said that "he is authorized to state that the President favors the negotiation of a treaty on the basis of this report of the International Joint Commission, or such modifications as may be agreed upon." He asked to be informed "whether the appropriate British and Canadian authorities are disposed to undertake the negotiation of a treaty."

Representative Ten Eyck of Albany, N. Y., made an extended speech in the House last week in opposition to the waterway project, in which he advocated the purchase by the United States of territory in Canada lying east and south of the line of the present center of the channel of the St. Lawrence River from its mouth to its source in order to establish American rights to develop and utilize half of the water power. Senator Calder of New York is also opposing the projected agreement vigorously.

New York State Government Contends that Federal Power Law Is Invalid

AN ATTACK upon the constitutionality of the federal water-power law—the first to be made—has just been launched by the State of New York, which has prepared, through its Attorney-General, a motion asking the United States Supreme Court to permit it to bring an original bill to test the law. The motion probably will be filed as soon as the court reconvenes.

The bill also will ask the court to enjoin the Secretaries of War, the Interior and Agriculture, constituting the Federal Power Commission, and the United States Attorney-General, as the law officer of the government, from enforcing the provisions of the act within the State of New York.

Conceding that the federal government has constitutional jurisdiction over navigable waters for the specific purpose of navigation, New York, in its motion, asserts that the federal water-power act will interfere with its rights and duties, as well as those of its citizens, and that "there exists the intent on the part of said, defendants [the federal officials] wrongfully to so construe and hurtfully enforce and administer said act" as to extend its provisions "to water powers on practically all streams in the state, large and small, except brooklets." The powers which the federal government proposes to exercise under the act, the state contends, are not required for purposes of navigation.

The formal motion presents in detail the various grounds which the state desires to urge in opposition to the federal statute. Some of those who have examined the motion and are familiar with the practice of the court are said to have predicted that it will be granted and that oral argument in the case will be heard early in the term beginning next October.

Child Labor Law Found Unconstitutional by Supreme Court

BY A UNANIMOUS decision the United States Supreme Court last week held the child labor tax imposed by Congress in the revenue law of 1918 to be unconstitutional as being an attempt by imposition of an excessive tax to regulate employment within the states, which the court held to be a matter for state control. The opinion was read by Chief Justice Taft. This is the second time that the Supreme Court has declared unconstitutional congressional legislation seeking to regulate the employment of child labor.

Electric Light and Power Rates Equalized in Los Angeles

AS A LOGICAL sequel to the absorption of the Southern California Edison Company's distribution system by the city of Los Angeles, the municipal authorities have lowered the electric light and power rates of the 120,000 consumers taken over by the city so as to conform with the municipal rate of the city's Bureau of Light and Power and make the rates alike all over the city. It was explained that the reduction in the rates paid by these former Edison consumers will result in a direct saving to them of approximately $50,000 per month, or $600,000 annually.

William Baurhyte, vice-president of the Los Angeles Gas & Electric Corporation, is quoted as saying that his company is prepared to meet any such change which the city may make, provided that it meets with the approval of the State Railroad Commission, and that his company will apply immediately to the State Railroad Commission for permission to make such equalization.

Bituminous Coal Output Increases

SPURRED to increased activity by the necessity of keeping the fast-dwindling reserve stocks of bituminous coal from reaching the danger mark of 25,000,000 tons, the non-union soft-coal mines produced 5,000,000 tons in the week ended May 27, the eighth week of the strike. This is an increase of more than 500,000 tons over the preceding week.

Administration officials are withholding comment on the situation because they are trying to avoid buyers' panics, but it is generally recognized in Washington that sooner or later the conditions will be such that, unless the unexpected happens, outside influence must be exerted in an effort to effect an end of the strike.

La Follette Prints Charges Against General Electric in "Record"

SENATOR LA FOLLETTE of Wisconsin last week in the Upper House had the secretary of that body read a long letter received by the Senator from Samuel Untermyer of New York, counsel for the Lockwood legislative investigating committee, and copies of two letters addressed by Mr. Untermyer to the Attorney-General of the United States. These letters, which thus became part of the *Congressional Record*, made charges against the General Electric Company of which the essence was that this company was violating in four particulars a decree issued against it in June, 1911, in favor of the federal government. The four particulars in which this decree was alleged to be violated were thus specified:

1. Operating companies controlled by the General Electric Company under their original names without announcing that company's interest or control.
2. Distributing lamps under agency or consignment agreements which are a cover for price fixing.
3. Acquiring the Franklin Electric Company.
4. Discriminating against dealers who failed to maintain the price-fixing program.

The letters addressed to the Attorney-General, dated in March, urged the prosecution of the General Electric Company by the federal officers of the New York district. Senator La Follette, in bringing to the attention of the Senate the fact that no action in compliance with this request had been taken by the Attorney-General, alluded to the General Electric Company as "one of the most oppressive monopolies in the country."

Proposed Lamp Tariff Brings Lively Senate Debate

THE 70 per cent ad valorem duty on incandescent lamps prescribed by the finance committee of the United States Senate was reduced to 45 per cent at the Wednesday night session, when the upper house adopted by 31 to 30 an amendment proposed by Senator Jones of New Mexico. An amendment to reduce the rate to 40 per cent was lost by only three votes. The discussion of the item led to an attack on the General Electric Company by Democratic senators, at which time a letter to Senator La Follette from Samuel Untermyer, counsel for the Lockwood housing committee of New York State, which investigated the General Electric's part in the lamp market, was the focal point in the debate. Seven Republicans voted for the 45 per cent rate.

The Senate has adopted the duty in paragraph 320 of the tariff bill covering electric storage batteries and parts, plates and plate materials wholly or partly manufactured. On motion of Senator McCumber of North Dakota the rate of 45 per cent ad valorem, as originally recommended by the finance committee, was reduced to 40 per cent and adopted. Senator McCumber explained that the duty on storage batteries should be as high as the duty on lead as lead constitutes 90 per cent of a battery. An amendment by Senator Simmons of North Carolina reducing the duty to 15 per cent was rejected.

House and Senate Are Likely to Become Deadlocked on Muscle Shoals

INVESTIGATIONS and negotiations in regard to the government's nitrate and power projects at Muscle Shoals, Ala., continued in Washington during the week. The House committee on military affairs rejected the bids of Henry Ford, the Alabama Power Company, Frederick E. Engstrum and others. The committee designed a set of specifications of its own, based on the Ford offer, first eliminating from any consideration whatever the government's interest in the steam plant at Gorgas, Ala., on the Warrior River, which the Alabama Power Company has a contract to buy and to purchase which it is in negotiation with the Secretary of War. The committee inserted in its specifications a clause guaranteeing the manufacture of fertilizer which is of the most cast-iron character. As this is telegraphed from Washington the representatives neither of Mr. Ford nor of the Alabama Power Company nor of others have made any counter offer to the committee based on the new specifications.

According to a ruling of Attorney-General Daugherty made last week, neither the Alabama Power Company nor the Air Nitrates Corporation has any prior right to purchase from the government properties they had used at Muscle Shoals.

The Senate committee on agriculture and forestry had before it at the end of the week Gifford Pinchot, Secretary of War Weeks and others, to obtain additional information on Muscle Shoals. The committee's plan is to attach a rider to the army appropriation bill when it comes on the floor of the Senate for an appropriation of $7,500,000 to go on with another year's work on Wilson Dam, while the private offers for Muscle Shoals are being examined into further. Information in Washington continues to point to a deadlock between the House and the Senate on Muscle Shoals legislation at this session of Congress.

The representatives of those who have submitted bids to the government for its Muscle Shoals property were called to the offices of the committee on military affairs of the House on May 27 and to each of them was handed a communication from the chairman of the committee. Those whose offers were for only a portion of the government's holdings at Muscle Shoals received copies of the conclusions reached some weeks ago by a sub-committee of the committee. It is assumed that the full committee has adopted those conclusions as essential to any offer.

The text of the communication handed one of those whose bid was for a portion of the property only is as follows: "It is the judgment of this sub-committee that any proposition for the purchase, lease or use of the Muscle Shoals property of the government of the United States shall be based upon the following as fundamentals and essentials: First, that the property shall at all times be subject to the absolute right and control of the government for the production of nitrates or other ammunition components or munitions of war and that Nitrate Plant No. 2 must be kept available therefor by the purchasers, lessees or users of the property; second, that the purchasers, lessees or users of the property shall be obligated in the strictest terms to the manufacture and sale to the public of fertilizers in time of peace; third, that any proposal for the purchase, lease or use of the Muscle Shoals property of the United States government must be for the entire property except the so-called Gorgas plant and the transmission line therefrom."

In the case of Mr. Ford, it is understood that the committee went over his offer paragraph by paragraph, amending it in a number of important particulars. In addition to eliminating the Gorgas plant, it is understood that it was made a condition of the contract that Mr. Ford manufacture 2,000,000 tons of mixed fertilizer on which his profit was to be limited to 8 per cent. As amended by the committee, the offer is understood to provide that the operating company must be capitalized at $10,000,000, all to be paid in. The committee is understood to be willing to accept the amounts proposed by Mr. Ford for payment and to accede to his desire for a lease period of 100 years. The committee was advised unofficially on the afternoon of May 31 that Mr. Ford would not accept the offer as amended.

Utilities Commissioners to Meet at Detroit

THE annual convention of the National Association of Railway and Utilities Commissioners, composed of the members of the various state public service, railway and utility commissions and also of the Interstate Commerce Commission of the United States, will be held at Detroit, Mich., beginning Sept. 26. It is expected that, among other matters of importance, a permanent plan of co-operation between the Interstate Commerce Commission and the various state commissions, looking toward the elimination of conflicting rules and orders, will be perfected.

Abolition of the Indiana Public Service Commission Threatened

ABOLITION of the Public Service Commission of Indiana has been made one of the planks of the Republican party's platform for this fall's campaign, despite the wishes of Governor McCray. This action of the Republican state convention is regarded as an outcome of the fight launched by Mayor Lew Shank of Indianapolis against the commission. It will be remembered that Mayor Shank led a mob of Indianapolis citizens to the State House three months ago as a protest against the merger of a number of electric light and power companies.

It is understood also that the Democratic State Committee had selected the abolishment of the Public Service Commission as one of its planks, but the Republicans convened first and adopted the issue. Governor McCray, it is said by those who are familiar with the political situation, will not give up the hope of retaining the Public Service Commission, but the adherents of the Indianapolis Mayor declare that the political power of the latter is in the ascendant.

The Indiana General Assembly convenes next January, and leaders of the Shank faction of the Republican party assert that steps will be taken immediately toward pushing through the legislation they desire. Virtually every utility in Indianapolis, with the exception of the Indianapolis Street Railway Company, has failed to get along with the Mayor. The electric power merger started the agitation, which was fostered by an increase in rates granted the Indiana Bell Telephone Company, and when the Citizens' Gas Company petitioned for an advance of more than 30 per cent the Mayor became still more incensed.

Pacific Coast Section Considers Menace of Proposed California Power Act

THE opening sessions of the annual convention of the Pacific Coast Electrical Association, which is a geographic section of the National Electric Light Association, held in Los Angeles on Wednesday of this week, indicated that it would be one of the most successful meetings of that section. More than 400 were registered on the opening day, and the sessions, which were held at the Ambassador Hotel, were all well attended.

The menace of the proposed California water and power act was again emphasized by President A. B. West in his address. President-elect Frank W. Smith of the national body delivered a forceful address which brought out the need for close co-operation between all the geographic sections and the national organization.

On Wednesday afternoon parallel sessions of the Technical, Commercial and Accounting Sections were held. In the technical session committee chairmen made progress reports on inductive interference, apparatus, power factor and prime movers. These reports were discussed briefly, and concrete suggestions were made for continuing during next year the activities now under way. In the commercial session great interest was aroused in the subject of electrical heating for industries and homes and in electrical cooking. The general opinion was that, although some progress had been made in the past, these fields were hardly touched and that those engaged in the industry should as a first step adopt electrical heating and cooking themselves.

On Thursday parallel sessions were to be continued, and on Friday, following the final general business session, an industrial conference was to be held. This conference was to follow the lines laid out at the last convention, its aim being to acquaint those outside the electrical industry with its problems.

American Engineering Council's Executive Board Meets

THE licensing of engineers, national reforestation, governmental reorganization, employment service, affiliation of local organizations and the federal water-power situation were some of the questions discussed and acted upon by the executive board of the American Engineering Council at the Pittsburgh meeting which closed May 27.

Committee reports were acted upon, and President Cooley outlined definite objectives. Consolidation of the engineering and public works functions of government under a single head was advocated by the committee on public affairs. A progress report was made by the committee studying the relative merits of the two-shift and three-shift day in industry. The Engineering Society of Western Pennsylvania was host to the executive board.

Better Teaching the Slogan at Convention of the S. P. E. E.

A REALIZATION of the necessity for better teaching and closer co-operation with industry has led to the selection of these topics for the program of the annual convention of the Society for the Promotion of Engineering Education, which will be held at the University of Illinois, Urbana, June 20-23.

Prof. Charles F. Scott of Yale is president of the organization and will give the keynote address at the opening session. Prominent educators who will take part are Dr. Howe of the Case School of Applied Science, Dean Raymond of Iowa University, Dean Potter of Purdue and Professor Talbot of Illinois.

Seattle-Tacoma Project for Interchange of Hydro-Electricity

THE contemplated agreement for interchange of hydro-electric power between the cities of Seattle and Tacoma, Wash., outlined in the ELECTRICAL WORLD for April 1, has reached a more definite stage. This plan concerns surplus power generated by the Skagit River hydro-electric plant of Seattle, now under construction, and the proposed Lake Cushman hydro-electric plant of Tacoma. A 15,000-kw. tie line between the two cities, costing about $150,000, will be built. Each city will bear half of this expense. Under the proposed contract each city will be permitted to draw on the other for surplus power whenever any is available. The price is to be ½ cent per kilowatt-hour for hydro-electric energy and 1½ cents per kilowatt-hour for energy generated by steam.

At present Seattle buys power for the operation of its municipal railway system from the Puget Sound Power & Light Company, and Tacoma buys power from the same company whenever the demand for power exceeds the capacity of the municipal plant.

Receivership of Memphis Gas & Electric Company May End July 15

RECEIVERS of the Memphis Gas & Electric Company are, it is said, laying plans to end the receivership of the company about July 15, following reorganization. The attorney for the company announces that its properties will be advertised for sale for thirty days. The Public Utilities Commission of Tennessee has before it a petition from the city of Memphis asking for a reduction in gas and electric rates. The hearing will come up June 1. Under a ruling made by the commission when the company was allowed to raise rates reductions must be made when the company's surplus exceeds $50,000. An excess above that figure has been reached.

Salt Lake City Plans Electric Show

PREPARATIONS are now under way for a big electrical exposition to be held in Salt Lake City, Oct. 2 to 14. The Rocky Mountain Electrical Co-operative League is taking the initiative, and Col. A. M. Jackson, local representative of the Locke Corporation, has been made chairman of a committee to further the project. All electrical interests as well as business institutions in general are giving the movement their enthusiastic support. W. D'Arcy Ryan will have charge of the spectacular illumination, and it is expected that the exposition will be the greatest held in the West.

Terms and Service to Determine Radio Outlet Discussed

THE largest gathering of jobbers and manufacturers' representatives that ever attended a convention of the Electrical Supply Jobbers' Association assembled last week in Hot Springs, Va. Monday and Tuesday were devoted to meetings of the executive committee, Wednesday and Friday morning to group meetings of the Atlantic and Central Divisions and executive sessions of the full association, and Thursday to open meetings addressed by distinguished guests.

Milan R. Bump, president of the National Electric Light Association, discussed the co-operative movement for business development now in operation under the guidance of the joint committee representing all branches of the industry, pointing out the jobber's part in the project. William E. Robertson of Buffalo, who represents the jobbers on the N. E. L. A. executive committee, said that there was no reason why 1922 cannot be made the greatest year in the jobbers' history if each one will undertake to make conditions in his own locality right by tying all the electrical interests of his community into this movement.

Dr. Frank B. Jewett, vice-president of the Western Electric Company and president of the American Institute of Electrical Engineers, gave an illustrated lecture on the development of radio, in which he dwelt on its distinct place in the economic situation. The element of fad, he said, will wear off and popular attention and appreciation will center on the service which radio can render. It is these fundamental factors that must be counted upon for the permanent business.

David Saranoff, general manager of the Radio Corporation of America, told the romantic story of the evolution of broadcasting and the radio market to the present unmeetable demand. More than ten thousand applications, he said, have been received from concerns and individuals who wish to become distributers for the Radio Corporation, and as many as ten thousand letters, a thousand telegrams and a thousand visits have been received in a single day from persons desiring information or apparatus. The mail at present averages five thousand letters a day. Mr. Saranoff discussed the problems of broadcasting and stated that the most practical range is a hundred miles, which would require about a hundred broadcasting stations to serve the entire country. He expects to see about twelve stations in operation by the end of the year.

T. E. Berger, secretary of the Society for Electrical Development, read a paper analyzing the present set-up in the system of distributing electrical supplies and pointing out the need for definite readjustments.

H. F. Thomas, St. Paul, chairman committee on accounting and statistics, presented a final, complete report embracing a year's survey of the cost of operating five jobbing houses. The first six months' report appeared in the ELECTRICAL WORLD for March 25, page 577. The full year's statistics will be published in an early issue.

F. D. Van Winkle, Cincinnati, chairman committee on moving pictures, reported the completion of a scenario to be used by jobbers to carry to the electrical contractor and dealer the message of "Sell 'Em Something More" along the lines of the successful "Ask 'Em to Buy" movement of the automotive accessory industry. It will be ready for action at the next meeting.

Frederick Rost, Newark, presented for consideration a code of ethics which had been developed by a special committee for the jobbing industry. This code will be voted on at the next meeting.

J. G. Johannesen, Baltimore, was elected chairman of the Atlantic Division and L. V. Garron, Philadelphia, and Bruce Wetmore members of the executive committee. W. R. Herstein, Memphis, was re-elected chairman of the Central Division, and F. W. Van Winkle, Cincinnati, and H. F. Thomas, St. Paul, were again made members of the executive committee. F. M. Bernardin, Kansas City, was re-elected executive committeeman-at-large for the Central Division. F. S. Price, Boston, and W. E. Roberson, Buffalo, were appointed to serve on the joint committee of the industry which is being organized by the Society for Electrical Development to deal with the duplication of effort.

College Deans Favor Five-Year Course for Engineering Students

AT A CONFERENCE held recently in Chicago by fourteen representatives of engineering colleges in the Middle West, all but two of whom are the deans of their respective institutions, an optional five-year engineering course was favored in the following terms:

> Resolved, That in order to meet the constantly enlarging responsibilities of the engineering profession we favor an advance in engineering education at this time that shall provide for five years of collegiate training for those engineering students whose aim is to be qualified to take positions among the creative leaders in the profession, and that such advance shall be made in substantial accordance with the following plans:
>
> 1. Remodel the present four-year engineering curriculum, substituting a substantial proportion of humanistic and fundamental subjects in place of an equivalent amount of advanced technical work. It is desirable that so far as possible the curriculums in the different branches of engineering shall be sufficiently uniform to permit students to defer their final choice of a specialty at least to the end of the second year.
> 2. Add a fifth year of advanced work, mostly or wholly technical and specialized to such an extent as desired.
> 3. The first four years of work shall lead to a bachelor's degree and the fifth year to an advanced degree in engineering.

The members of the conference agreed to present these recommendations to the authorities of their respective institutions and to report back at a second session to be held at Urbana, Ill., during the week of June 18. The institutions represented were the State University of Iowa, University of Minnesota, Ohio State University, Purdue University, University of Michigan, Michigan Agricultural College, University of Illinois, Northwestern University, University of Wisconsin, University of North Dakota, University of Nebraska, Iowa State College, Washington University and the University of Colorado.

Utilities' Credit Must Not Be Impaired, Says Large Investment Banker

BECAUSE the utilities must seek additional capital from year to year, it is of extreme importance that they preserve their credit on a high plane, declared A. G. Hoyt, vice-president of the National City Company, before the one-day convention of the Metropolitan New York Section of the N. E. L. A. on May 26. This meeting was held in order that the employees of the different light and power companies operating in Greater New York might have the opportunity to take up and review briefly the work and reports of the Commercial, Accounting and Technical Sections of the national association for the year just closed. Pointing out that if a utility cannot finance expenditures for additional plant and extensions, it will be unable to meet the demand for service, Mr. Hoyt continued:

"Credit is a very elusive thing, and it is not always easy for a company to keep its credit unimpaired. In this connection the financial structure of a company is very important. It should have a well-balanced, conservative capitalization. The bonded debt should not exceed 60 per cent to 70 per cent of the investment value of the company. It should have a flexible mortgage which will permit it to issue from time to time additional bonds. The bonds issued, however, should not exceed 75 per cent of the amount of the added property, and fixed charges should not be increased to a point where they are much over 50 per cent of net earnings. The company should sell additional stock to supplement its bond financing.

"No company can successfully finance itself continuously from year to year by selling bonds or obligations bearing fixed charges. The time will come when the equity which is represented by the stock will bear too small a relation to the bonded debt. The property, which may have been bonded originally for from 50 to 60 per cent of its value, will with continuous issues of obligations come to be bonded for 80 or 90 per cent of its value. Under such conditions the company's credit becomes adversely affected and the investing public will properly refuse to buy more of its bonds. The sale of stock from time to time will tend to keep a proper balance between investment and bonds."

Program for Spring Lake Convention of Supply Manufacturers

ARRANGEMENTS for the annual meeting as well as the section meetings of the Associated Manufacturers of Electrical Supplies, to be held at the Essex and Sussex Hotel, Spring Lake, N. J., during the week commencing June 19, are progressing favorably and a large attendance is assured. In addition to the annual meeting of the association, all the sections will also hold their annual meetings, at which officers will be elected for the coming year.

A feature of the meetings this year will be a special general meeting for all members, in addition to the annual meeting, for the discussion of all matters of common interest, whether technical or otherwise.

At the meeting of the general standards committee on Monday, June 19, there will be presented for final adoption some eight or ten standards covering electrical devices which have received the approval of the membership. The schedule of meetings follows:

Monday, June 19.—General standards committee.

Tuesday, June 20.—Signaling Apparatus Section, Heating Appliance Section, Panelboard and Switchboard Section (two days), Snap Switch Section, Lamp Receptacle and Socket Section, Attachment Plug Section, Armored Conductor Section, Non-Metallic Conduit Section, Rigid Conduit Section, Metal Molding Section.

Wednesday, June 21.—Knife and Inclosed Switch Section, Outlet Box Section, Air-Circuit-Breaker Section, Industrial Lighting Section, Electrical Porcelain Section, Radio Apparatus Section, Molded or Formed Insulation Section, magnet wire group, Wire and Cable Section.

Thursday, June 22.—(Morning) Fuse Section, Line Material Section, Laminated Phenolic Condensation Products Section, Carbon Section; (afternoon) annual meeting of the association, meeting of board of governors; (evening) informal dinner dance.

Friday, June 23.—General meeting of common interest.

May Financing Reaches the Highest Total of the Year

DURING the month of May stocks and bonds amounting to $69,344,560 were reported as offered to investors by the electric light and power public utilities. This figure, the highest total reached this year, represents an increase of more than $26,000,000 over April, 1922, and more than $13,000,000 over May of last year. An interesting feature of the month's flotation is the New Bedford Gas & Electric Light Company issue, a 5 per cent bond at a 3.29 premium. While the average yield for May, 6.74, is slightly higher than that for April, four issues—those of the Lehigh Navigation Electric Company, the Philadelphia Electric Company, the New Bedford Gas & Edison Light Company and the Utah Light & Traction Company—yielded the investor a rate of return less than 6 per cent. The number of separate issues was large and long-term securities continue to predominate. The issue of the Commonwealth Power Corporation—$12,500,000—constitutes the largest single offering.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Continental Gas & Electric Corp. (Ohio)	$1,500,000	Twenty-five-year	Refunding mortgage bonds, series A	To provide funds for acquisition of new properties and for extensions to existing properties	6	93	6.55
Houston Lighting & Power Co. (Texas)	500,000		Cumulative preferred stock		7	94* or 95†	7.44
Lehigh Navigation Electric Co. (Pa.)	3,000,000	Twenty-one-year	First (closed) mortgage gold sinking-fund bonds, series A		6	102	5.83
Utilities Power & Light Co.	600,000	Fifteen-year	Secured sinking-fund gold bonds		7	95½	7.50
Philadelphia Electric Co.	7,500,000	Twenty-five-year	First lien and refunding mortgage gold bonds		5	99½	5.53
Great Western Power Co. of California	2,000,000	Thirty-year	First and refunding mortgage bonds, series C		6	100	6
Metropolitan Edison Co. (Pa.)	1,805,760		Cumulative participating preferred stock		7	96	7.29
Western States Gas & Electric Co. of California	500,000	Ten-year	Gold notes of 1917 (secured)		6	96½	6.88
Northern Indiana Gas & Electric Co.	7,000,000	Thirty-year	First lien and refunding mortgage gold bonds, series May, 1922	To purchase and cancel or pledge under this mortgage certain underlying bond issues, to pay existing floating debt and for additions and betterments	6	95	6.37
West Virginia Water & Electric Co.	3,300,000	Twenty-year	First mortgage gold bonds		6½	100	6.50
New Bedford Gas & Edison Light Co. (Mass.)	1,500,000	Sixteen-year	First mortgage gold bonds of 1918, series D		5	103.29	4.70
Utah Power & Light Co.	5,000,000	One-hundred-year	Gold debenture bonds, series A	To provide funds for retirement of floating debt and for other corporate purposes	6	91	6.60
East Kootenay Power Co., Ltd. (Can.)	2,000,000	Twenty-year	First mortgage sinking-fund gold bonds		7	97½	7.25
Commonwealth Power Corp.	12,500,000	Twenty-five-year	Secured sinking-fund gold bonds	To be applied to payment of debt due and bonds due	6	90	6.85
Penn Central Power Co.	3,350,000	Forty-year	First mortgage sinking-fund gold bonds, series A	To provide funds for additions	6	99½	6†
Northern New York Utilities, Inc.	1,322,800	Twenty-five-year	First and refunding bonds, series B	To reimburse treasury for past expenditures and to provide money for additions	6	100	6
Utah Light & Traction Co.	12,471,000	Twenty-two-year	First and refunding mortgage gold bonds, series A		5	91	5.70
Philadelphia Suburban Gas & Electric Co.	700,000	Fifty-year	General mortgage gold bonds	To provide funds for general corporate purposes	6	95	6.35
Mississippi Valley Power Co.	400,000	Twenty-five-year	First mortgage gold bonds, series A		6	91	6.75
Rockingham County Light & Power Co. (New Hampshire)	$650,000	Fourteen-year	(Closed) mortgage gold bonds		5	90	6.05
Coast Valleys Gas & Electric Co.	400,000	Thirty-year	First mortgage bonds	To redeem notes falling due and to reimburse treasury for part of the cost of recent extensions and betterments	6	96½	6.25
Lake Superior District Power Co.	1,345,000	Twenty-year	First mortgage and refunding gold bonds, series A		6½	94½	7
Total	$69,344,560						

* Cash. † On installment plan.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Hydro-Electric Progress in Tennessee.—A development of 4,500 hp. on the Watauga River, near Johnson City, Tenn., is being undertaken by the Tennessee Eastern Electric Company, at a cost of about $300,000, and transmission lines to Johnson City and nearby points will be built.

Utilities Development Corporation Changes Name.—The name of the Utilities Development Corporation, Chicago, has been changed to Utilities Power & Light Corporation. The company owns and operates the Indiana Power Company, Vincennes, Ind., and the Interstate Power Company, Chicago.

City Commission of Jacksonville Opens Electrical Display Rooms.—The City Commission of Jacksonville, Fla., recently opened electrical display rooms containing ranges and water heaters of every description, with demonstrators to explain their operation and quote prices and terms to those desiring to cook with electricity. The opening of these display rooms is in line with the city's plan to conduct a campaign for the utilization of the full capacity of the municipal electric plant.

Vacuum Street Cleaners Advocated for New York City.—Electric vacuum cleaners may replace the army of "white wings" on New York streets. The plan is urged by the Downtown League, which has sent an appeal to the Street Cleaning Department. The league says the city will eliminate disease-bearing dust, cut the mortality list, release the "white wings" for other work and save hundreds of thousands of dollars by using the cleaners. It is claimed that a suitable motor-driven vacuum cleaner can be built at reasonable cost and operated economically.

The World's Highest-Head Plant.—What seems undoubtedly to be the highest-head hydro-electric development in the world is the reserve plant of the Société d'Electrochimie on Lake Fully, Valais, Switzerland. This plant is fed from a reservoir constructed in the Alps at a height of 5,413 ft., as compared with the 3,083 ft. of the Arly development in the Pyrenees and the 3,067 ft. of the Lake Tanay (Switzerland) plant. The Fully power house was built as an auxiliary to the larger plant of the company at Martigny, to guard against the insufficient supply of water which would otherwise be experienced in the winter time, when the maximum output of 16,000 hp. may fall to 5,000 hp., because the glaciers from which the mountain streams are fed are no longer responsive to the rays of the sun. Under the impact of the water falling more than a mile, a liter (0.035 cu.ft.) of water a second exerts a force of 16½ hp. upon the axis of the turbines at the Fully plant, which, at a turbine efficiency of 75 per cent, represents 12 kw. at the generators.

France to Adopt Electric Tram Lighting.— As an outcome of the Batignolles tunnel disaster the French government has decreed that gas lighting on trains must be abolished by the end of 1922 to do away with the menace contained in carrying cylinders of gas under pressure. In response to the government decree the first electrically lighted train between Paris and Versailles has already begun to operate with entire success, and the work of substituting electricity for gas is proceeding rapidly.

Madrid's Electrical Service to Be Improved.—The Hidroélectrica Española, the second most important hydro-electric company in Spain, has nearly completed the construction of its station at Dos Aguas, at the junction of the Jucar and Gabriel Rivers, to the southwest of Valencia. This station will give about 100,000 hp. when completed and will help to improve the inadequate light and power service of Madrid, where the demands have increased enormously in the last few years. The problem in that city, according to the *Engineer*, is very acute, and it is possible that a large steam-power station will have to be built to preserve the city from the failure of electric service that now arises from time to time when the rainfall is inadequate.

British Remove Ban on Wireless Broadcasting.—The British Postmaster-General has announced that it has been decided to permit the establishment of certain wireless-telephone broadcasting stations in the United Kingdom. It is proposed to divide the country into areas centering about London, Cardiff and Plymouth. Birmingham, Manchester, Newcastle, Aberdeen and Glasgow also are to be centers under the plan proposed. Sending stations are to be allowed in each area, with the stipulation that permits for broadcasting will be granted only to British firms which are bona-fide manufacturers of wireless apparatus. The ban of the government on all such projects heretofore has been the chief obstacle in the way of England following America's radio lead.

State Power Maps Now Available.—A new map of Virginia on a scale of one to five hundred thousand, showing the location of the power stations and transmission lines used in public service and the names of the public utility companies, has just been published by the United States Geological Survey. This map is one of the series of state power maps now being published by the Geological Survey. Maps have already been completed of New York, Pennsylvania, Massachusetts, Rhode Island, Connecticut, Maryland, Delaware, District of Columbia, Vermont, New Hampshire and New Jersey, and maps of Indiana, Maine and West Virginia are being prepared for publication. The maps that are available for distribution may be purchased from the director of the United States Geological Survey for 50 cents a copy.

Rate Readjustment for Oklahoma Utility.—Further revision of electric rates of the Minnesota Electric Light & Power Company, which has a generating plant at Cushing, has been made by the Oklahoma Corporation Commission. A short time ago the rates were reduced from 14 cents to 12 cents for the first 30 kw.-hr., and at the same time the rate-making valuation was also lowered. After the rehearing, at which readjustments were requested, slight changes were obtained. The basic rate, however, is still 12 cents, but it applies to the first 100 kw.-hr. instead of the first 30-kw.-hr.

Northern Indiana's Financial Plans.—The Indiana Public Service Commission has authorized the Northern Indiana Gas & Electric Company to issue and sell approximately $24,000,000 in bonds and stock for the reorganization of its financial structure and improving its financial condition so as to provide funds for needed additions and extensions of its properties. The new issues are to be used for retiring outstanding securities. The issues ordered include $5,000,000 common stock to be sold at not less than par, $9,000,000 preferred stock at not less than par, $5,970,000 in 6 per cent gold bonds, $1,030,000 in 6 per cent mortgage bonds for pending improvements and $1,885,000 in 5 per cent mortgage bonds for improvements since Dec. 1, 1918. The old bond issue is to cover securities affecting the South Shore Gas & Electric Company, Hammond, Whiting, East Chicago, Indiana Harbor and Michigan City utilities.

Coming Meetings of Electrical and Other Technical Societies

American Association of Engineers—Salt Lake City, June 5-7.

Electric Power Club—Hot Springs, Va., June 5-7.

American Society Heating and Ventilating Engineers—Buffalo and Detroit, June 6-10.

N. E. L. A. Geographic Divisions—Northwestern, Boise, June 7-10; North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.

Canadian Electrical Association—Ottawa, Ont., June 15-17.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25.

Society for the Promotion of Engineering Education—Urbana, Ill., June 20-23.

American Society of Civil Engineers—Portsmouth, N. H., June 21-22.

American Association for the Advancement of Science—Salt Lake City, June 22-24.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30. (For program see issue of May 13, page 968.)

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of May 13, page 972.)

A. I. E. E., Pacific Coast Convention—Vancouver, B. C.—Aug. 8-11.

International Association of Municipal Electricians — New Bedford, Mass. Aug. 22-25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

The Public and the Service Charge.—While ordering, in deference to public opposition, the discontinuance of a service charge made by the Lansing Fuel & Gas Company, the Michigan Public Utilities Commission said: "In doing this it must be understood that this commission is not surrendering its convictions that a service charge comes nearer to doing exact justice to the gas users than the flat rate does. One great trouble has been that the public has not fully understood just what this service charge means. Some have had the impression, and probably have it yet, that this is a charge which the gas company makes for reading the meter. Some have the impression that it is a rental of the meter. Others have the impression that on removing the service charge the rate of $1.25 per 1,000 cu.ft. will remain. These are erroneous ideas. We are of the opinion that when the public comes to understand what this readiness-to-serve charge really is there will be a demand for it."

Valuation Dicta of the California Commission.—In its order reducing the rates of the San Joaquin Light & Power Corporation (see Electrical World, May 6, page 894), the California Railroad Commission laid down a number of rulings on fundamental questions related to regulation. The "present value" theory as a basis for rate making was rejected as unduly advantageous to the company. The theory was declared to be unfair to the consumers on a rising market and unfair to the utility on a falling market, and the commission's method, taking the reasonable costs at the time of construction, regardless of whether the cost to reproduce the properties now would be higher or lower, was declared to be sound. A claim of "cost to reproduce" was disallowed, the commission asserting that the cost to reproduce a given amount of business could not be computed simply by taking the deficit below a full return upon the investment in the past six years of more or less abnormal business, especially as these six years could not properly be considered as being within a development period. Water-right values were excluded as based on mere hypotheses, and federal income taxes were declared not an operating expense. In refusing to allow an arbitrary percentage return over the cost of money to the company the commission said: "Were financial conditions that existed at the time of the hearing to continue, there might be some justification for allowing an 8.5 per cent return to this company, which would be about 1.2 per cent more than the cost of bond money. It is, however, unfair in a decision of this character to recognize the high interest rate paid on bonds, when as a matter of fact some of those bonds are now being called for redemption and others should be, if interest rates continue to decline. . . . The company's system, though not overdeveloped, has possibilities of reducing costs due to the general tendency to reduced costs of operation and a greater concentration of business on its system. The economic depression prevailing all over the country during the past year and affecting the territory served by San Joaquin company, although now showing indications of recovery, justifies a temporary sacrifice of a portion of the full return."

Rate Increase Follows Threat to Discontinue Service.—A rate increase from 10 cents to 14 cents a kilowatt-hour has been placed in effect in Ridgeway, Ohio, by the Mount Victory Light & Power Company, following approval of its application to the Public Utilities Commission. The case was vigorously fought before the commission, but weight was given the power company's application by the fact that the village owes more than $1,500 for street lighting for which, it was said, no promise to pay had been forthcoming. Street-lighting service was discontinued several months ago when the bill reached such a figure that the company declined further credit. Demand was then made by the company that the village pay the bill immediately under threat to discontinue service to domestic consumers. When the village failed to comply with the demand, the company filed application with the utilities commission for leave to discontinue all service. The commission refused to grant authority for discontinuance of service, but indicated approval of increased rates.

Service Charge Authorized in Massachusetts.—Graduated service charges combined with reduced rates for energy have been approved for the Malden Electric Company and the Suburban Gas & Electric Company of Revere by the Massachusetts Department of Public Utilities. The Malden company's general lighting schedule was formerly 11 cents per kilowatt-hour with a minimum charge of $9 per year. The company proposed to substitute a base service charge of 35 cents per month and an energy rate of 9 cents per kilowatt-hour. This would eliminate the minimum monthly charge. The department established a service charge of 35 cents per month for a customer using a 5, 10 or 15-amp. meter, and this is gradually increased to 85 cents for a 600-amp. or 1,200-amp. meter, with other charges in proportion. Similar service charges and a 9-cent energy rate were authorized for the Suburban company, but as it serves a beach resort where there are many summer customers, it is provided that if service is not used for five successive months, there may be a minimum charge not exceeding $5.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Liability of Company for Damage from Wire Owned by Another.—Fiquett vs. Wade Electric Light & Power Company was a suit to recover the value of a mule killed by a wire erected by the owner of a planing mill for the transmission of electrical energy furnished, not in the regular course of business but under a special understanding, by the defendant company. The Supreme Court of Alabama has found the Wade company liable, despite an alleged agreement on the part of the owner of the wire to maintain it in good order. (91 So. 357.)*

Agreement Under Workmen's Compensation Act Cannot Be Collaterally Attacked.—In Smith vs. Port Huron Gas & Electric Company the plaintiff, an electrician who had been injured by contact with a switch, elected to receive compensation under the workmen's compensation act from the industrial concern for which he worked. Subsequently, claiming that his signature to the agreement had been obtained fraudulently, he brought suit against the central-station company as the wrongdoer that caused his injury. The Supreme Court of Michigan holds that under the circumstances cited such an action cannot be brought by the workman but only by his employer, although the agreement alleged to be fraudulent may be impeached by a direct proceeding in equity. (187 N. W. 292.)

Death from Electricity Transmitted for Household Lighting Puts Burden on Company to Prove Itself Not Negligent.—In Stark vs. Badger Public Service Company, an action for damages because of a death caused by electrocution from the socket of an electric lamp in the basement of a residence supplied with electricity upon a secondary wire ordinarily carrying 110 volts, proof that deceased stood in a place where contact with this voltage would not ordinarily result in death or serious injury, and that there was an opportunity for the 2,300-volt primary wires to touch the secondary wires, owing to the power company's negligence in not making seasonable repairs, was held by the Supreme Court of Wisconsin to establish defendant's liability under the doctrine of *res ipsa loquitur* ("the thing speaks for itself"), in the absence of proof that defendant was not negligent, the burden in such case being on the power company to prove itself not negligent. (187 N. W. 651.)

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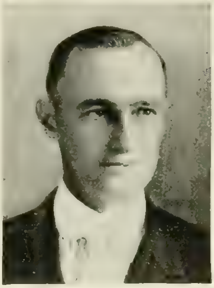
*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

R. S. Reading has been appointed chief engineer of the Southwestern Gas & Electric Company. Mr. Reading comes to his new position after several years of experience in the operation of Southern public utilities. He was born in Richmond, Tex., and was graduated from the Texas Agricultural and Mechanical College as an electrical engineer in 1910. Immediately upon graduation he became associated with the Otis Elevator Company and later became service agent for the Southwestern district of that company, this leading up to his employment with the Stone & Webster Company at El Paso, Tex., in 1916. In 1918 he became power-plant electrician with the El Paso Electric Railway Company, and later was engineer in charge of electrical construction for Stone & Webster at Houston, Galveston, Beaumont and Port Arthur, Tex. In June, 1920, he was appointed electrical engineer with the Galveston & Houston Electric Railway Company, Galveston Electric Company and the Houston Electric Company. In February of this year he was appointed engineer in charge of the engineering department of the Southwestern Gas & Electric Company, with headquarters at Texarkana, Tex.


R. S. READING

Erlon V. Crimmin, electrical engineer of the Lowell (Mass.) Electric Light Corporation, has resigned and will join the technical department of the Edison Electric Illuminating Company of Boston.

James C. Webster has become connected with the Canadian National Carbon Company, Ltd., Toronto, as brush engineer. He was formerly with the National Carbon Company, Inc.

Fred. W. Brownell, formerly general accountant for Stone & Webster, Inc., has been appointed comptroller of the Puget Sound Power & Light Company and subsidiary companies.

Waldo M. Plaisted has been appointed superintendent of the Waterbury division of the Connecticut Light & Power Company. Mr. Plaisted is a graduate of the engineering course of the General Electric Company.

Herman J. Pettengill, Jr., sales manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., and the Pawtucket Gas Company, has been transferred to the Boston office of the Stone & Webster Company and will be with the securities department.

Thomas D. Hawkes, treasurer of the Great Northern Power Company, has been appointed general manager, succeeding W. N. Ryerson. Mr. Hawkes has been connected with this company since its organization and has taken an active part in the management of its affairs. He will continue as treasurer and have charge of the company's finances as well as being in direct charge of the management.

W. M. Carpenter has been appointed engineer for the Empire State Gas and Electric Association. Mr. Carpenter has been associated for the past five years with the Utilities Mutual Insurance Company. He was graduated from Columbia University in 1909 and previous to his connection with the Utilities Mutual Insurance Company served as engineer for the New York Municipal Railway, the Chicago Traction Commission and the Charleston (W. Va.) Interurban Railroad.

W. W. Schwarting has been appointed general superintendent of the Hibbing (Minn.) Water & Light System, vice Charles Foster, resigned. Mr. Schwarting was graduated from Iowa State College in electrical engineering in 1905. Upon graduation he became associated with the Westinghouse Electric & Manufacturing Company until 1910, when he was employed by the People's Power Company as assistant to the general superintendent, in charge of central-power-station and gas-works operation. In 1913 he was promoted to be superintendent of power-plant construction in the same company, and four years later he was appointed general superintendent of the People's Gas & Electric Company, Mason City, Iowa. In 1920 he again entered the employ of the Westinghouse Electric & Manufacturing Company as sales engineer in the Minneapolis district, which position he held until his present appointment.

W. D. A. Peaslee has been appointed chief engineer of the Belden Manufacturing Company of Chicago.

Clarence G. Spencer, recently on the consulting board of the American Sugar Refining Company, is now connected with McClellan & Junkersfeld, Inc., of New York City.

Carl C. Long, until recently electrical engineer of Riegos y Fuerza del Ebro, Barcelona, Spain, is now in the engineering department of the Southern California Edison Company.

Charles Heston Peirson, formerly advertising agent, is now supervisor of public information for the Southern California Edison Company. Mr. Peirson has been with the Edison company for thirteen years. He has had a long experience as a writer and since entering the electrical business has prepared many articles of general interest to the industry. In addition to his regular duties, he has found time for special work on numerous committees and at the present time is chairman of the publicity committee of the Pacific Coast Electrical Association.

E. D. Bell was elected president of the Middle West Division of the N. E. L. A. at the Kansas City meeting last April. Mr. Bell is the general manager of the St. Louis Electrical Terminal Railway Company and is also in charge of properties of the Illinois Traction System, including the Madison County Light & Power Company and the St. Louis Electrical Bridge Company. After graduation from the Engineering College of the University of Illinois in 1901, he took charge of the light and power company in Urbana. In 1903 he joined the staff of the Illinois Traction System and was first stationed at Danville, Ill. He remained there a year and was then transferred to St. Louis, where he has been stationed ever since. Mr. Bell has been actively engaged with the association work of the Missouri Association of Public Utilities, which included the organization and direction of the Missouri Committee on Public Utility Information.

E. D. BELL

F. E. Wilcox has resigned as president and general manager of the D. Wilcox Manufacturing Company, Mechanicsburg, Pa.

J. H. Shahan has been appointed sales representative in the Southern territory for the Diehl Manufacturing Company, Elizabeth, N. J. Mr. Shahan has established headquarters at 45-A Trinity Avenue, Atlanta, Ga.

C. C. Eagle, Jr., has been placed in charge of the newly established branch office of the Bristol Company, instrument manufacturer, Waterbury, Conn. Mr. Eagle was formerly in charge of the Detroit office of the company and has had wide experience in the instrument field both in the production and sales departments.

E. P. Waller has recently been appointed manager of the railway department of the General Electric Company. He has been assistant manager of this department since 1912. J. G. Barry, who has heretofore held both the position of general sales manager of the company and that of manager of the railway department, will devote his entire time and attention to the work of the sales managership. Mr. Waller was born in Martinsville, Va., and was graduated from the Virginia Polytechnic Institute in the class of 1900. Following his graduation he entered the testing department of the General Electric Company at its Schenectady works. After two years in the testing department he joined the staff of the publication bureau, assisting in writing and editing bulletins, instruction books, technical letters, etc. When the *General Electric Review* was instituted he became associate editor, M. P. Rice being editor. In the fall of 1903 Mr. Waller took up commercial railway work under Mr. Barry, and in 1912 was made assistant manager of the railway department. Mr. Waller has for many years been an active factor in the committee work of the American Electric Railway Association. He is a member of the Engineers' Club of New York.

E. P. WALLER

L. E. Hickok has been elected general manager of the D. Wilcox Manufacturing Company, Mechanicsburg, Pa.

S. F. Hauck has assumed the duties of chief executive of the D. Wilcox Manufacturing Company, following the resignation of F. E. Wilcox as president and general manager.

E. Zinsmeyer, the new president of the Electrical Warehouse, Inc., Detroit, brings to this position years of experience gained in the electrical merchandising field. In 1900 Mr. Zinsmeyer joined the Frank Adam Electric Company at St. Louis and served successively as timekeeper, cost clerk, draftsman, salesman and sales manager. In 1920 he moved to San Antonio, Tex., as secretary and manager of the Martin Wright Electric Company. October of the same year saw his return to the North, where he accepted the position of sales manager of the Electrical Warehouse. He remained in this capacity until his recent election to the presidency of the company.

George Baily, assistant to the manager of the supply department of the Westinghouse Electric & Manufacturing Company, has been appointed supervisor of distributing agents of that company. Mr. Baily was graduated from Lehigh University in 1904 and at that time entered the employ of the Dravo Construction Company of Pittsburgh. Six years later he entered business for himself in Cincinnati as sales agent and contracting engineer. In 1913 he entered the employ of the Westinghouse company as manager of the supply division of the Cincinnati office, remaining there until 1917, when he joined the engineer officers' training camp. Mr. Baily was mustered out of the army with the rank of major and returned to the Westinghouse company as manager of the supply division of the Cincinnati office. In 1920 he was made assistant to the manager of the supply department, the position he held at the time of his present appointment.

GEORGE BAILY

Obituary

F. L. Blaschke, who had been connected with the National Lamps Works of the General Electric Company at Cleveland for ten years, died May 26. He was a graduate of Purdue University and joined the engineering department of the General Electric Company in 1911. Subsequently he was connected with the "Mazda" service bureau on the Pacific Coast and later with the publicity department as editor of *Stimulator* and in charge of "Ivanhoe Regent" advertising.

Antoine Bournonville, for years identified with the activities of the Electrical Credit Association of the Middle and Southern Atlantic States, died during the last week in April at the Marlborough-Blenheim, Atlantic City. Mr. Bournonville was a charter member of the Electrical Credit Association and had served as president, vice-president and member of the board of directors.

Clifford Dudley Babcock, inventor, died in New York on May 22, at the age of fifty-six. Mr. Babcock was connected with the electrical industry from 1887 and was one of the pioneers in wireless. He collaborated with Lee De Forest on preliminary work on the audion. Mr. Babcock took out many patents for radio inventions, one of the latest of which covered the annular arrangement of the elements. Mr. Babcock served with the Ordnance Department of the army during the war.

Curtis E. Vandel, credit manager of the Kansas City branch of the Western Electric Company, died in that city recently at the age of forty-nine. Mr. Vandel had held the position of credit manager for the Western Electric Company in Kansas City for the past nine years and was well known in the electrical credit world, having been active in the affairs of the Electrical Credit Association. He was born in Princeton, Mo., in 1872 and was educated in the public schools there and at the Stanberry Normal School, Stanberry, Mo. in 1898 he went to Kansas City, where he was connected in succession with several mercantile establishments. In 1912 he went to the Western Electric Company and remained there as credit manager until his death. About the time he accepted the Western Electric position he became interested actively in the work of the Kansas City Association of Credit Men, serving as director, as president of the association in 1914 and as director of the National Association of Credit Men in 1916. For several years he was also principal instructor in the school of credit of the Kansas City association and was chiefly responsible for the growth and success of this school.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

April Fails to Halt Decline in Electrical Exports

ELECTRICAL exports for the month of April showed a large decrease from the total for the previous month, the loss amounting to more than $1,000,000, or about 20 per cent. The figure for April was only $3,859,428, as compared with $4,927,984 for the preceding month and with $8,467,820 for April a year ago. Just why this large drop should have occurred during April is hard to explain, particularly since the previous month had shown a satisfactory increase over February. A large number of the items listed in the table below showed a smaller demand, but, on the other hand, many item totals increased over March, so that the explanation of generally bad conditions in foreign markets cannot be applied in this case.

Those items which show increases as compared with March include copper wire, direct-current generators and alternating-current generators under 2,000 kw., wet batteries, rectifiers, transformers other than power, switch and panelboards, switches and circuit breakers, fuses, meters, lightning arresters, stationary motors, carbon lamps, searchlights, motor-driven household devices, heating devices, therapeutic apparatus, radio apparatus, signal apparatus in general, conduit, wiring supplies and fixtures. Perhaps the most startling shrinkage was shown by insulated wire and cable, none of which was exported in April against $129,002 in March. Other important lines whose totals dropped during the month were electrical porcelain, alternating-current generators over 2,000 kw., dry and storage batteries, power transformers, fractional-horsepower motors, electric fans, metal-filament lamps, telephone apparatus, spark plugs and magnetos.

Wherever the new classification permits comparisons to be made April, 1922, shows up very poorly beside the same month last year, with the exception of copper wire and carbons for lights.

The table was compiled from figures supplied by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Sales Increase for 32 per Cent of Jobbers in First Quarter of 1922

THAT thirty-nine electrical supply houses reported increases in percentages of sales for the first three months of 1922 as compared with the same months of 1921 is shown in a report just issued by the Electrical Supply Jobbers' Association and which is compiled from data returned by a total of 122 main and branch houses in all

ELECTRICAL EXPORTS FOR APRIL, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO.

	April, 1921		April, 1922	
	Volume	Value	Volume	Value
Electrical glassware, except for lighting, lb.			143,284	$ 9,791
Electrical porcelain, lb			735,054	107,784
Carbons for electric lighting, electrodes and batteries, lb.		$12,059	584,569	49,928
Insulated wire and cable (iron and steel), lb.			122,927	23,819
Other manufactures of aluminum, lb.		209,745	191,909	64,798
Copper wire (bare), lb.	711,858	133,051	2,217,709	308,340
Insulated copper wire and cable				
Generators:				
Direct-current—				
Under 500 kw., number			382	71,502
500 kw. and over, number			5	98,674
Alternating-current—				
Under 2,000 kw., number			38	31,354
2,000 kw. and over, number			2	114,170
Accessories and parts of generators, lb.			8,631	10,202
Self-contained lighting outfits, number			72	22,622
Batteries—				
Primary—dry, number			294,727	85,795
Primary—wet, number			1,136	1,716
Storage, number			8,141	109,300
Transforming or converting apparatus:				
Power transformers, number			499	124,337
Other transformers, number			2,920	117,461
Rectifiers, number			257	4,946
Condensers, double-current and motor-generators, dynamotors, synchronous and other converters, number			1,238	40,868
Transmission and distribution apparatus				
Switchboards and panelboards, except telephone, number			225	227,911
Switches and circuit breakers, number			140,558	157,974
Fuses and fuse plugs, number			164,415	15,169
Watt-hour and other measuring meters, number			8,385	73,662
Volt, watt and ampere meters and other recording, indicating and testing apparatus, number			6,892	64,218
Lightning arresters, choke coils, reactors and other protective devices, number			1,965	30,571
Motors, starters and controllers:				
Motors, under 1 hp., number			3,238	54,126
Stationary motors—				
1 hp. to 200 hp., number			1,171	212,567
Over 200 hp., number			46	82,585
Railway motors, number			3	$ 300
Electric locomotives, number	5	$ 31,499		......
Other motors, number		1,711,620	2,373	59,966
Rheostats, controllers and other starting and controlling equipment, lb.		164,745	128,163	43,170
Accessories and parts for motors, lb.			116,846	65,633
Electric appliances:				
Electric fans, number	10,089	120,361	6,751	96,593
Electric lamps—				
Arc, number	133	1,927	55	1,233
Incandescent—				
Carbon-filament, number	84,796	22,602	23,754	6,123
Metal-filament, number	1,316,251	384,224	276,080	78,205
Other electric lamps, number			11,810	9,845
Flashlights, number			15,629	10,707
Searchlights and projectors, number			362	18,096
Motor-driven household devices, number			3,312	58,489
Domestic heating and cooking devices, number		165,962	14,401	59,947
Industrial electric furnaces and ovens, number			42	11,205
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc., number			489	52,988
Signal and communication devices:				
Radio and wireless apparatus, lb.			105,611	116,221
Telegraph apparatus, lb.			41,262	43,088
Telephone including switchboards, lb.			196,899	290,188
Police, fire and burglar alarm, lb.			2,700	5,006
Railway signals, switches and attachments, lb.			215,185	54,332
Bells, buzzers and annunciators, number			5,271	4,985
Other electric apparatus:				
Spark plugs, magnetos and other ignition apparatus, lb.		131,474	87,471	85,852
Metal conduit, outlet and switch boxes, lb.			291,009	26,790
Sockets, outlets and receptacles, number			119,717	28,061
Other wiring supplies and fixtures, lb.		170,038	162,849	86,652
Other electrical apparatus not elsewhere specified, lb.		2,485,766	1,819,027	736,845
Total		*		$3,859,428

* Total electrical exports for April, 1921, amounted to $8,467,820. This figure is not included in the above table because of the incompleteness of figures for that month under the new classification.

COMPARATIVE INCREASE OR DECREASE IN SALES IN PERCENTAGE FOR THE FIRST THREE MONTHS OF 1922 AS COMPARED WITH THE SAME PERIOD OF 1921

	No. of Houses Reporting	Increases			Decreases		
Zone 1: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut		10.00	10.00	10.00	4.00 16.00 25.00	5.80 16.00 3.10	8.00 11.00
Zone 2: New York and New Jersey	18	21.00 2.00 4.24	20.00 20.00 0.45	31.40 10.00 30.00	3.00 26.00 24.00	12.00 39.34 3.50	28.73 20.40 8.70
Zone 3: Pennsylvania and West Virginia	14	6.00	7.00	6.00	25.60 29.20 28.00 33.00	33.00 50.20 25.00 48.00	11.00 21.00 44.00
Zone 4: Maryland, Delaware, District of Columbia and Virginia	5	16.60	2.95		5.40	15.00	10.60
Zone 5: Ohio and Kentucky	11	1.60	15.70		27.00 16.21 17.70	24.98 23.00 27.81	15.30 7.80 26.00
Zone 6: Michigan and Indiana	9	11.20 13.81	15.00 2.20	13.93	10.70 33.00	23.00	2.17
Zone 7: North Carolina, South Carolina, Georgia and Florida	4				4.92 24.00	25.30	25.50
Zone 8: Wisconsin and Illinois	8	2.60	7.20		25.00 12.13	7.50 20.00	6.80 14.00
Zone 9: Tennessee, Arkansas, Alabama, Mississippi and Louisiana	4				16.10 40.50	15.90	½ of 1% (.5)
Zone 10: Minnesota, North Dakota, South Dakota and Iowa	7	19.67	19.00		31.00 24.00	15.00 39.90	8.30
Zone 11: Nebraska, Kansas and Missouri	9				22.30 18.70 14.00	15.00 6.96 24.00	1.00 25.70 1.50
Zone 12: Oklahoma and Texas	2	27.60			21.00		
Zone 13: Montana, Wyoming, Idaho and Utah	5				34.20 29.20	21.90 38.00	29.00
Zone 14: Colorado, New Mexico and Arizona	3	25.00				20.00	1.20
Zone 15: Washington and Oregon	6	3.46 23.60	11.33⅓ 1.00	31.70			8.00
Zone 16: California and Nevada	6	6.50 25.40	4.71	9.50	20.00	1.81	

parts of the country. This is 32 per cent. Eighty-three houses showed decreases.

Of eighteen houses reported in the New York and New Jersey zone, nine returned decreases and as many others returned increases.

Taking the average percentage of the total number of houses that reported increases, the result amounts to a general gain of 12.80 per cent over 1921. The percentage of decrease for houses reporting losses in sales over the first three months of 1921 is an average loss of 19.21 per cent.

Severe Jobber Competition Keeps Wire Price Down

IN SPITE of the fact that the present price of refined copper, 14 cents per pound for electrolytic, represents the highest point reached by that commodity in the last two years quotations of jobbers on all sorts of wire have failed to show much increase. This paradoxical situation is the result of the fact that many jobbers have large stocks of rubber-covered, weatherproof and bare wire, ordered at old prices in expectation of a heavy spring demand, and are attempting to move it quickly by keeping the price low.

There is a fair market for wire, particularly the rubber-covered type and bare wire for radio purposes. Demand for rubber-covered is expected to improve as more and more of the building started in the last two and three months reaches the electrical stage. At present, however, demand falls considerably below supply, and so jobbers are doing quite a bit of price cutting. It is possible to obtain No. 14 rubber-covered wire in 5,000-ft. lots in New York as low as $6 per 1,000 ft., with other quotations running as high as $6.25. There have even been some instances reported of large buyers obtaining a quotation as low as $5.90 per 1,000 ft. In other cities farther away from the wire-drawing plants the price runs as high as $6.75. Nowhere, however, do reports show that the rise in copper has had more than a slight firming effect on the wire market.

How long these prices will be quotable depends on how large jobbers' present stocks are. Wiredrawers are being forced to pay more for their raw materials, and sooner or later this will reach the jobber and the contractor. As noted above, copper is rising steadily and the producers are making every effort to give the increase a healthy and permanent character. Cotton at the end of last week had risen to 20¾ cents per pound for July delivery, and reports of bad weather in the West caused more unsettlement in the market than even this price shows. Rubber during April advanced 2 cents a pound for spot. It is estimated that New York stocks are very large, but they are controlled by strong interests, and attempts by buyers to obtain lower than sellers' prices have failed. Lead demand is fair, and while no large price increases have occurred lately, the market is firm.

Metal Market Situation

At the beginning of the week the copper market was generally quotable at from 13⅞ cents to 14 cents per pound, electrolytic, delivered in May or June. How long the price will remain at or below 14 cents is dependent to a very large extent on the attitude of the buyers. If demand should continue at the pace it set last week, 15-cent copper is not at all an impossibility. However, there were signs by Saturday of last week that the rush was over at last and that consumers were beginning to feel that their requirements for the next couple of months were covered safely. Whether this hesitation was caused entirely by the feeling that needs were filled or was due somewhat to the approaching holiday remains to be seen.

NEW YORK METAL MARKET PRICES

	May 23, 1922	May 29, 1922
Copper:		
London, standard spot	£ s. d. 62 2 6	£ s. d. 62 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.87½	13.87@14.00
Electrolytic	13.75	13.75
Casting	13.12½	13.37½
Wire base	15.12½–15.37½	15.12½–15.37½
Lead, Am. S. & R. price	5.50	5.65
Antimony	5.37½–5.50	5.37½– 5.50
Nickel, ingot	36.00	36.00
Sheet zinc, f.o.b. smelter	7.50	7.50
Zinc, spot	5.50	5.62½
Tin, straits	30.87½	31.75
Aluminum, 98 to 99 per cent	19.10	17.87½

OLD METALS

Heavy copper and wire	11.50 –11.75	11.50 –11.75
Brass, heavy	5.25 – 5.75	5.50 – 6.00
Brass, light	4.87½– 5.25	4.87½– 5.25
Lead, heavy	4.70 – 4.80	4.70 – 4.80
Zinc, old scrap	2.75 – 3.00	2.87½– 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical industry in many parts of the country seems to have spent last week in a state of suspended animation. There was the usual activity in wiring material and radio. Outside of that jobbers and dealers had not a great deal to do, though the prospects are that June will be a busy month with its flood of wedding-gift buying and the real start of the fan season. Chicago, owing to a spell of sultry weather, is proving a very good market for fans. Thus far the Middle West city is alone in this regard, though Atlanta retailers have been selling them to some extent.

Low motor stocks is the phenomenon reported from San Francisco. It is estimated that demand there will exceed supply about as long as it takes manufacturers to learn of the condition and get shipments through. St. Louis and Southwestern utilities are buying more freely from electrical jobbers than are industrials. Boston and Atlanta jobbers also report sustained buying of some kinds of materials.

Prices are unsettled, particularly those of wiring materials. Jobbers all over, and this includes some of the larger houses, are cutting prices viciously, and the condition is creating much dissatisfaction in the jobbing trade and among manufacturers.

NEW YORK

Little if any change in conditions in the electrical trade was reported by the jobbers this week. Business is moving along in a fairly even manner, some days showing more activity than others, but on the whole there is a steady volume of orders coming through. There is a good demand for wiring materials of all kinds, and prices are being well maintained, with the possible exception of rigid conduit, on which there is a reluctancy to advance quotations to conform with the last schedule. Wire prices have stiffened slightly in response to the increased cost of copper; however, there has been no material advance in quotations thus far.

The building activity in this section shows no signs of letting up, and while the new construction which is just being started will not reach the electrical stage until the latter part of the summer, it constitutes a large potential market which may be counted upon. Fan sales so far this season have been about 25 per cent ahead of last year, and present indications point to a banner summer.

Rigid Conduit.—Jobbers so far have held to the old quotations on pipe, and there is considerable price competition throughout the trade. Large stocks and orders placed before the last advance tended to hold down quotations. Some jobbers are holding for the new schedule but are making no sales. Quotations this week showed the following range. For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Although quotations on wire were a little easier last week, they have stiffened somewhat because of the higher cost of copper. No. 14, rubber-covered, single-braid, is quoted at $6 to $6.15 per 1,000 ft. in 5,000-ft. lots, and while the demand is not heavy, there is little tendency to shade these prices.

Flexible Armored Conductor.—Stocks in jobbers' hands are ample to meet the present demand, which is fairly steady. No. 14, two-wire, single-strip, sells for $43 per 1,000 ft., and double-strip for $45 per 1,000 ft., both for that quantity or over.

Metal Moulding.—Prices on this material are slightly lower than previously reported. The three-wire size in 1,000-ft. lots is now quoted at $4.80 per 100 ft. The cash discount, however, has been reduced from 5 per cent to 2 per cent.

Sockets.—No change in prices has been reported. In standard-package lots of 250, full-chain sockets sell for 33 cents each, key sockets in lots of 500 for 18 cents each, and keyless in the same quantity for 16 cents each.

Tape.—Friction and rubber tape are both quoted at 36 cents per pound in lots of 25 lb. and over.

Fans.—Sales have been exceptionally good so far this spring, showing an increase thus far of about 25 per cent over those of last year. The decrease of about 12 per cent in prices has helped stimulate this business.

CHICAGO

The electrical trade is steadily but slowly moving upward. Not a few indications of this fact were apparent in the past week, an improved demand for rubber-covered wire and conduit being one sign. The steady increase in building permits is causing this demand, and from estimates obtained the month of May to date will equal if not better April. Manufacturers of high-tension equipment are unanimous in reporting a brisk business. Poles and pole-line equipment are also selling well.

Illinois employment conditions have also improved. The May report of the Free Employment Bureau states that for every 100 jobs offered only 141 applications were received. This is the lowest mark since November, 1920. The metals, machinery and conveyance group reported an increase of 2.6 per cent. The sheet-metal workers averaged an increase of 8.9 per cent, the contractors one of 18.7 per cent, structural iron workers one of 7 per cent.

Wire.—The market for rubber-covered No. 14 wire is improving and jobbers are reporting a good volume of sales to contractors for house wiring. In 5,000-ft. lots this material sells for $6 per 1,000 ft. Stocks are in good condition. Weatherproof and bare wire have felt the strengthened copper market, and both of these commodities are selling around 16⅞ cents per pound.

Conduit.—This material is also showing activity. The price is still maintained at $43 per 1,000 ft. for the ½-in. black pipe and stocks are ample.

Flexible Armored Conductor.—The call has been steady, though jobbers explain that the demand for conduit and wire has been heavier than for the armored conductor. Prices have remained constant and the No. 14 two-wire, single-strip, is available in 5,000-ft. lots at $43 per 1,000 ft. Stocks are in good condition.

High-Tension Equipment.—The week's business was reported brisk by the majority of manufacturers. One company filled orders for utilities in the Northwest.

Poles.—The pole situation appears to have remained unchanged, most dealers saying that activity is continuing at a brisk rate. Most of the orders appear to be for replacements. Stocks are good, and no price changes have occurred.

Pole-Line Hardware.—This material, following the good movement in the pole-line demand, is active. Prices have not changed and stocks are ample.

Cross-Arms.—Maintenance and repairs on utility lines have stimulated the demand for cross-arms so that dealers state there is a much better market for this material than on poles. The standard 3-ft. 3¼-in. x 4¼-in. fir arm in 1,000-ft. lots is priced at $45.68 per 100, f.o.b. Chicago.

Fans.—Sultry weather during the past few weeks has aroused public interest in fans, and most dealers are reporting an active start of their summer business. The 16-in. oscillator appears to be the most popular and stocks are good.

BOSTON

Business continues on the upward climb despite labor troubles in the textile industry and very slow improvement in foreign trade conditions. Probable acceptance of a 15 per cent wage reduction by shoe-factory workers at Lynn marks a better outlook in the leather field. Metal-working plants in New England are doing better, and the rubber factories are very busy. Paper mills continue active and car builders are handling large orders, one New Hampshire plant having $1,500,000 of business on its books. Woolen mills are well employed. Retail electrical stocks are running lower and resultant buying from jobbers is in considerable evidence. Prices are about the same as last week in electrical circles. Central-station outputs are gaining steadily, and a better outlook for small-power business is apparent. Local industries are much interested in the rate reductions ordered upon the railroads, but it is too early to gage their effect on New England business in general. Public utility financing is progressing well, an issue of $35,000,000 New England Telephone & Telegraph Company bonds having been oversubscribed during the week. Building operations continue to boom.

Wire.—Competition in wire sales is very sharp. Rubber-covered No. 14 was moving at the week end at $6.25 per 1,000 ft. in 5,000-ft. lots. Central stations are buying moderate quantities of weatherproof, and radio enthusiasts continue to dominate the market for bare copper wire of smaller sizes. No shortage is now apparent in the latter.

Flexible Armored Conductor.—Sales are in good volume on account of the large amount of interior wiring under way. House-wiring campaigns in many parts of New England are meeting with remarkable success. No. 14 single-strip is moving around $44.20 per 1,000 ft. in 1,000-ft. lots, with plenty in stock in all localities.

Loom.—Sales are exceedingly dull, and the small-order business existing is handled at acute competitive figures. It is suggested that not a little of this material changes hands below cost to the jobber in order to move it, and considerable dissatisfaction with the price situation is known to exist in the trade.

Knobs and Tubes.—Fairly steady sales are reported, with little change in prices from week to week. "Nail-it" knobs are selling at $18.25 per 1,000 in barrel lots and 3-in. tubes at $5.85 in the same quantity.

Meters.—Sales are probably 10 per cent better than last winter, and one distributer reports a gain of at least 25 per cent in new business as compared with a year ago. Most of the meters sold are absorbed into residential construction programs. Prices have been steady for many months, and stocks are easily maintained for prompt deliveries.

Motors.—Little week-to-week change in the motor market is apparent, but the tendency is toward better sales. Central-station power sales departments are now adding loads in moderate volumes to existing lines, and this means a good deal of scattered but cumulative demand upon motor stocks.

ATLANTA

Agricultural activities which have got well under way have been materially slowed down by a week of rain, with a consequent delay in getting planting finished and a retarded growth of cotton just up. The price of Atlanta cotton reached 20 cents last week, and this price is stimulating the sale of cotton held since last fall, with a resultant improvement in the liquidation of old accounts. Business, as a whole, however, does not show a very rapid improvement, though all indications point to a much healthier condition than has existed for several months, with prospects very bright for great improvement by fall.

The cut in freight rates recently announced by the Interstate Commerce Commission will be a great help to the South, and the opinion expressed by prominent business men is that this reduction will go far toward reawakening business in general. Electrical jobbers report business somewhat better throughout the line, but there is to be noted a complaint that retailers are devoting their primary attention to radio equipment, with the result that heating devices and hollow-ware sales are below what they should be. The large building program which has been under way some little time is beginning to stimulate the sales of electrical building materials, and there is to be noted an increasing demand for industrial equipment in general.

Conduit.—Industrial work, together with the building program, is causing a very satisfactory movement in this line in practically all sizes, both black and galvanized. Local stocks and shipments are both satsifactory, with prices showing no tendency at present to change.

Armored Conductor.—This item is moving very satisfactorily, with a 10 per cent advance in price recently announced. Present quotations for No. 14, two-wire, in lots of 5,000 ft., are $51.15 per 1,000 ft. Local stocks and shipments are satisfactory.

Wire.—A good market is reported on wire in popular sizes, both rubber-covered and weatherproof, though there is a slight reduction in No. 14 rubber-covered of 24 cents per 1,000 ft. Increasing number of inquiries for the larger sizes and for cables for industrial expansion are reported.

Exhaust Fans.—This item has not yet begun its summer movement, though sales continue to hold up fairly well, particularly in the 22-in. to 30-in. sizes. Jobbers' stocks are somewhat spotty with shipments excellent.

Meters.—The movement of meters has not yet responded to the increase that will result from residential and commercial construction, but middle summer should see many buildings completed and ready for service, and then the more popular sizes of meters will of course be in brisk demand. The larger sizes are slow because little industrial business is being connected just at the present time.

Fuses.—This line is following its usual seasonal tendency with a resultant falling off in the volume of orders. There is to be noted an increase in popularity in the refillable type, with plug fuses enjoying their usual steady demand.

Outlet Boxes.—This line is showing the stimulation to be expected from the building program, jobbers reporting a satisfactory movement in all the popular sizes. Both stocks and shipments are satisfactory, with prices steady.

High-Tension Transformers.—Several satisfactory jobs have been closed in the past two weeks, with prospects very fair for the purchase of large units within the next thirty days. Local stocks are very spotty, except in the popular sizes, with shipments at present from six to ten weeks.

ST. LOUIS

Jobbers report that business last week was marked by substantial improvement in demand, particularly from the telephone companies, power companies, railroads and, to some extent, from the industrials. Merchandise lines continue to move at a comparatively slow rate, and house-wiring materials are selling spasmodically yet with continual advancement. It is felt that the improvement being noticed is permanent in character and that further betterment can be expected.

Agricultural conditions on the whole are encouraging. The total strawberry production in the Ozark region will, according to estimates, amount to 2,715 carloads, which will be the largest crop ever harvested. Cotton is behind and has been damaged in some districts by excessive rainfall. There is an increased acreage in cotton this year, however, and it is expected that the yield will at least equal that of last year. With average conditions winter wheat will at least equal the yield of 1921, and spring wheat may do better than for several years. It is too early to make predictions regarding the corn crop, but the total acreage will be about the same as last year. Of particular interest to the farmers is the comparative stability of prices of their products, enabling them to discount their future yields better and to purchase needed supplies and equipment with greater freedom. These conditions aid materially in restoration of business morale in this territory.

With the recent changes in prices of steel, copper and other basic materials jobbers have been making corresponding adjustments in their local prices on goods. A tendency to equalize the prices on competitive lines is also noticed. Among the changes which have occurred may be mentioned a stiffening in quotations on wire, conduit, conduit boxes, locknuts and bushings and lower prices in flexible armored conductor, dry cells and friction and rubber tape. Representative prices are as follows:

Wire.—Rubber-covered, solid, single braid, in coil lots, per 1,000-ft.: No. 14, $6.50; No. 12, $10.25; No. 10, $12.90; No. 8, $17.84. No. 14 solid double-braid sells for $9.23 per 1,000-ft. in coil lots. Triple-braid, solid, weatherproof, is quoted in 500-lb. lots as follows: No. 4/0 to No. 8, inclusive, $16 per 100 lb.; No. 10, $18 per 100 lb.; No. 12, $19.50 per 100 lb.; No. 14, $21 per 100 lb.; No. 18 rubber-covered black fixture wire is priced at $3.77 per 1,000 ft. in coil lost.

Conduit.—The following prices obtain: ½-in. black, $4.56; ½-in. galvanized, $5.20; ¾-in. black, $5.77; ¾-in. galvanized, $6.61—all per hundred ft. in amounts of 100 ft. or more.

Conduit Boxes.—Net prices per 100 boxes, for orders of 100 or more, are: 3¼-in. black octagon, $9; 3¼-in. galvanized octagon, $10; 4-in. black octagon, $11; 4-in. galvanized octagon, $12.

Flexible Armored Conductor.—No. 14, two-conductor, is quoted at $60 per 1,000 ft. in lots less than 250 ft., and at $46 per 1,000 ft. in larger lots. The net price on connectors is $3.60 per 100 for 100 or more.

Tape.—Friction is selling for 35 cents to 65 cents per pound in 100-lb. lots, depending upon grade, and similarly rubber sells for 35 cents to 84 cents. The 35-cent grade in each class is commanding the bulk of the business.

Dry Cells.—Railroad demand and radio are stimulating sales, which have been good without slackening for more than a year. The regular is priced at $30.86 per 100 and the igniter at $31.86 per 100, both in barrel lots. The four-cell unit brings $1.70 each in barrel lots of 24.

SAN FRANCISCO

The past week has shown, all in all, a marked acceleration in trade and building. Industrial and business construction is steady, and the building of single dwellings and small apartment houses is increasing at a marked rate. It is significant that not for years have so many renting opportunities been offered by real-estate agents. Another feature is the remodeling of many old flats into apartment flats. Labor conditions are better than they were. And the clouds that seemed to portend another disastrous strike of the building trades seem to have blown away. Non-employment has been reduced to a minimum even among unskilled laborers, who are being set to work upon municipal housecleaning in expectation of the summer convention traffic. A campaign similar to the "Save the surface" paint movement would benefit electrical contractors if applied, say, to the renovation of old wiring. The lower labor rate is responsible, it is said, for many such small repair jobs.

Motors.—A splendid sale is reported of all sorts of motors, particularly of two-phase and three-phase, and for the first time in several years stocks are at a minimum. In fact, this spring recalls to some extent the conditions of 1920 intensified by the greater amount of power available and its wider distribution.

Radio Apparatus.—An increasing call for better and larger outfits and the entry and active participation of the larger companies feature present conditions. Better stocks are on hand, though factory shipments are still being prorated upon their receipt. Tenser competition is noted, many of the newer dealers offering considerable discounts to schools and industrials, and even to private individuals.

Household Appliances.—Clothes washers are selling better, justifying the belief that big commissions for vacuum cleaners had caused their temporary sidetracking. Far fewer makes are being sold than at this time last year, although an occasional new type appears at regular intervals. Still the backbone of the washer business is made up of long-established types. The mercantile stores show a tendency to raise the list in order to raise their solicitors' commissions. For instance, one particular cylinder type is being sold at about $160 with a commission of $25 to salesmen, whereas the market price for cylinder machines averages from $130 to $140. Vacuum cleaners in general have slackened somewhat, the bulk of the sales being made by hardware and household stores. Sewing machines are slow, ironers are moving very well and dishwashers are slower than a few weeks back.

Schedule Material.—Stocks in general are excellent and shipments are coming through well. Demand is large and well proportioned.

SALT LAKE CITY—DENVER

Denver crop forecasts for the Intermountain region are highly encouraging. There have been no serious late frosts to damage fruits and the planting is proceeding normally. Acreage for the staple crops is holding up to a good average with the exception of sugarbeets, in which there is a considerable falling off. Wool growers are getting a record price for their clips, 40 cents a pound not being an uncommon figure. This timely market will go a long way toward steadying and rehabilitating an industry that has been unusually hard hit. Recent readjustments of freight rates are very favorable, putting the jobbers in a better position to compete with Pacific Coast distributers. Labor conditions are satisfactory. Unemployment is fast disappearing, with the farms, mines and construction projects constantly absorbing men who have been idle. Interest continues to grow in radio. A company has been organized in Salt Lake City that will proceed at once to erect a factory equipped to turn out all kinds of radio apparatus.

Fans.—The fan season has not yet begun in this territory as the weather is still moderately cool. Jobbers and dealers, however, are getting ready for a good business. Stocks on hand are ample, covering a full range of types and sizes. A price reduction that amounts to nearly 20 per cent is counted on to stimulate buying.

Ranges.—It is believed that the coming summer will record a good movement of electric ranges from dealers' stocks to housewives' kitchens. "Cook electrically" propaganda is widespread and persistent. Reductions averaging from $31 to $80 are quoted by one large distributing concern. Sales to date have been satisfactory.

PORTLAND—SEATTLE

The reduction of 10 per cent in freight rates ordered by the Interstate Commerce Commission will, it is predicted, have a very stimulating effect on the industry of the Northwest. A reduction of 12½ per cent in rail tariffs affecting lumber, effective July 1, will do much to help trade with the interior. Lumber production for the week ended May 20 was 5 per cent above normal, while new business was 18 per cent and shipments were 5 per cent above production. Building continues very active throughout the Northwest.

An unprecedented movement of tourists to the Northwest is forecast by advance bookings made with the park hotels for the summer season. Railway officials say that homeseekers from the East and Middle West in considerable numbers will seek permanent homes here this summer.

Business in the electrical trade is showing gradual gains from week to week. Household appliances are moving well. The improved demand for wire is reflected in advances during the week in both bare and weatherproof prices. Rubber-covered is expected to advance in the near future. The base prices of bars and weatherproof wire are now 15½ cents and 17½ cents per pound respectively. Seattle jobbers report an increase of 5 per cent in the price of rigid conduit.

Heaters.—Stocks were very well cleaned up this year, and fans are beginning to move actively. Retail prices on fans reach from $10 for the 8-in. non-oscillating to $35 for the 16-in. oscillating type. Ranges are moving very well, particularly in Portland. The demand for washers, ironers and vacuum cleaners is only fair, the prices remain unchanged, washers selling at about $140, ironers, manual type, at $170, automatic type at $185, and vacuum cleaners at $45.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

General Electric Moves Controller Department

The General Electric Company, Schenectady, N. Y., is removing its controller manufacturing department to its Erie (Pa.) works and will concentrate production in this line there. A working force of about 150 men will be employed, and this quota will be increased at an early date. The Banner Electric Division of the National Lamp Works of the company will build an addition to its plant at Youngstown, Ohio, to cost about $75,000.

Chicago Engineer Moves to New Location

C. A. Chapman, Inc., is now established at the Madison Terminal Building, 9 South Clinton Street, Chicago, having recently moved from 28 East Jackson Boulevard. The changeover will afford this engineering company an increase in floor space of approximately 25 per cent.

Roller-Smith Company Moves Chicago Office

The Roller-Smith Company, formerly at 739-40 Monadnock Block, Chicago, has moved its office to 430 South Green Street. Mortimer Frankel, Western sales manager, says that while no changes have been made in the personnel of the office it will be conducted as an agency rather than a branch office. Improvement in business due to the radio demands has been noted by the company.

Fixtures Better Last Year's Sales, Says Manufacturer

The fixture business has made larger sales during the first four months of 1922 than during the same period of 1921, according to Robert Biddle, president of the National Council Lighting Fixture Manufacturers and president Biddle-Gaumer Company, Philadelphia.

"As president of the National Council Lighting Fixture Manufacturers," he said, "I have received reports for the past few months from different sections, these reports showing particularly a better business trend in the West. The improvement in the West is due to fewer labor disturbances.

"I understand that business in Los Angeles is much better than elsewhere for lighting fixtures. In Philadelphia the sale of lighting fixtures is holding its own at present, but the demand is for a cheaper quality owing to the fact that much building of small houses is under way. With the increased building in Philadelphia and with the considerable number of permits being taken out each month, we expect a good volume of sales when the houses at present under construction are completed and the residential building that is going on in the suburbs is finished. Better grade of fixtures well then be in greater demand.

"Prices of electrical goods are firmer, with a possible slight increase in the fall. Considering these various conditions, an optimistic opinion can be taken of the present and future business outlook."

Blumenthal-Kahn to Build New Plant Soon

The Blumenthal-Kahn Electric Company, 505 North Eutaw Street, Baltimore, has acquired property at 527-29 North Howard Street, comprising a four-story and two-story building, for a consideration of about $100,000. The structures are now occupied under leases, and as soon as these expire the buildings will be razed and a new five-story plant erected for exclusive use of the company.

Radio Manufacturer Merges with Phonograph Maker

The Air-o-phone Corporation, 122 Fifth Avenue, New York, manufacturer of radio apparatus, has completed an amalgamation with the National Phonograph Company of Canton, Pa. Under the new arrangement "Air-o-phones" will be manufactured and assembled at the plant of the National Phonograph Company at Canton. A move of this character was necessary, it is stated, owing to the large demand for radio equipment. Increased manufacturing facilities were needed quickly, and the new arrangement will permit the manufacture of sufficient apparatus to take care of the present demand. The estimated production will be in the neighborhood of 300 machines weekly.

Lewis T. McFadden, president of the National Phonograph Company, was elected vice-president of the Air-o-phone Corporation.

Specialty Maker Speeds Up Production

The Connecticut Telephone & Electric Company, Britannia Street, Meriden, Conn., has increased production at its plant to about 75 per cent of normal. The bulk of production is devoted to electrical specialties for automotive service.

Westinghouse Agent-Jobbers in Session at Hot Springs

The thirty-four agent-jobbers of the Westinghouse Electric & Manufacturing Company and their guests were in session this week at the tenth annual convention of the Westinghouse Agent-Jobbers' Association. The meetings extended from Monday until Friday, with Monday set apart as guest day with open sessions. H. A. Lewis, business manager *Electrical Merchandising*, made an interesting address on "Capitalizing the Dealer," in which he pointed out the vital need for interesting local capital in the development of the electrical business in each community. The automobile business, he said, was financed in each town through the fact that the local "J. P. Morgan" purchased a car, became interested and invested money in the first garage, supply house and agency. The same fount of capital may be tapped by the electrical industry.

F. F. Watts, editor *Electrical Record*, talked on promoting the greater use of electricity and painted a graphic picture of the opportunity that lies ahead. William L. Goodwin, assistant to the president of the Society for Electrical Development, told the story of the evolution of that organization and its present scope and purpose. John J. Jackson, counsel for the Agent-Jobbers' Association; T. E. Berger, secretary Society for Electrical Development, and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD, also spoke.

The evening session was devoted to the subject of radio, with addresses by M. C. Pykinski, Westinghouse Electric & Manufacturing Company, and David Saranoff, general manager Radio Corporation of America.

Associated Engineers Establishes Survey Service

The Associated Engineers, Incorporated, 86 Michigan Street, Milwaukee, have announced the establishment of a quantity survey service which will be supplied to engineers and architects who desire this data as part of their plans and specifications.

Instrument Company Enters Radio Field

The Bristol Company, Bristol, Conn., for many years a producer of electrical and other recording instruments, has announced its entrance into the radio apparatus manufacturing field.

The company now is in production on a loud-speaker horn, which is sold under the trade name "Audiophone." For the last six years the company has been carrying on research work for the purpose of developing a loud speaker for use with the Bristol talking moving pictures soon to be placed on the market. The adaptation of this loud speaker to radio work was decided on recently.

New Huntington Headquarters for Westinghouse

The Westinghouse Electric & Manufacturing Company has recently erected and is now occupying the Westinghouse Electric Building, at Second Avenue and Ninth Street, Huntington, W. Va. In the new building the activities of the sales, service and warehouse departments have been co-ordinated, and this, with the furnishing of more adequate facilities, is expected to result in better service to customers.

The building is a three-story structure containing 30,000 sq.ft. of floor space. Convenient railroad sidings permit the direct handling of inbound and outbound freight, and the adequate floor space allows for the stocking of large apparatus and sufficient quantities of the smaller apparatus to meet the immediate demands of customers.

The service department is fitted to repair all classes of electrical apparatus. The department maintains close contact with the engineering department at the Westinghouse East Pittsburgh Works and as a result engineering advice is immediately available. Arrangements have been made to furnish steam and electrical engineers to install, inspect and repair equipment in the field.

The Westinghouse company plans to maintain its offices at Bluefield and Charleston, W. Va., in addition to the added facilities of the Huntington branch.

National X-Ray Company Acquires Winslow Library

Owing to the retirement from the commercial world of the Winslow Brothers Company, well known for its skill in the creation of ornamental bronze and iron work, the National X-Ray Reflector Company, Chicago, it is announced, has been enabled to obtain the famous Winslow Library of designs to add to the equipment of its designing staff. The library consists of 189 volumes gathered by the senior member of the Winslow Brothers Company and represents long years of research in all parts of the world. The collection is said to be one of the most complete of its kind in existence. It is to be used by the National organization as an aid in properly interpreting the true spirit of any architectural treatment in the design of lighting fixtures.

A New Manufacturer of Loud Speakers

The Radio Telephone Company, 160 North Wells Street, Chicago, has recently been incorporated with a capital stock of $15,000. This company controls five patents on loud speakers and is manufacturing the "Electra-Voice" loud speaker for radio, musical and vocal reproduction, patented radio apparatus and flasher tubes. P. S. Bear, the general manager, while speaking with a representative of the Electrical World, said that he expected to lease a plant in the near future but that at present no definite plans had been laid. He also reported a steady demand for radio equipment, particularly the loud speaker. The officers of the company are: William G. Keith, president; P. S. Bear, general manager; B. E. Cover, secretary; E. G. Hall, treasurer.

Electric Fusion Corporation Reorganizes and Expands

The reorganization of the American Electric Fusion Corporation, Chicago, and its plans for immediate expansion have been announced. The capital stock of the company has been increased from $30,000 to $40,000 and larger quarters have been attained, consisting of 8,000 sq.ft. of floor space at 972 Montana Street. This gives the company six times its previous space, and its production is being increased proportionately. In addition to this the company has purchased the complete equipment of the Picturola Corporation. The company's business has increased 300 to 400 per cent within the last twelve months, and the added production is necessary to catch up with the bookings. Production consists of welding machines, and in the near future three new types, including a small spot welder and a seam welder, are to be added to the line.

In the reorganization E. J. Henke has been re-elected president, A. B. Sonneborn has been made vice-president and G. F. Strand secretary and treasurer. Mr. Strand was formerly president of G. F. Strand & Company, Chicago, pattern maker and machinist, and joined the forces of the American Electric Fusion Corporation recently after his plant had been destroyed by fire. He will have charge of manufacturing.

Electric Refrigerator Company Finds Expansion Necessary

The Icenomor Electric Refrigerator Company, Evansville, Ind., has experienced so great a demand for its product this spring, according to E. D. Pellegrin, president, that removal to larger quarters has been necessitated. The company has procured the factory formerly occupied by the Shimer Steel & Wire Company, Evansville, and has started production there. The new plant consists of a main building, 50 ft. x 210 ft., situated on the river front and having also a private railroad spur for both the receiving and shipping departments, giving good facilities for shipping both by rail and water. There are also included in the plant a private power plant and several office buildings.

Mr. Pellegrin stated to the Electrical World that the company is now producing about 100 household refrigerating units a month and is booking orders so fast that a material increase in production is planned. A. B. Owen is vice-president and superintendent; F. R. Cook is treasurer and sales manager, and F. W. Rank is secretary and assistant treasurer.

The Betts & Betts Corporation, electrical manufacturer, 511 West Forty-second Street, New York, has appointed W. Ross Hilton as its sales representative in Quebec, Ontario, New Brunswick and Nova Scotia territory, with headquarters in Montreal. The company also has arranged to have its Minnesota, North and South Dakota territory covered by the Spector Company, St. Paul.

The John L. Taylor Company, dealer in power and other machinery, has removed from the Bulletin Building to 211 North Third Street, Philadelphia.

The P. A. Geier Company, Cleveland, vacuum-cleaner manufacturer, reports a successful exhibit of its product at the recent electrical exposition in Geneva, Switzerland. Modern cleaning processes, it is estimated, were viewed by more than 30,000 visitors.

The Garde Company, manufacturer of electrical goods, Hartford, Conn., has filed a certificate with the Secretary of the State of Connecticut to increase the capital stock of the company from $10,000 to $50,000.

The American Supply Company, 135 Washington Street, Providence, R. I., has been appointed agent for the Providence district to represent the Quigley Furnace Specialties Company, New York, manufacturer of "Hytempite." The Quigley products are warehoused in Providence for quick delivery to local points.

The Delco-Light Company, Ltd., of Canada, has been organized by the American company to manufacture and sell the "Delco-Light" products in Canada. R. H. Myers will be in charge of the plant at Oshawa, Oont.

A. H. Grebe & Company, manufacturers of radio sets and parts, Jamaica, N. Y., are building a three-story addition to their plant. It is 80 ft. x 100 ft. and is expected to cost about $100,000.

Shepherd & Hovey, consulting engineers, 53 West Jackson Boulevard, Chicago, have succeeded C. H. Shepherd, who had an office at the same address. The members of the firm are S. S. Hovey and C. H. Shepherd.

The Electric Hoist & Derrick Company is represented at Hog Island, Pa., by Frank M. Gorsuch and Benjamin Samler, instead of by W. H. Price, Jr., as stated on page 982 of the May 13 issue of the Electrical World.

The Bristol Company, manufacturer of recording instruments. Waterbury, Conn., has opened a branch office in Philadelphia at 1311 Widener Building. C. C. Eagle, Jr., is in charge.

The Electrical Engineering & Manufacturing Company, Pittsburgh, has established a branch office in Cleveland. J. P. Hutcheson is branch manager, with headquarters in the Union Building.

The Locke Insulator Company, Victor, N. Y., will commence immediately to erect a one-story addition to its Baltimore plant at Charles and Cromwell Streets, to cost about $35,000.

Foreign Trade Notes

PROPOSED WIRELESS SERVICE BETWEEN SWEDEN AND THE UNITED STATES.—In 1920 the Swedish government, *Commerce Reports* states, appropriated 2,000,000 crowns for the establishment of wireless-telegraph communication between Sweden and the United States. Negotiations were entered into with an American company, but up to March, 1921, no agreement had been reached. On that account and the general business depression the matter was not presented to the 1921 Riksdag. The question has now been brought before the government again in a note from the Telegraph Administration, with the intention of requesting permission to use the 2,000,000 crowns previously appropriated in order to proceed with the project.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Canada (No. 2,212) wishes to secure the representation of firms for the sale of electrical goods of all kinds.

A merchant in Austria (2,214) desires to secure the representation of firms for the sale of electrotechnical material, iron and steel products.

A manufacturer in Mexico (No. 2,215) wishes to purchase an electric water-purifying plant, with a capacity of 12,000 one-half-pint bottles daily, for use in soft-drink factory.

The purchase of electrical supplies, hardware, etc., is desired by an importer in Spain (No. 2,221.)

An agency is desired by a firm in South Australia (2,260) for the sale of electrically operated machinery, self-contained lighting outfits and miscellaneous electrical equipment, etc.

A commercial agent in South Africa (No. 2,283), covering the Transvaal, wishes to secure representation of manufacturers of a moderate-price belting for the market on the Rand, direct-coupled, direct-current motor and centrifugal pumping sets, with a capacity of 500 gallons in twenty-four hours, and agricultural implements suitable for South Africa.

HYDRO-ELECTRIC PLANT FOR CATAMARCA, ARGENTINA.—Tenders will be received by the Argentine Board of Sanitary Works until June 28, according to the *Electrician*, for construction and equipment of a hydro-electric plant and substation for the town of Catamarca, Province of Catamarca.

CABLE AND ACCESSORIES FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by R. Liddelow, secretary State Electricity Commission of Victoria, Melbourne, Australia, until June 17 for aluminum steel-cored cable and accessories (Specification No. 243.) Copies of tender form and specifications will be available upon application to the offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, First National Bank Building, Chicago, and 734 Custom House, New York City. The specification may be inspected at the above offices and also at the office of the Commissioner for Australia in the United States, Room 3,012, 61 Broadway, New York City.

EQUIPMENT POWER STATION AND WATER WORKS FOR BUENOS AIRES, ARGENTINA.—Tenders are being asked, the *Electrician* states, for equipment for three pumping stations, one power station and eight transforming substations for the Buenos Aires waterworks.

New Apparatus and Publications

STORAGE BATTERIES.—The General Lead Batteries Company, Chapel Street, and Lister Avenue, Newark, N. J., manufacturer of the "Titan" storage batteries, is distributing bulletin No. 34, entitled "Manifestations of Proper and Improper Battery Operation," in which its gives instructions regarding the care and use of storage batteries.

ELECTRIC MOTOR DRIVE AND CONTROL.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, is distributing bulletin No 48,717, describing and illustrating the "Sprague" electric motor drive and control system for newspaper presses.

CIRCUIT BREAKERS.—The Cutter Company, Philadelphia, has issued a sixteen-page booklet covering its various remote-control circuits of both motor-driven and magnetically operated types, together with other apparatus especially adapted to central-station requirements.

GRAPHIC INSTRUMENTS.—"Getting Business with Graphics" is the title of bulletin 422 issued by the Esterline-Angus Company, Indianapolis, Ind. In this publication it calls attention to the possibilities of the use of graphic records in the sale of technical products.

PUMPS.—Bulletin 248 issued by the Dayton-Dowd Company, Quincy, Ill., describes and illustrates its type "CSU" multi-stage automatically balanced centrifugal pumps.

TRANSFORMER.—The Wappler Electric Company, Inc., 162 Harris Avenue, Long Island City, N. Y., has developed a transformer for control of high-voltage current and is designed particularly for X-ray and other inside work.

LIGHTING CODE.—The Westinghouse Lamp Company, 165 Broadway, New York City, has issued Bulletin E-103, which describes the lighting code for factories and mills as prepared by the Illuminating Engineering Society.

BRUSH MOUNTINGS.—The Rochester Electric Products Corporation, Rochester, has issued the first of a series of "Little Motor Talks," which takes up the matter of brush mountings. Other features of motor designs will be taken up in other issues from time to time.

RENEWABLE FUSE.—The Bussmann Manufacturing Company, 3819-25 North Twenty-third Street, St. Louis, is distributing an eight-page booklet describing the new knife-blade type "Buss" renewable fuse.

STRUCTURAL SLATE.—The Structural Slate Company, Pen Argyl, Pa., is distributing a booklet, entitled "Slate for Electrical Uses," which contains valuable research data and the results of a series of exhaustive tests made by Lehigh University on the electrical properties of slate.

New Companies

THE ASCUTNEYVILLE (VT.) ELECTRIC LIGHT CORPORATION has been incorporated by Seth N. Gage, C. H. Martin, A. L. Divoll, A. G. Hitchcock and George Fitch, all of Ascutneyville. The company is capitalized at $2,000 and proposes to furnish electricity in Ascutneyville and vicinity.

THE KENTUCKY-TENNESSEE FARM LIGHT & POWER COMPANY, Clarksville, Tenn., has been chartered with a capital stock of $1,000 by R. W. Harrison, J. H. Tate, J. B. Williams and others.

THE UTILITIES POWER COMPANY, Meredith, N. H., has been incorporated with a capital stock of $700,000 to construct a hydro-electric plant on the Pemigewasset River. The officers are: Herbert B. Rust, president; Bertram Blaisdell, treasurer, and Frank R. Prescott, clerk, all of Meredith.

THE STAUNTON POWER COMPANY, Boydton, Va., has been incorporated with a capital stock of $50,000 to supply electricity for lamps and motors in Halifax, Charlotte, Campbell, Lunenburg and other towns. D. F. Clark is president and E. L. Baptist secretary.

THE SOUTHAMPTON LIGHT & POWER COMPANY, Richmond, Va., has been incorporated with a capital stock of $5,000 to distribute electricity in Henrico and Chesterfield Counties. The officers are John H. Guy, Richmond, president, and D. W. Barrett, secretary.

THE AMASA (MICH.) LIGHTING COMPANY has been incorporated with a capital stock of $30,000 by Maurice E. Richards, Lewis T. Sterling and F. J. Engblom, all Iron Mountain, to furnish electricity in Amasa.

THE CLIFFS ELECTRIC COMPANY, Ishpeming, Mich., has been incorporated by M. M. Duncan, O. D. McClure and J. I. Keeton, all of Ishpeming. The company is capitalized at $10,000 and proposes to distribute electricity for lamps and motors in and around Ishpeming.

THE KENWOOD (OKLA.) WATER & LIGHT COMPANY has been chartered with a capital stock of $25,000 by J. W. Hoffman, Kansas City, Mo.; Arthur Day, St. Louis, and E. H. Brady, Muskogee, Okla.

Record of Electrical Patents

Notes on United States Patents

(Issued May 9, 1922)

1,415,186. Process of Eliminating Color from Caustic Alkali; Thomas C. Meadows and Herman D. Ruhm, New York, N. Y. App. filed Jan. 25, 1919. By electric current.

1,415,220. Electrical Condenser; Henry F. Causebrook, Greenfield, Mass. App. filed June 18, 1921. Tinfoil and paper type.

1,415,240. Resistance Unit; Lee P. Hynes, Albany, N. Y. App. filed July 13, 1921. Metallic ends adapted to be placed in spring clips.

1,415,256. Chime-Striking Action; Leonard D. Morris, Chicago, Ill. App. filed Aug. 7, 1919. Operated by magnets.

1,415,275. Storage Battery; Norman D. Sturges, Bellerose, N. Y. App. filed Jan. 5, 1921. For preventing disintegration of plates.

1,415,284. Regenerative Motor-Control System; Samuel T. Webster, St. Louis, Mo. App. filed Jan. 6, 1919.

1,415,309. Electric System; Frank A. Byles, Schenectady, N. Y. App. filed June 12, 1919. Farm-lighting generator set.

1,415,321. Electrical Apparatus; Eugene D. Eby, Pittsfield, Mass. App. filed Oct. 23, 1919. Bushing arrangement on high-tension oil-submerged apparatus.

1,415,382 Amplifier; Joseph W. Milnor, New York, N. Y. App. filed Jan. 17, 1918. For amplifying submarine telegraphic signals.

1,415,385. Generating Plant; Earl P. Oswald, Detroit, Mich. App. filed Oct. 24, 1918. Storage-battery reserve.

1,415,430. Electric Motor for Talking Machines; William W. Dean, Newark, N. J. App. filed July 17, 1918. Motor geared direct to table shaft.

1,415,446. Apparatus for Making Aluminum Nitride and Other Chemical Substances; William Hoopes, Pittsburgh, Pa. App. filed Sept. 19, 1919.

1,415,456. Electric Cooking or Heating Vessel; Clarence H. Lauth, London, England. App. filed Dec. 16, 1919. Shell of vessel used as element.

1,415,457. Electrically Heated Liquid Heater; Clarence H. Lauth, London, England. App. filed June 16, 1920. Low-voltage high current directly through containers.

1,415,466. Electrolyzer; Rudolphe Pechkranz, Carouge-Geneva, Switzerland. App. filed June 1, 1920. Of the open-tank type.

1,415,479. Electrically Heated Fusing Implement; Edwin W. Putnam, Hartford, Conn. App. filed Oct. 28, 1921. Melts wax for sealing envelopes.

1,415,499. Recorder; James N. Tuttle, Boston, Mass. App. filed Oct. 13, 1919. Heated stylus for curve-drawing instrument.

1,415,505. Current Transformers; Donald J. Angus, Indianapolis, Ind. App. filed June 28, 1920. Hole through core for additional primary turns.

1,415,521. Motor-Starting Device; George A. Burnham, Saugus, Mass. App. filed Aug. 2, 1918. Switch arrangement for auto-transformer.

1,415,524. Method of Mending Electric Resistance Elements; Noel Carrico, Sidney, Mont. App. filed Jan. 22, 1921.

1,415,528. Recording Instrument; James R. Craighead, Schenectady, N. Y. App. filed Oct. 17, 1919. For measuring short-circuit currents.

1,415,531. Engine-Starting Apparatus; James K. Delano, New York, N. Y. App. filed Sept. 28, 1918. For airplane and truck engines.

1,415,534. Variable Resistance; Harold P. Doole, Meriden, Conn. App. filed Dec. 15, 1921. For radio panels.

1,415,539 Method and Apparatus for Submarine Signaling; Reginald A. Fessenden, Brookline, Mass. App. filed July 20, 1917. For signaling and detecting submarines.

1,415,541. Battery; Oliver P. Fritchle, Denver, Col. App. filed April 2, 1920. Method of attaching cover.

1,415,550. Electric Heating Apparatus; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 31, 1915. For industrial use.

1,415,564. Mechanical Construction of Electrical Motors; John J. Holahan, Norfolk, Va. App. Nov. 2, 1920. Rotor readily taken out.

1,415,565. Arc-Current Regulator; Joseph A. Holifield, Mobile, Ala. App. filed Nov. 20, 1919. For regulating arc-welding apparatus.

1,415,577. Adapted for Motor-Brush Shunts; David R. Knapp, Pottsville, Pa. App. filed Oct. 12, 1920.

1,415,588. Jig for Use in Electrically Welding the Parts of Automobile Bodies and Other Structures; Joseph Ledwinka, Philadelphia, Pa. App. filed July 1, 1919.

1,415,644. Winding Mechanism; Andrew J. Holmes, Tacoma, Wash. App. filed Jan. 25, 1921. For winding coils on cores integrally connected.

1,415,648. Selector Switch; Carl A. W. Hultman, Stockholm, Sweden. App. filed Dec. 23, 1918. For automatic telephone exchange.

1,415,660. Electric Heater; Richard G. Ledig, Philadelphia, Pa. App. filed Aug. 27, 1921. For heating or melting liquid or solid materials.

1,415,683. Process of Treating Separators for Storage Batteries; Horace W. Nordyke, Indianapolis, Ind. App. filed April 26, 1921. To reduce natural content of acetic acid.

1,415,723. Bipolar Magnetic Chuck; Frank L. Simmons, Woonsocket, R. I. App. filed Sept. 11, 1917.

1,415,748. Electrical Resistor; Ezechiel Weintraub, New York, N. Y. App. filed April 30, 1920. Possesses negative resistance characteristics.

1,415,770. Electric Radiator; Herbert H. Berry, London, England. App. filed May 3, 1921. Imitation coal fire.

1,415,774. Electrode for Electric Arc Welding and Metal-Cutting Purposes; William H. Boorne, London, England. App. filed March 28, 1921. Electrode coating forms a flux.

1,415,779. Electrostatic Generator; William S. Bowen, New York, N. Y. App. filed March 30, 1920. Pulsating current generator using an electrostatic field.

1,415,804. Storage Battery and Method of Making It; Walter H. Crissey, Reading, Pa. App. filed May 12, 1921. Hard-rubber rings around every other plate for separators.

1,415,807. Sound-Reproducing Device; Patrick B. Delany, South Orange, N. J. App. filed Feb. 1, 1918. Electrically reproducing sounds produced by phonograph.

1,415,832. Battery; Frank Garaca, Cleveland, Ohio. App. filed Oct. 15, 1918. Generates current when heated.

1,415,845. Selectively Opposing Impedance to Received Electrical Oscillations; Michael I. Pupin, Norfolk, Conn. App. filed Feb. 10, 1916. Applies to wireless telegraphy.

1,415,848. Tube-Welding Machine; John W. White, Detroit, Mich. App. filed Aug. 25, 1920. For the manufacture of tubes.

(Issued May 16, 1922)

1,415,853. Telephone Exchange System; Wallace P. Andrick, Hohokus, N. J. App. filed Oct. 25, 1920. Common telephone circuit for offices.

1,415,860. Depolarizer for Primary Batteries; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Aug. 22, 1918. Cuprous oxide mixed with sulphur.

1,415,868. Transmission Equalization Arrangement; Leo H. Darrow, New York, N. Y. App. filed Oct. 2, 1919. For telephone system.

1,415,875. Armature Winding; Alfred W. Houchin, Kirkwood, N. J. App. filed April 30, 1917. Split-core type.

1,415,907. Means for Equalizing Transmission Over Lines of Different Electrical Characteristics; George K. Thompson, Maplewood, N. J. App. filed Oct. 29, 1918. Telephone system.

1,415,971. Motor-Control System; John H. Albrecht, Pittsburgh, Pa. App. filed April 5, 1916. Automatic control of field excitation.

1,415,972. Electrical Switching Device; Roy M. Allen, Bloomfield, N. J. App. filed Aug. 13, 1920. Snap switch.

1,415,987. Trolley-Wheel Mount; George O. Burwell, Detroit, Mich. App. filed Sept. 29, 1921. Springs bear on axle for better contact.

1,415,989. Three-Phase Crucible Furnace; C. H. Carpenter, Irwin, Pa. App. filed May 22, 1920. Electric resistance type.

1,415,992. Receiving Station; Lewis M. Clement, Newark, N. J. App. filed March 22, 1918. Radio-tube circuits.

1,415,993. Electric Heating Device; Ora A. Colby, Irwin, Pa. App. filed Aug. 30, 1920. Heating bars by passing current through them.

1,415,999. Static Reducer for Wireless Signals; Austen M. Curtis, Brooklyn, N. Y. App. filed Nov. 1, 1916. Crystal detector used with tubes.

1,416,007. Electric Arc Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Oct. 6, 1919.

1,416,009. Control System for Electric Ranges; Frank F. Forshee, Flint, Mich. App. filed March 1, 1920.

1,416,024. System of Control; Rudolf E. Hellmind, Swissvale, Pa. App. filed June 18, 1919. Pilot-motor-operated controller.

1,416,025. Heating Apparatus; Joseph I. Herbert, Chicago, Ill. App. filed July 29, 1920. Electrically heated radiators.

1,416,026. System of Control; Lloyd J. Hibberd, Wilkinsburg, Pa. App. filed May 14, 1920. Resistor for accelerating polyphase motors.

1,416,045. Electric Current Collecting Device; Samuel S. Mathhes, Mansfield, Ohio. App. filed Oct. 17, 1921. For two-wire trackless trolley.

1,416,047. Control Apparatus; Harry R. Meyer, Wilkinsburg, Pa. App. filed June 9, 1920. Cell-type resistor for railway motors.

Construction News

Projects, Plans, Bids and Contracts; Contemplated or Under Way

New England States

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company has issued $650,000 in bonds, part of the proceeds to be used for extensions and improvements.

WORCESTER, MASS.—One of the generators at the Webster plant of the Worcester Electric Light Company was recently damaged, causing a loss of about $20,000.

SHANNOCK, R. I.—The Columnia Narrow Fabric Company plans to erect a power house at its proposed new plant. Lockwood, Greene & Company, 60 Federal Street, Boston, are engineers.

FARMINGTON, CONN.—The Union Electric Light & Power Company has issued $100,000 in capital stock, the proceeds to be used for the installation of a new unit at its hydro-electric power plant and for other extensions and improvements.

WEST HARTFORD, CONN.—The construction of a new power house at the municipal filtration plant is under consideration.

Middle Atlantic States

AKRON, N. Y.—The Public Service Commission has granted the Genesee Light & Power Company, Batavia, permission to operate a high-tension transmission line in Akron. Electricity will not be distributed within the village limits, but service will be furnished in Newstead Township.

BINGHAMTON, N. Y.—Plans are being prepared by the Board of Supervisors of Broome County for the installation of electric lamps on the principal highways, to cost about $25,000.

BUFFALO, N. Y.—Bids will be received by John H. Meahl, Commissioner of Parks and Public Buildings, until June 12, for the erection of a power plant at the J. N. Adams Memorial Hospital, at Perrysburg, including power-house equipment, tunnels, conduit, etc.

BUFFALO, N. Y.—The Commissioner of Parks has authorized plans for the installation of ornamental lamps in Delaware Park and on the Bidwell, Jewett, Lincoln, Scajaquada and West Humboldt Parkways. The standards will be purchased by the city and service furnished by the Buffalo General Electric Company. The cost is estimated at from $35,000 to $50,000.

MASPETH, N. Y.—The New York & Queens Electric Light & Power Company, Long Island City, will build a substation, in Maspeth, to cost about $50,000.

WEST WINFIELD, N. Y.—The property of the West Winfield Electric Company has been purchased by the Madison Power Company, Utica. Electricity to operate the local system will be secured from Utica, and a twenty-four-hour service, it is expected, will be established.

PATERSON, N. J.—The Paterson & Passaic Gas & Electric Company has received permission from the Board of Public Utility Commissioners to issue $50,000 in bonds for extensions and improvements.

LYNN, PA.—The Lynn Light & Power Company will install a distributing system at Wanamakers.

PETERSBURG, PA.—The Warrior Ridge Power Company contemplate the erection of a transmission line from Petersburg to Mooresville, with a distributing system in the Shavers Creek Valley district, Mooresville and vicinity.

PHILADELPHIA, PA.—The McCahan Sugar Refining Company will build a power house at its plant at Tasker Street and Delaware Avenue, to cost about $45,000.

POTTSVILLE, PA.—The Eastern Pennsylvania Light, Heat & Power Company has acquired a site at Pinegrove, for a new generating plant to cost about $2,000,000. When completed power plant in Pottsville will be held for reserve service. New transmission lines will be built.

TOPTON, PA.—The Topton Electric Light & Power Company will extend its transmission line from Longswamp to Shamrock.

WOODBURY, PA.—The Woodbury Township, Taylor Township and Bloomfield Township Power Companies, recently organized by C. A. McClure and F. W. Woodcock, are planning to install distributing systems in the different districts. A main transmission line will be built. The companies are represented by James J. Collins, Bullitt Building, Philadelphia.

WILMINGTON, DEL.—The Wilmington Sugar Refining Company, Christiana Avenue and B Street, will build a power house at its new local refinery, in course of erection. W. J. Wayte, Inc., 125 East Forty-sixth Street, New York, is engineer.

BALTIMORE, MD.—Extensions and improvements are contemplated to the municipal power plant at Bay View, to cost about $40,000. C. L. Reeder, 916 North Charles Street, is consulting engineer.

BALTIMORE, MD.—Bids will be received by the Board of Awards, office of the City Register, City Hall, until June 7, for incandescent lamps for the various municipal departments. J. Reese Pitcher is city purchasing agent.

BALTIMORE, MD.—The Baltimore & Ohio Railroad Company contemplates the construction of two hydro-electric power plants, one on the North Branch of the Potomac River, near Bloomington, and the other on the Cheat River, near Rowlesburg, W. Va., in connection with the proposed electrification of its Cumberland division, for which surveys are being made.

BUCKHANNON, W. VA.—The Peck's Run Coal Company is considering plans for the rebuilding of its power plant recently destroyed by fire, causing a loss of about $27,000.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, District Building, until June 5 for construction of power house at the Gallinger Hospital, including equipment and radial brick stack.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 13, for twenty centrifugal separators, electrical and mechanical spare parts, including motors and control panels for battleships (Schedule 9667).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 13, for alternating-current generators in lots of 15, 30 and 50, for Anacostia, D. C., and Philadelphia, Pa. (Schedule 9672).

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Engineer, United States Army, Munitions Building, until June 8, for motor-generators in lots of 1, 100, 110, 120 and 150; motor-generator equipments in lots of 10, 20, 30 and 50, and dynamotors in lots of 35, 40, 45 and 60. (Circular PR 11,000—1CP.) Also until June 10, for five alternating-current induction motors, 10 hp., and five starting compensators for same. (Circular PR 11,507—1 CP.)

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, United States Army, Munitions Building, until June 12, for a quantity of radio and telephone supplies (Circular PR 11,000—3 ACP). Also for telephone switchboard apparatus (Circular PR 10,903 - 1CP). Also, until June 12, for 1,000 common-battery telephone (Circular PR 11,487 —1 CP).

North Central States

ANN ARBOR, MICH.—The trustees of the University of Michigan have awarded a general contract to H. G. Christman, Stephens Building, Detroit, for a four-story and basement building, 190 ft. x 235 ft., to be equipped as engineering and mechanical shops and laboratories, to cost, with equipment, about $750,000. Shirley Smith is secretary.

DETROIT, MICH.—The Detroit Edison Company is completing plans for a one-story addition to its service building at Second Street and Elizabeth Avenue. Plans are also under way for improvements in the power house at Ypsilanti to cost about $27,000.

GRAND RAPIDS, MICH.—The American Seating Company contemplates the construction of a 2,000-hp. power plant and a four-story warehouse 400 ft. long.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until June 9 for series multiple transformers and for constant-current regulating transformers.

GRANDVIEW, OHIO.—The Council has approved plans for a new street-lighting system. Walter H. Whissen is clerk.

HAMILTON, OHIO.—The Froelich & Emery Engineering Company, Second National Bank Building, Toledo, has submitted a report to the City Council recommending the construction of a new municipal electric light plant, to cost about $687,288, and improvements to the electric lighting distribution service, to cost about $105,770. Improvements in the waterworks plant, to cost $159,810, were also recommended.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company has issued $300,000 in capital stock, part of the proceeds to be used for extensions and improvements.

OWENSBORO, KY.—The Field Packing Company will build a new power house in connection with its proposed cold-storage plant.

INDIANAPOLIS, IND.—The Interstate Public Service Company has been granted permission by the Public Service Commission to issue $372,000, in capital stock, part of the proceeds to be used for extensions and improvements.

INDIANAPOLIS, IND.—The Indiana Refrigerating Company, 232 South Pennsylvania Street, is planning to rebuild a portion of its power department and refrigerating building recently destroyed by fire, causing a loss of about $80,000, including machinery.

SOUTH BEND, IND.—The Indiana-Michigan Electric Company will build a one-story-and-basement addition to its local power plant, 50 ft. x 50 ft.

CHICAGO, ILL.—The Chicago, Burlington & Quincy Railroad Company, 547 West Jackson Boulevard, Chicago, is considering the construction of power plants at Alliance and McCook, Neb., each 48 ft. x 60 ft.

CHICAGO, ILL.—Plans are being prepared by the Commonwealth Edison Company for two new substations, one to be located at 750 West Adams Street, 50 ft. x 190 ft., and the other at 4712 Prairie Avenue, 35 ft. x 75 ft.

SPRINGFIELD, ILL.—The Commonwealth Power Corporation, recently organized to operate electric properties in Michigan, Ohio, Indiana and Illinois, has arranged for a bond issue of $12,500,000, part of the proceeds to be used for extensions and improvements.

BIG FALLS, WIS.—The Lake Superior District Power Company has issued $1,345,000 in bonds, part of the proceeds to be used for extensions and betterments, including the completion of its local hydro-electric power plant, with an initial capacity of 8,000 hp., which will be increased later to 12,000 hp. The project includes an 88,000-volt transmission line. L. E. Myers is president.

MANITOWOC, WIS.—Bids will be received by the Board of Education until June 15 for the proposed new central high school building, with a separate heating and power plant, including vocational training shops.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company, Boone, Iowa, contemplates the construction of hydro-electric plant and dams on the Des Moines River.

OTTUMWA, IOWA.—Plans are under way for the installation of an ornamental lighting system in the business district. M. A. Sheehan is clerk.

SHENANDOAH, IOWA.—The Continental Gas & Electric Corporation has issued $1,500,000, in bonds, part of the proceeds to be used for extensions and improvements.

JEFFERSON CITY, MO.—The Jefferson City Light, Heat & Power Company will take bids at once for extensions to its power plant, to cost about $45,000.

LEOTI, KAN.—Bonds to the amount of $24,000 has been voted for a municipal electric light plant.

Southern States

GREENSBORO, N. C.—Bids will be received by the City Council until June 8 for the construction of a dam across Reedy Fork Creek to develop an impounding reservoir and for the installation of an auxiliary power plant. The equipment will include a pumping unit, consisting of a 3,500-gal.-per-minute centrifugal pump to operate under a 156-ft. head, connected to twin horizontal turbines operating under 12-ft. to 14-ft. head. P. C. Painter is city manager.

JACKSON, N. C.—The Council of Jackson has awarded a contract to George A. Sanderford, Franklin, Va., for the construction of a municipal lighting system, including power house, distribution and street-lighting system. Henry B. Reardon, Norfolk, Va., is consulting engineer.

HOMESTEAD, FLA.—Extensions and improvements are contemplated to the municipal electric plant, to cost about $50,000.

LAKELAND, FLA.—The Non-Acid Fertilizer & Chemical Company will build a power plant in connection with its proposed new local factory. H. E. Memminger is engineer and general manager.

MOBILE, ALA.—The Mengel Company, Louisville, manufacturer of boxes, etc., is considering establishing a new plant in the vicinity of Mobile, consisting of a sawmill, planing mill with electric haulage system, hoisting machinery, etc., to cost about $500,000. T. F. Faust, Mobile, representative, is in charge.

TUSKEGEE, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 22 for boiler plant (except building and smokestack), including outside heating, electric water and sewer services; the deep wells, pumping plant and water supply systems, and the sewage disposal plant for the United States Veterans' Hospital, Tuskegee.

MONROE, LA.—The Singer Sewing Machine Company, 149 Broadway, New York, will build a power plant in connection with its proposed new lumber and woodworking mill in Monroe, to cost about $500,000.

OKLAHOMA CITY, OKLA.—An ordinance has been adopted by the City Commissioners providing for the electrification of all railroads entering the city, effective Nov. 1. Among the railroads affected are the Atchison, Topeka & Santa Fé, St. Louis & San Francisco, Missouri, Kansas & Texas and the Chicago, Rock Island & Pacific.

TULSA, OKLA.—The Mid-West Utilities Company, 72 West Adams Street, Chicago, will soon commence the erection of a power plant at Tulsa, to cost about $500,000. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

DALLAS, TEX.—Plans are under way by the Stickle Lumber Company for the construction of ten buildings, including sawmill, planing mill, power house, machine shops, etc., to cost with equipment about $350,000. The plans also include a logging railroad.

HARLINGTON, TEX.—Improvements are being made to the municipal electric light plant, including the installation of a 200-hp. Fairbanks-Morse Diesel type engine directly connected to a 150-kw. generator. C. A. Crippe is manager of water and light department.

Pacific and Mountain States

NEWPORT, WASH.—The Bead Lake Gold-Copper Mining Company, Spokane, contemplates the erections of a transmission line to its mill north of Newport.

SEATTLE, WASH.—The Puget Sound Power & Light Company will build a new transmission line on the Mercer Island Boulevard.

SEATTLE, WASH.—Arrangements have been made for interconnection of the municipal plants of Seattle and Tacoma. A transmission line will be erected at a cost of $150,000 to tie in the two systems, each city to defray one-half the cost. A new substation will be built on West Spokane Street, Seattle, and a transmission line extended to this point. The cost to the city of Seattle is estimated at $123,000.

SPOKANE, WASH.—The erection of 100 miles of new transmission lines and rebuilding other lines in Palouse County this summer is planned by the Washington Water Power Company. The proposed work includes 60 miles of 110,000-volt transmission line from Lind to Colfax and 40 miles of 60,000-volt line from Colfax to Pullman.

CORVALLIS, ORE.—The installation of a new street-lighting system in the business section of the city is under consideration by the business men.

EUGENE, ORE.—Permission has been granted to the city of Eugene by the State Engineer for permission to appropriate 400 second-feet of water from McKenzie River for the development of electricity for light and power purposes. The cost is estimated at $120,000.

HOOD RIVER, ORE.—Preparations are under way by the Pacific Light & Power Company, Portland, it is reported, for the construction of a 6,000-kw. hydro-electric plant on Hood River, a short distance from here, to cost about $1,250,000.

RIDDLE, ORE.—At a recent election a bond issue was voted for the installation of an electric light plant and an auxiliary water system.

AUBURN, CAL.—The American River Water & Power Company, recently organized, is planning to construct a transmission and distributing system in western Placer County. James E. Walsh heads the company.

PLACERVILLE, CAL.—The El Dorado Water Corporation contemplates the construction of a hydro-electric plant in connection with its Webber Creek irrigation project.

SAN FRANCISCO, CAL.—James P. Sweeney, Nevada Bank Building, and associates have been granted permission by the State Water Commission to construct and operate a hydro-electric power plant on the Mokelumne River, Amador County, to develop about 35,000 hp. The cost is estimated at about $5,000,000.

MURTAUGH, IDAHO.—Arrangements have been made between Harvey Hall of the Ball Electric Company, Burley, and the citizens and farmers of the town of Murtaugh whereby the former will erect an electric transmission line from Hansen to Murtaugh and supply electricity in Murtaugh and to residents along the line. At Hansen the line will connect with the system of the Idaho Power Company from which electricity will be secured. The transmission line will be operated by Mr. Ball, under the name of the Murtaugh Light & Power Company.

MISSOULA, MONT.—Work will begin at once on the erection of a central power house at the University of Montana, to cost about $110,000.

PIOCHE, NEV.—The Dixie Power Company, St. George, Utah, is considering extending its transmission lines to supply electricity in Pioche, Caliente and other communities in Lincoln County. It is about 35 miles from the nearest line of the company to this section.

Canada

EDMONTON, ALTA.—Extensions to the municipal electric light plant, to cost about $75,000, are under consideration.

BRANTFORD, ONT.—A by-law providing for appropriating $65,000 for extensions and improvements to the municipal hydro-electric system has been approved by the City Council.

CREDITON, ONT.—Contract has been awarded to the Ontario Hydro-Electric Power Commission for the installation of an electric lighting power system in Crediton to include a 3-mile transmission line. The cost is placed at $35,000.

NEW LISKEARD, ONT.—Work, it is reported, has started on a 6,000-hp. hydro-electric development at Indian Chutes on the Montreal River, 12 miles above the town of Elk Lake, for the Matachewan River Power Company, Ltd. Sutcliffe & Neelands, Ltd., New Liskeard, are engineers.

Miscellaneous

PEARL HARBOR, H. T.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for extensions to power house at Pearl Harbor and also to power house at Heeia. (Specification 4,639.)

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary, H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Niagara Falls, Ontario, June 26-30.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 26 to July 1.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, Spring Lake Beach, N. J., June 19-25.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual meeting, Cleveland, Ohio, Sept. 11-15.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto. Convention, Niagara Falls, Ont., June 22-24.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada. Annual convention, Ottawa, June 15-17.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo. Annual meeting, Hot Springs, Va., June 5-7.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton, Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainsville, Fla.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto. Annual meeting, Boston, Sept. 25-28.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Convention, New Bedford, Mass., Aug. 22-25.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa. Annual meeting, Lake Okoboji, Iowa, June 20-22.

Kansas Public Service Association. Secretary-treasurer T. T. Parker, Kansas Electric Utilities Co., Emporia, Kan.

Kentucky Association of Public Utilities. Secretary, E. F. Kelly, Louisville Railway, Louisville, Ky.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Middle West Division, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio. Annual meeting, Cleveland, June 28-29.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 5-7.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual meeting, St. Paul, Minn., June 13-15.

Northwestern Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho. Annual meeting, Boise, Idaho, June 7-10.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, Ohio, July 11-14.

Oklahoma Utilities Association. Acting secretary, O. D. Hall, Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, 1106 First National Bank Bldg., Oklahoma City, Okla.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, C. E. Warsaw, Burlington, Vermont.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Secretary-treasurer, Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington, W. Va.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Utilities Association. Executive secretary, John S. Cadby, Madison, Wis.

Wyoming Utilities Association. Secretary, C. Luscombe, Western Light & Power Co., Boulder, Col.

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Volume 79 *Number 23*

The Way of Understanding

MOST of the irritation, criticism, ill feeling and active antagonism that develops between public utilities and the people whom they serve is the product of a simple human condition of misunderstanding. Such misunderstanding is the natural outgrowth of the fact that John Smith and the utility maintain a living contact which they view from entirely different angles.

The public utility man's mind is naturally focused on providing and maintaining service to the people in the mass and the individual becomes of far less import than "the service." But to John Smith this service rates only with that of the grocer or the milkman, for the utility supplies him with what is now a common necessity of life.

He understands the grocer and the milkman, and what they do for him and how. The utility, however, still remains a mystery, and he is never sure of his own knowledge that they treat him fairly and appreciate his patronage. And so each bit of gossip and each indiscretion on the part of a utility employee he takes as evidence that they do not.

THE cure for all this obviously is to build up understanding. The Pennsylvania Railroad, for instance, has found a way through the menu of its dining-car service that provides an inspiration.

It is a four-page folder that shows first a glimpse of what the engineer sees from his seat in the cab. That grips the interest. Then follows perhaps a little message on "signals and safety," some short word picture of the human side of the railroad. Then comes a clear diagram of the cooking and serving mechanism of the dining car, with facts about the kitchen, the pantry, the food, the water, how the work is handled and the scope of the service. Then come a page of menus and a page of "facts about this railroad."

And as you wait you read. And as you read, you get new understanding of this familiar railroad that you never had before.

WHAT of the human stories that the central station has to tell of the meter, the fuse, the transformer, the transmission lines, the switchboard, the generators, the turbines, the boilers, the load dispatchers, the trouble shooter, the accounting, the sales problem, to say nothing of the motor, the storage battery and the other appliances? Each has its message—little human stories, told man to man in a simple, friendly way.

Suppose such a little human story came to each of us with every bill, marked: *"Put this little folder in your pocket. Read it some time when you are waiting."* Think how much helpful understanding it would bring.

William Spencer Murray

Consulting engineer who was in charge of the New Haven electrification and who caused "superpower" to have a national significance.

THERE are plenty of men who are enthusiasts when the way is clear and the goal is in sight. It takes a different kind of moral fiber, however, to be optimistic and to encourage others when the way is rough and the results are uncertain. This has been one of the outstanding characteristics of W. S. Murray, consulting eengineer, New York City.

Two accomplishments stand out in the career of Mr. Murray. He first came into prominence as the one responsible for making alternating-current heavy traction a fact. More lately, through his connection with the Boston-Washington Superpower Survey as chief engineer, he caused the word "superpower" to attain a significance which it never had before not only with the engineering world but with the general public.

Seventeen years ago Calvert Townley, then acting vice-president of the New York, New Haven & Hartford Railroad in charge of electrification, realizing the need of a man as chief electrical engineer who could do things in a large and courageous way, chose Mr. Murray. In his hands were placed the electrical engineering and construction details of an electrification costing $25,000,000. Later he became consulting engineer for the New Haven road in charge of all features of electrical operation. Thus he was responsible for the construction and operation of the first single-phase electrification of a steam railroad in this country.

During the war Mr. Murray became imbued with the Atlantic seaboard superpower idea and was foremost in attracting favorable attention to the scheme. He was chairman of the committee of the Engineering Council which presented the matter to Congress. When Congress made its appropriation for the work to be conducted under the auspices of the Geological Survey, Dr. George Otis Smith, director of the Geological Survey, promptly selected Mr. Murray as chief engineer of the Superpower Survey, with full authority to go ahead. With his customary vigor and enthusiasm Mr. Murray proceeded to gather around him a staff of experts. In the short period of a year the report was completed. Although the project is of too large proportions to warrant any immediate action, it is a fact that Mr. Murray brought to the nation a fuller and more complete conception of the economic possibilities of large plants properly placed and tied together with a transmission network.

Mr. Murray was born at Annapolis, Md., Aug. 4, 1873, and was graduated from Lehigh University in 1895 with the degree of electrical engineer. The next seven years he spent with the Westinghouse Electric & Manufacturing Company in several departments, after which he opened a consulting engineering office in Boston. Then came his work on the New Haven electrification. While still engaged in this work in 1913 he formed a partnership in consulting engineering with E. H. McHenry, formerly a vice-president of the New Haven railroad. In 1917 he became president of the Housatonic Power Company and chief engineer of the Connecticut Power Company. In 1919 he returned to the consulting end of his profession, and he is now senior member of the partnership of Murray & Flood.

In association work Mr. Murray has been quite active. He has served on numerous committees and presented many papers. He has served as manager of the American Institute of Electrical Engineers, and was a vice-president of that body from 1912 to 1914.

Editorial Comment

Electrical World, June 10, 1922
Volume 79 Number 23

The War Tax Burden to Be Balanced

AS WE read the newspapers these days it is a fine thing to realize that the fast-unfolding confidence and increasing business activity which are reflected on all sides have been achieved in spite of conditions that might well have been looked upon as permanently blighting influences. Through the recent years possibly 20 per cent of our entire national production has gone into taxation. Rents and wages are thereby increased. The cost of production is raised some 25 per cent by the added carrying cost of the losses imposed by the war, and we must go along with it. In addition, we have suffered the shock of a 20 per cent depreciation in the value of our entire stock of goods within a period of eighteen months. And yet, almost paradoxically, there is today a well-founded business optimism on every side.

Business is better, but we must remember that there are some very definite handicaps yet to be overcome. We have in America a high degree of efficiency in individual activity, but a low efficiency in co-operation between different industries and within the trades. Here, however, lies the one promising opportunity to take advantage of the returning era of prosperity to balance the heavier burden of taxation by an improvement in our costs of distribution. By the elimination of waste in production, by the electrification of our transportation lines and factories and by a closer co-operation between the different agents of distribution, we must more fully restore the economic balance and make the products of our work mean what they did before the war.

There is no problem before American business men more vital than this. We may have come whole through our trials and tribulations. Better business health may be encouraging us to happiness once more. But until we absorb this increased tax burden by increased production efficiency we can hardly feel content.

Competition Has No Place in the Electric Light and Power Business

THE fundamentally and rightfully non-competitive character of the electric light and power business under government regulation has received a fresh confirmation in the decision of the United States Circuit Court of Appeals sitting at Richmond, Va., that the Southern Power Company must supply hydroelectric energy to the North Carolina Public Service Company on the same terms as to its other customers, even though the latter be its own subsidiaries. The Southern Power Company set up in its defense the well-established principle that no one is bound to help a rival to his own detriment. The North Carolina company maintained that it would be forced to discontinue service in two towns if the defendant company were permitted to refuse to sell energy to it on the same terms as to others and fought against the destruction of its business by a competitor in the field.

When the state steps in to regulate public utilities, it, by implication, guarantees to each secure possession of the territory that its franchise covers so long as it renders adequate and faithful service. This guarantee, which applies alike to generating and to distributing companies, is not the least of the benefits that spring from commission rule.

Public Service Commissions Have Come to Stay

EVIDENTLY the movement headed by the redoubtable Mayor Shank of Indianapolis for the abolition of the Public Service Commission of Indiana did not, after all, arouse great popular enthusiasm, in spite of the strong political support accorded to it, for news comes that the Mayor and the Governor of the state, who is opposed to doing away with the regulating body, have agreed on a program of amendments to the commission law which will take the place of the radical program previously championed by the Mayor and his followers. It will be remembered that a similar agitation swept the neighboring state of Illinois a year or two ago, and that in accordance with what appeared to be the voters' mandate the old Public Utilities Commission of that state was legislated out of being. It was, however, at once replaced by the Illinois Commerce Commission, in which were vested powers of the same kind as those possessed by its predecessor and which functions in the same manner as did the antecedent body. The fact is that the principle on which public service commissions are based has become too firmly rooted to be easily destroyed, and that the abolition of any existing body is likely to be followed by the creation of another in much the same image.

Now, although a commission by any other name will probably work as well, constant assaults, we do not mean on personnel, for such attacks are part of democratic government, but on the foundation upon which commissions are reared and the time-tested theories which they exemplify, are disturbing and may become demoralizing. May it not be that as public education in this matter progresses many states will sooner or later find the way to its permanent basic adjustment by writing, as Oklahoma did, a public service commission, with prescribed duties and procedure, into the constitution of the commonwealth? The commission would then cease to be a mere creature of the legislature and become a part of the organic law of the state, like the executive and the courts. Its members, whether elected or appointed, would no more than now be immune from public criticism; if guilty of malversation, they could be reached in their own persons or through the governor who appointed them; they would not be secure against removal or impeachment. But the commission itself—the body as distinct from the men—would be protected against injury and threatened destruction from every wind that blows without knowing whither it listeth.

Radio May Now Contribute Central-Station Revenue

WITH the production and sale of electron tubes for use with radio sets already reaching 300,000 a month, the new prospect of energizing these tubes directly from the lighting socket makes the subject of radio of even greater interest to the central-station company. As is described elsewhere in this issue, the Bureau of Standards has devised a way to dispense with the storage battery hitherto required for the vacuum tube and to substitute a direct connection to the 60-cycle circuits through a lamp socket. In short, radio becomes by this means a household energy-consuming appliance that offers a possible new source of revenue in something like a million homes throughout the country.

The most perplexing problem of the radio boom has been the question of how to finance the cost of broadcasting through revenue to be obtained from the receiving station that enjoys the service. So far no way has been found. Interesting possibilities are suggested, however, through the combining of carrier-current broadcasting over the lighting lines, as is now being done experimentally by General Squier in Washington, and this new use of central-station power in place of storage batteries. The consumption of energy by the receiving set, plugged into the nearest socket, would automatically provide a revenue directly creditable to broadcasting, perhaps enough to finance it. Who knows? It would depend entirely on the number of connected sets, and that number is already great and growing.

There are no end of questions that can be asked, of course. Radio still is in large part a vision, as to which each may make his guess. How broadcasting will trend and what part wired wireless will play in it we cannot say. Perhaps the telephone system will prove the most effective conductor, perhaps the power system. All this lies in the still unfolded future. But meanwhile it is worth watching and thinking about. That the central station has a part to play in it is hard to doubt.

Reactor-Type Circuit Breakers Deserve Investigation

FROM time to time there crops up the suggestion of a switch or circuit breaker shunted with resistance or reactance, the breaker being also equipped with additional contacts for finally opening the shunt circuit. The obvious principle is that when opening the main contacts the reactance lowers the resulting load, which may then be safely opened on the auxiliary contacts. The suggestion is a very old one and from time to time has been used in practice. Switches of this character were employed in connection with one of the important early electrical developments at Niagara. The principle is sound as applied to loads up to the rating of a circuit breaker, in that the maximum demand upon both breaker contacts and reactance is known. The use of the reactor thus permits the use of a smaller capacity of breaker. Breakers of this type have been used to some extent abroad, but in this country operators have preferred to avoid the complication caused by the reactor connections by using larger breakers without reactance.

Experiments investigating the effectiveness of the shunt device would be well worth carrying out. There would appear to be considerable doubt whether the time interval involved in the transference of a short-circuit current, which must have attained considerable proportions before the main contacts open, to the shunt reactor circuit would not materially reduce the value of the device when applied for this purpose.

Alabama Power Leads the Way in Hydro-Electric Plant Design

SOME rather revolutionary innovations are being made in the new Mitchell Dam plant of the Alabama Power Company on the Coosa River which hold great promise of solving two outstanding problems in hydro-electric development. The chief departures from conventional practice are the semi-outdoor construction, the backwater suppressor and the position of the turbines. The suppressor, as explained elsewhere in this issue by J. A. Sirnit, depends essentially on the energy of a sheet of water flowing over the down-stream face of a dam of ogee section to sweep the backwater away from the foot and thus increase the effective head on the turbines. To utilize this effect it has been necessary to mount the units on separate foundations distributed across the up-stream face of the dam.

The success of the suppressor depends on the assumption that sufficient water will be available during flood season to make a marked decrease in the elevation of the tailwater without robbing the turbines. Prior to its adoption in the Mitchell Dam plant, O. G. Thurlow, chief engineer of the company, who is responsible for the idea and its development, constructed two experimental installations. The data on the larger of the two installations show, with the suppressor in use, an increase in head of over 30 per cent under some conditions. Such a result will justify a considerable expenditure of money, though in this case the statement is made that the installation will actually cost less than the ordinary type of hydro-electric plant. The experiment will be watched with a great deal of interest since it offers a way of making practical many developments that might not be feasible otherwise because of severe back-water conditions during flood season.

The plant will be notable not only for this hydraulic feature but because the company has had the courage to put into its design important modifications in the type of building. The usual imposing structure is omitted, and the generators are covered with low buildings having roofs so designed that they can be removed and any part or all of the equipment taken out by use of a gantry crane which serves the entire power-house section. The design is a decided step in the direction of the outdoor generating plants that have been discussed rather seriously in the last few years. The trend of the times is steadily away from the "frills" that have been largely conventionalized in plant and substation construction, probably because the first developments of the industry were made under conditions requiring construction common in other industries.

If a departure from the conventional will result in reduced cost of service without lowering of service standards, those having the courage to make the break are entitled to congratulation and the help of the industry. While some will be found to delight in criticism of the innovations that are being made in this case, the majority will hope sincerely that the designs will completely fulfill the expectations of the designers. Because of the careful studies that have been carried out there seems to be no good reason to expect otherwise.

Top Dimensions of Wooden Poles Mean Nothing

THAT the use of the top diameter in designating the size of a wooden pole means nothing is one of the interesting facts that have come out of the recent discussions of the pole situation. The practice was adopted at a time when there was less demand for poles and when fewer kinds of wood were used, which were apparently available in unlimited quantities. The real practical measure of the strength of a pole is its dimensions at the ground line. In addition a limiting dimension can be put on the top to prevent the shipping of poles that have an excessive taper. The taper of many poles now available is such that the specification of a seven-inch or an eight-inch top without any other limiting dimension can easily mean a very inadequate ground-line dimension.

It will be well for those who are concerned with the buying of poles to carry this fact in mind and also to study carefully the new pole specifications that have been prepared by the overhead-systems committee of the National Electric Light Association. Owing to the depletion of the supply of wooden poles there is apparent need of a change in some of the practices of the past, and the new specification is a move toward that end. There is yet time to suggest changes if experience shows any need for them.

Maintain the Supply of Trained Research Men

UNTIL very recent times relatively small numbers of men have devoted their principal efforts to research, and the reason has probably lain in the absence of a sufficient stimulus. The rewards even of successful research have not been of a material nature, and those men who have devoted the principal efforts of their lives to investigation have often done so at great personal sacrifice, having been impelled rather by an inward realization of the glory attaching to service rendered to succeeding generations and by the fascination in the successive steps and problems of journeys of discovery into new fields.

Lately, however, the situation has changed markedly. The products of research now have a distinctly marketable value. In fact, it may be said that the bread cast upon the waters by the succession of earlier workers is now returning, approving the ideals of these early workers and showing the world the importance of continuing study and investigation. The value of research is now emphasized on every hand and especially in the fields related to engineering. Not only do our educational institutions have research divisions and experiment stations and our governmental bureaus devote a large part of their effort to research, but our industries are spending enormous sums of money and our national engineering societies are uniting in a common effort for the extension of the work of research.

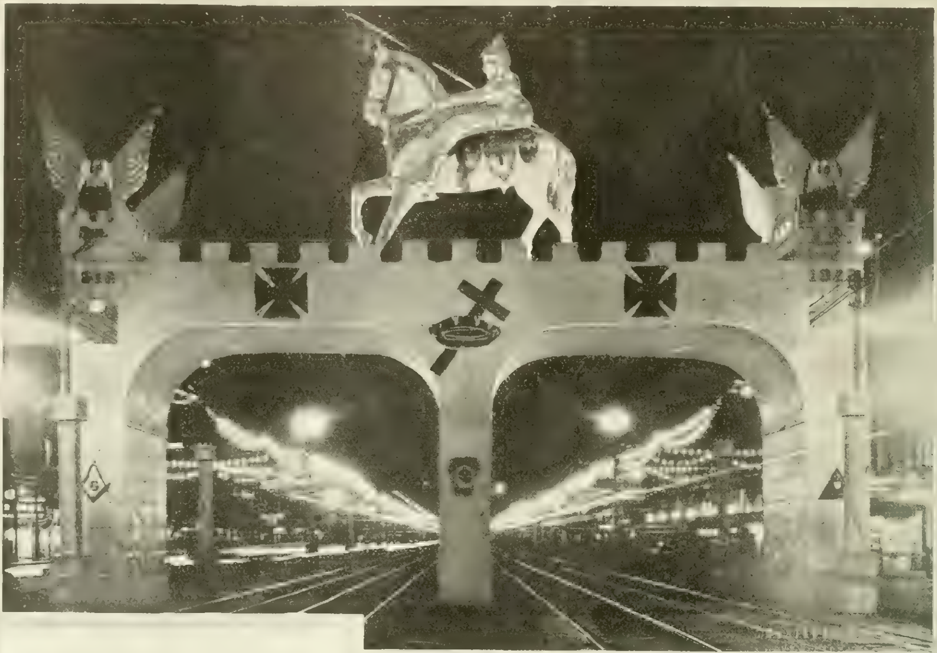
The immediate result of this modern recognition of the importance of research is a greatly increased demand for trained investigators. Experienced men in this field may now command salaries which compare favorably with, and in some cases even exceed, those in other branches of engineering endeavor. The demand is also clearly indicated by the eagerness with which the better grade of engineering graduate is absorbed into the research divisions of the great electrical industries.

There is, however, a serious danger to the future progress of research in this insistent demand for men. The danger is, first, the exhaustion of the sources of supply and, second, the want of realization of the importance of the complete training of research workers. The university laboratories are the natural training schools for men in this field. There are numerous instances in which the attraction of a well-paid position in an industrial laboratory has caused a useful and inspiring teacher to leave the training laboratory. Furthermore, the demand for young men in other phases of engineering activity causes the vast majority of them to leave college at the end of the four-year undergraduate course. The effect of this on the quality of the product available for the field of research is twofold—first, it diverts to other fields many young men who would make successful investigators, and, second, even if some of these young men are drawn into the research field, they are not sufficiently trained to become investigators of the first rank.

It would appear that the engineering professions and industry should in some way look to the conservation and improvement of the sources of supply of trained investigators. This could be done by supporting research work in colleges and universities and by encouraging young men to continue into graduate years of study. If industry demands the highest grade of investigators, why should not industry demand also a doctor's degree for its own laboratory staff? But industry cannot expect a young man to assume the burden of the exacting effort and expense of three or four years of graduate training unless it renders him some assistance. The methods are relatively easy and the cost would not be great. Graduate scholarships, fellowships and, best of all, professorships in special fields founded and endowed by a united industry would be an ideal solution.

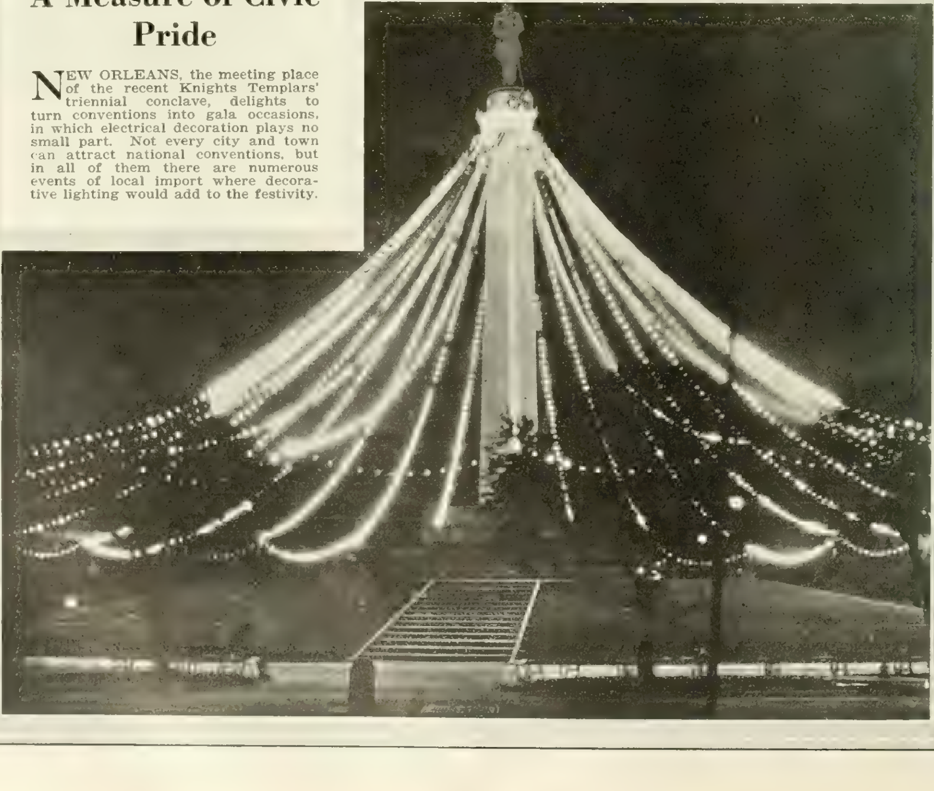
Use of Secondary Racks Needs Supervision

THE use of secondary racks for distribution construction has attracted a great deal of attention from distribution engineers because of the possibility that by their employment better and cheaper construction can be attained. It is not to be denied that some of the work done in this way has been cheaper in cost than construction of other kinds, but in certain cases it has been less desirable because it has brought an increase in hazards. This has been largely due to the practice, time-honored in the distribution field, of turning the job over to the line foreman or even leaving it to the judgment of the individual lineman, without any engineering consideration as to how the racks should be used. Like every other form of construction, the rack has its problems and limitations. There are many places where the use of cross-arms is better, as, for instance, where there are a number of secondary circuits on the same pole. This should be clearly recognized, and the distribution engineer who has the problem to face can then settle down to a study of the way in which the racks should be utilized and the methods of installation that will give the best results. A study of this kind is presented elsewhere in this issue by L. C. Peterman, whose paper is based on the use of rack construction at Chillicothe, Ohio. Such studies point the way toward further investigation that can be undertaken with considerable benefit.



A Measure of Civic Pride

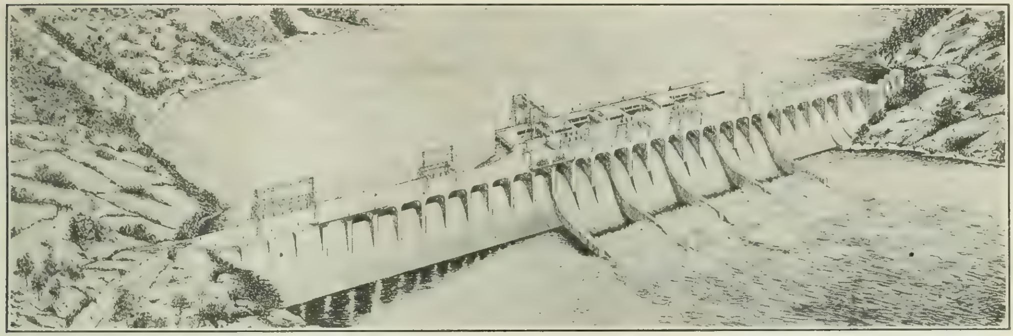
NEW ORLEANS, the meeting place of the recent Knights Templars' triennial conclave, delights to turn conventions into gala occasions, in which electrical decoration plays no small part. Not every city and town can attract national conventions, but in all of them there are numerous events of local import where decorative lighting would add to the festivity.



Semi-Outdoor Hydro-Electric Plant with Backwater Suppressor

Mitchell Dam Development of the Alabama Power Company Will Involve an Entirely New Principle in Hydro-Electric Construction —Results of Long Series of Experiments in Backwater Suppression

By **JOHN A. SIRNIT**
Designing and Electrical Engineer Alabama Power Company



WITH the demand for more and cheaper power caused by the rapid development of the country, and with the increasing cost of steam power, greater interest in water-power development is being shown in all parts of the nation. In this country as abroad hydro-electric developments are being made on a scale never attempted before, and plants are being built and generating units are being installed in sizes that would have been astonishing a short while ago. Just as a designer of steam plants endeavors to produce as much power as possible out of a pound of coal, so the designer of hydro-electric plants is anxious to utilize every drop of water and convert it into useful power with a minimum amount of loss and at the least cost. The designers of waterwheels and turbines have helped a great deal by improving the efficiency of the driving machinery, and the designers of generators have done likewise.

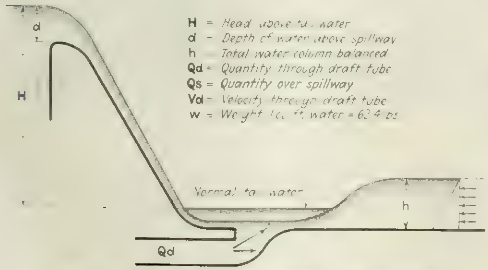

d
H
H = Head above tail water
d - Depth of water above spillway
h Total water column balanced
Qd = Quantity through draft tube
Qs = Quantity over spillway
Vd - Velocity through draft tube
w = Weight 1 cu. ft. water = 62.4 lbs
Normal tail water
h
Qd

FIG. 1—DIAGRAM SHOWING ACTION OF OVERFLOW SPILLWAY WATER ON THE TAILWATER

In many cases of proposed developments engineers have hesitated to recommend the carrying out of a project on account of backwater conditions in the tailrace. These can be predicted very closely. The proposed development at Great Falls on the Potomac River, which has been under discussion for many years, is an example in point. Engineers have wrestled with this problem for many years, and have tried to overcome the difficulty by installing a greater number of generating units, where it was possible to do so, to compensate for the loss in capacity in each unit. Such a procedure, of course, necessarily makes the installation more expensive, with a resulting increase of production costs. Attempts have also been made to counteract this loss in head by admitting water into the draft tube through jets at a relatively high velocity. Thus, by accelerating the velocity of the combined turbine discharge and the jet water through the draft tube, a negative head will be produced and added to the head of the turbine. A number of variations in the place and manner of introducing this jet into

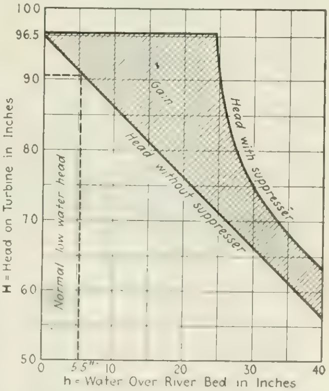


FIG. 2—CURVES SHOWING TURBINE HEAD WITH AND WITHOUT THE BACKWATER SUPPRESSOR

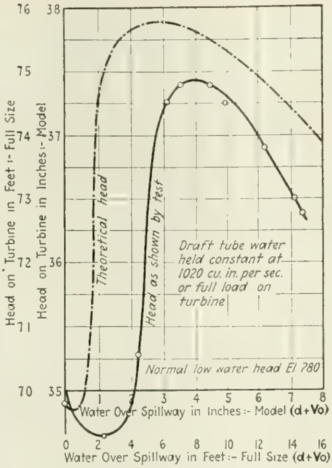


FIG. 3—THE EFFECT ON THE TURBINE HEAD OF DIFFERENT AMOUNTS OF WATER OVER SPILLWAY

TABLE I—COMPARISON BETWEEN CALCULATED AND OBSERVED HEADS OF BACKWATER

EAST LAKE MODEL

d (Inches)	(Observed *h* Inches)	(Calculated *h* Inches)
4	6.00	6.5
5	7.75	8.05
6	8.75	8.9
7	9.75	10.0
7.5	11.00	10.6

JACKSON SHOALS MODEL

d (Feet)	(Observed *h* Feet, Corrected)	(Calculated *h* Feet)
0.25	0.40	0.59
0.50	0.84	0.88
0.75	1.30	1.20
1.00	1.51	1.56
1.25	1.72	1.78
1.50	2.10	2.08
1.75	2.48	2.35

the draft tube have been tried and the results published, but these results have not been entirely satisfactory. It would appear that the most logical and simplest way to maintain the normal head on the waterwheel and thereby the full capacity of the plant during flood periods, is to remove the high tailwater from the discharge opening. O. G. Thurlow, chief engineer of the Alabama Power Company, attacked this problem in a large way and has succeeded in arriving at a successful solution. The development of this conception involves the utilization of the waste water and has resulted in what is known as the Thurlow backwater suppressor.

It is a well-known phenomenon of nature that water flowing over a masonry dam having a down-stream face of ogee section leaves the apron in a thin sheet at high velocity. At a point below the dam the water arises turbulently, forming a so-called "standing wave," "hydraulic jump" or "back roll." The thickness of this sheet and the velocity of the water depend upon the height and shape of the down-stream face of the dam, upon the depth of water at the crest of the dam, and upon the quantity of water flowing over the dam. The energy developed in this thin sheet of water has generally been regarded heretofore as solely of a destructive nature, but in the backwater suppressor the energy of the spillway water is directed so as to remove the backwater from over the draft-tube orifice, sweeping it down stream and thus freeing the draft tube from the pressure of water over it and maintaining a practically uniform head on the turbine as long as the spillway water is able to sweep the backwater away from the draft-tube orifices.

In Fig. 1 is shown diagrammatically the action of the overflow spillway water on the tailwater. It is shown among other features that the energy of the spillway water not only removes the height of tailwater from the draft-tube orifice but even lowers the normal tailwater level to a level that can be predetermined.

In order to substantiate the idea and evolve a definite theory on which to base calculations a model was constructed on a scale of one in twenty-four at East Lake in Birmingham, Ala., where a small flow at 3-ft. (0.9-m.) head was available. The results obtained here were so interesting that, in order to check the data obtained and to increase the accuracy of measurements, a second and larger model was constructed to a scale of one in ten at Jackson Shoals, Ala., where a greater flow and head were available. The results obtained with the two models, when re-

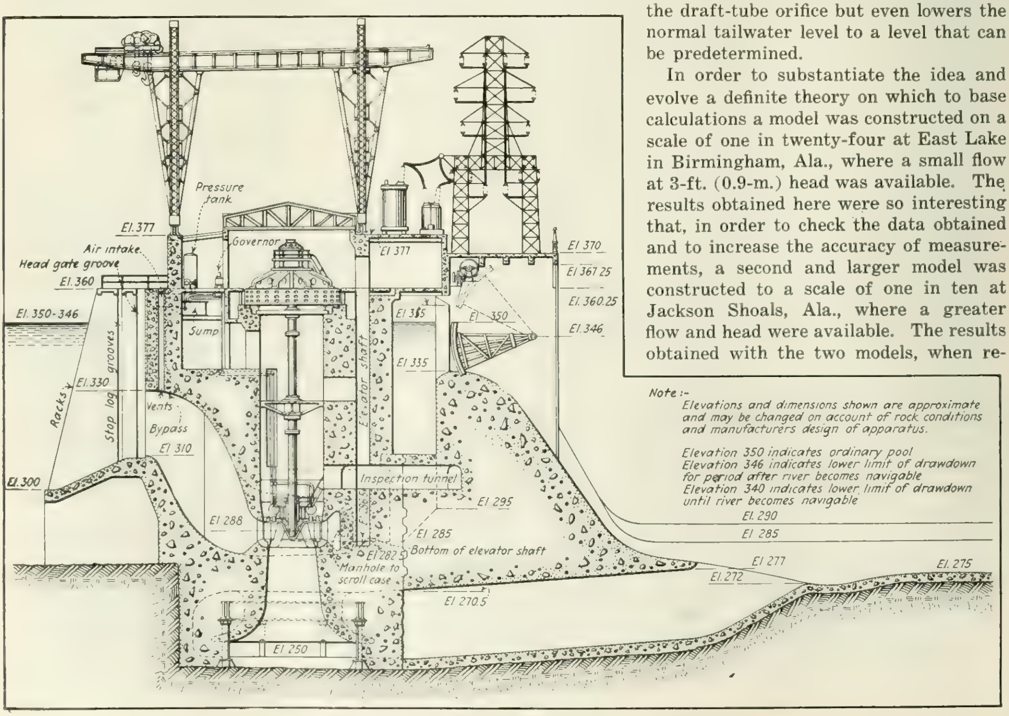


FIG. 4—CROSS-SECTION THROUGH POWER HOUSE AT MITCHELL DAM

TABLE II PERFORMANCE OF JACKSON SHOALS MODEL

Water Over Riverbed, in Inches	Head Without Suppressor, in Inches	Head With Suppressor in Inches
0	96	
0.50	95.50	96.50
2.75	95.75	95.75
19	77	96.75
20.75	75.75	96.50
21.50	74.50	97
22	74	96.50
22.50	73.75	96.75
22.75	73.25	96.75
23.75	72.75	96.50
24.50	71.75	89.50
24.75	71.75	88
26	70	87
27.50	68.50	80
29	67	73
29.75	66.75	74
30.75	65.75	73
34	62	68.75
35.75	60.75	66
40.50	55.50	66.75
46	50	56.50

duced to the same scale, were in close agreement and the observed results followed those calculated for similar conditions.

The height of the standing wave, taking a section of unit (1-ft.) width and neglecting losses due to the friction of the moving water over the spillway, can be approximated by the empirical formula $h = \sqrt{d^{\frac{3}{2}} \times H^{\frac{1}{2}}}$, in which d is depth of water in feet over the spillway and H head in feet above spillway apron. This does not take into account the effect of the turbine water. This factor will increase the height of the standing wave, so that the actual results will be somewhat better than those shown by this formula. A comparison between the calculated and observed heads of backwater which different amounts passing over the spillway are capable of removing from the draft-tube orifice is given in Table I. These figures are for a section of backwater 20 per cent greater in width than the spillway, using the formula, $h = \sqrt{0.83d^{\frac{3}{2}} \times H^{\frac{1}{2}}}$.

The figures in Table II, compiled from three separate tests made at different times, show the performance of the Jackson Shoals model with 18 in. (45-cm.) of water over the spillway in suppressing various heads of backwater. These readings are illustrated in Fig. 2, which shows curves of the turbine head with and without the backwater suppressor and is typical of the performance of the suppressor with a normal thickness of water over the spillway and varying heads of backwater.

The effect on the turbine head of different amounts of water over the spillway is shown by the curve in Fig. 3 (East Lake model). It will be noted that very small amounts cause a decrease in head because sufficient velocity has not been given to the draft-tube water to cause a thinning of the sheet over the draft-tube orifice, but when the ratio of spillway to draft-tube water increases to about one to one the curve takes a decided course upward, reaches its peak and starts falling off again, owing to a greater quantity of water passing over the orifice with virtually no increase in velocity above that of the point of maximum head. This curve does not represent the best performance possible, but it is typical of the ideal theoretical curve which is shown in the figure.

DESIGN OF THE POWER PLANT AT MITCHELL DAM USING BACKWATER SUPPRESSOR

Encouraged by the splendid results of the model tests and substantiated by careful studies of the benefits involved, the Alabama Power Company decided to apply the backwater suppressor at Mitchell Dam on Coosa River, Ala., which is now under construction; but before this decision was made a careful analysis was prepared to determine the economic advantages of this innovation.

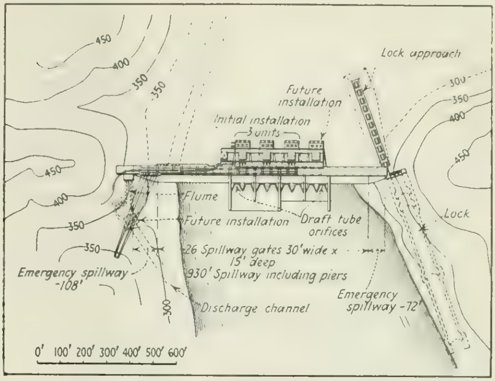


FIG. 5—GENERAL PLAN OF MITCHELL DAM POWER PLANT, ON COOSA RIVER, ALABAMA

Being satisfied that the backwater suppressor will perform as indicated by the tests, the next logical question would be, Will the suppressor-type power plant cost more to build than the conventional type of equal abilities, and if so, how much more? If the cost is higher than that for a plant of conventional design with an equal output, or even if the cost is the same in both cases, the conventional type of power plant would be preferred, because in a new and untried design things will always be found that may not work out as predicted, while the conventional type of plant has already proved its worth.

The estimates, however, not only showed that the cost of the suppressor-type plant was not higher than that of a conventional plant with equal output, but it showed even lower cost for the same number of units, which, of course, meant that for a given output the suppressor-type plant was considerably lower in cost.

The design finally evolved for the Mitchell Dam power plant with the backwater suppressor shows several radical changes and represents an entire departure from the established conventional design of hydro-electric power plants. Fig. 5 shows the general plan at this development. Fig. 4 shows a cross-section through the power house. The salient points of interest, especially those departing from time-honored practice, are many, but only the more important ones will be outlined.

The principal and outstanding feature in this plant is the location of the power units on separate foundations in the river on the up-stream side of the dam. Although this is not necessarily the only possible way to build the power house, in this particular instance it was the most economical. The river at this point being comparatively narrow, the entire length of the dam was required for spillway, and since the prime requisite of this type of plant is that the draft tube shall discharge directly under the spillway section, the units were to be so located that they would not obstruct any part of the spillway section.

The individual and separate power-house units offer the added advantage that trash racks do not present a solid front, which helps materially in cleaning them and affords an easy and convenient way of diverting the trash past the power house and over the spillway. The usual power-house building is entirely eliminated, and the generator room is covered with a low roof, which is designed in two sections, joined on the transverse line and mounted on rollers, the sections moving in opposite directions. In normal operation the generator room is completely protected from the weather, but if access is required for handling heavy parts of the machinery, this roof can be opened and all parts handled through that opening with the crane.

A single gantry crane with full travel over the entire length of the power-house section is so designed that everything, with the exception of the spillway gates, can be handled with its aid. It is equipped with one 125-ton and one 20-ton hook, the former for handling heavy machinery and the latter for raising and lowering penstock gates, handling racks, stop logs and all other lighter parts.

An outdoor-transformer and high-voltage switching station is located on the bridge over the spillway. It should be mentioned in this connection that this plant is designed for operation on the unit system; that is, the generator and its bank of step-up transformers are connected as a unit and all principal switching is to be done with the high-voltage circuit breakers. In stations where units are of large capacity, as in the plant under discussion, where they are rated at 20,000 kva., the unit system is very economical and is preferable, as it presents the simplest, and yet a sufficiently flexible, form of operation.

The entire operating floor is on one floor level—the generators, governors, switchboards, low-tension switches, bus galleries and offices are easily reached without climbing stairs. This materially adds to the convenience of operators and makes the supervision and inspection of the plant more effective. It should be mentioned that the provision of easy accessibility to all important parts of the station is frequently lost sight of by the designer, and this lack of convenience has been the cause of inefficient operation or even breakdowns caused by neglect.

The generators are so installed that the hot air from the generator is discharged into a separate compartment under the main floor and in summertime is expelled into the atmosphere through side openings in the room, thereby keeping the place reasonably cool. In winter, however, when heat in the rooms is desired, the outside openings can be closed and registers in the floor of the generator room opened, letting the warm air in. The penstock is not a true scroll casing, but rather a combination of scroll effect and open flume.

Although little has been said here about the electrical features of the plant, that part of the installation is one of its most important points and has received the closest study in the interest of economical and efficient operation.

Building Advertising on the Foundation of a Common Interest

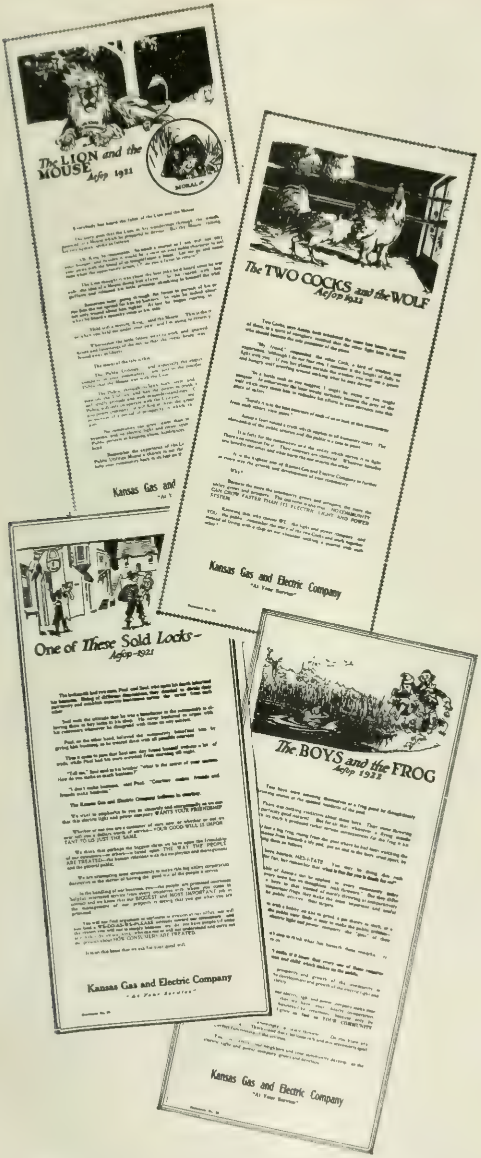
A Campaign of Good-Will Advertisements Featured in Kansas—Written Around Aesop's Fables, These Appeals to the Public Have Aroused Wide Interest in Two States Among Those Who Would Not Read Business Data

THERE is often a tendency on the part of the inexperienced advertiser to tell a story in his advertising that appeals to him personally. Such an appeal is based on a knowledge of the business he is talking about, which has been gained over a long period of time, and is needed as a background against which to understand and appreciate the advertising. As a matter of fact, most advertising to the general public must be written on the assumption that the individual to be reached does not understand the subject matter at all, and the appeal must be first through the medium of something that fits his habits of thought, and through which the message to be conveyed can be pressed home. It is a lamentable fact that much money is wasted in public utility advertising by failure to observe these elementary rules.

What will appeal to one community may not appeal to another because of local conditions, but underlying any successful advertising are principles that can be applied everywhere. Such a principle is well illustrated in a recent series of advertisements used by the Kansas Gas & Electric Company which are based on the common knowledge of Æsop's fables and their popularity. They have occasioned a very large amount of varied and extremely interesting comment in that state and in a neighboring state as well. Some of this comment has been decidedly critical, more has been favorable, and a recent investigation in several communities where the series has been used indicated that the public, at first indifferent to the advertisements, has come to look for each succeeding one with eager interest. Inquiry of several newspaper men indicated a unanimous opinion that the message has been getting across.

The real fascination about the advertisements lies in the use made of the fables. Perhaps no type of stories are so universally known as Æsop's fables, the rhymes of Mother Goose and the old fairy stories. They strike a chord that awakens childhood memories, and incidentally they drive home in a forceful way the most important lessons a human being can learn. So it is safe to say that there are few men, no matter how busy, who will not pause a moment to see what use the fable is put to. In this series, a few of which are reproduced here, the stories are cleverly and forcefully used to tell the utility story in words that even the children can grasp.

To the banker or the utility man who has been trained to think in dollars and cents, or in terms of the balance sheet only, the story may not appeal, because it does not tell the facts he wants to know. Unfortunately for thinkers of that type, they are numerically very much in a minority. The story they are interested in goes over the heads of the vast majority. Balance sheets do not interest the general public.



The LION and the MOUSE
Aesop 1921

Kansas Gas and

The TWO COCKS and the WOLF
Aesop 1921

Kansas Gas and Electric Company
"At Your Service"

One of These Sold Locks—
Aesop 1921

Kansas Gas and Electric Company
"At Your Service"

The BOYS and the FROG
Aesop 1921

Kansas Gas and Electric Company
"At Your Service"

A SERIES OF SIXTY OF THESE UTILITY ADVERTISEMENTS HAS AROUSED GREAT INTEREST AMONG THE PEOPLE OF KANSAS

The fact that a utility needs money to give service is of no interest until the service fails to materialize, and then it is too late. But the fact that the utility has a definite relation to the community welfare is a matter with which every one is concerned. If this fact can be "put across," the other facts need not cause worry, for they will take care of themselves.

The accompanying illustration shows the general appearance of these advertisements. The following is a good example of the "copy" appeal and shows how the moral of the fable is tied to the utility business:

THE OLD MAN AND THE STICKS

Of course you have heard Æsop's story of the Old Man with the quarreling sons.

Time after time he had tried to persuade them that this was sure to end in disaster for them, but to no avail. At length he decided to try something else.

Gathering a quantity of small sticks, he made them into a tight bundle, and then handed it to his sons, telling them to try to break the bundle. In vain they strained, one after another, in their attempts—not one of them could break it.

Seeing that they were unable to perform the feat, the Old Man at length took the bundle to pieces and gave each a small stick to see if he could break that.

"Why that's child's play," they said, as each snapped with ease the twig handed to him.

Then the Old Man said: "My sons, I wanted to show you how much more powerful you would be if you would stick together like brothers instead of wrangling like beasts."

So thoroughly did the ancients understand the truth of the old phrase "In union there is strength" that the Fasces—a bundle of sticks bound together—was the official symbol of the Roman Empire.

What the ancients discovered remains true today.

"Blood brothers" cannot fight and quarrel among themselves without bringing to themselves sure and swift disaster.

So closely interwoven into the business and home life of the community is the electric light and power company that the COMMUNITY and the COMPANY are nothing more or less than "blood brothers."

How foolish, how silly, how UNBUSINESSLIKE for them to quarrel!

The great and powerful enemy to these two "blood brothers" is HARD TIMES. If they would bring prosperity into partnership and kick hard times out the back door, these two—the light and power company and the community—must stand together as brothers should.

No community is any bigger or better than its electric system.

No electric system is any bigger or better than the community.

In a word, then, the COMMUNITY and the COMPANY are dependent upon each other for prosperity. Like the boys in the fable, they should learn the great truth that co-operation brings success.

KANSAS GAS & ELECTRIC COMPANY

"At Your Service"

The story of the utility's place in the scheme of community affairs is forcefully set forth in this series by a careful tying of each of the fables to a vital utility fact and the pointing of the moral in a few simple sentences. No knowledge of the utility business is needed to understand the application of the fable, and there is no table of complicated financial data that the average citizen is only too ready to dodge because of lack of understanding of their significance. The series included about sixty advertisements. They undoubtedly would not fit all localities, but the plan on which they are constructed makes them a valuable study for the man who must handle central-station advertising.

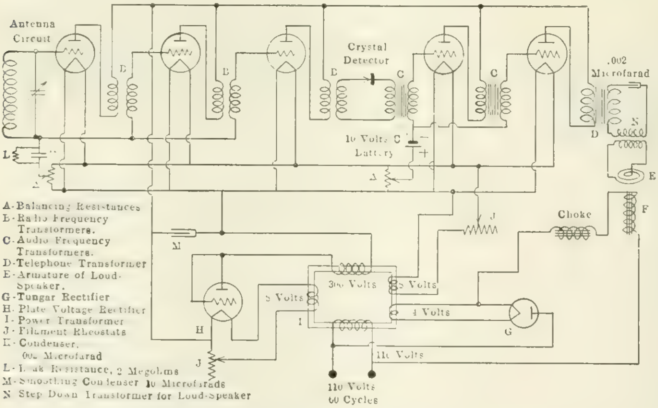
Advertising, of course, has but one object—that of telling a story to the individual it is desired to reach so effectively as to leave an impression on him that will either induce him to buy something or take some sort of action that will be of benefit to the advertiser. Consequently successful advertising is that which accomplishes the result, and in the preparation of advertising copy a real knowledge and consideration of the habits of thought of the individuals that are to be reached is inevitably involved.

The first requisite is absolute honesty and reliability on the part of the advertiser. No advertising, no matter how good, can be effective for long unless it is backed to the limit. Another factor in public utility advertising that must be considered is the influence of the contact between employees and the public. Absolute honesty and reliability may back the advertising, yet if employees are not educated to meet the public courteously and with an evident desire to render service, much, if not all, the value of reliability and honesty will be lost. The old idea that the use of advertising space in local papers is merely a method of buying the support of the editor has been proved too utterly false to excuse its lingering longer in any man's mind. There may be a few papers that can be bought in this way, but usually it wins only the contempt of the editor.

Lamp Socket Can Now Replace Antenna and Battery

Bureau of Standards Development Makes Possible the Use of 60-Cycle Supply for Electron-Tube Filament and Plate

RADIO receiving connections have been devised by the Bureau of Standards which dispense with the storage battery normally required for vacuum-tube sets and substitute therefor a plan whereby the filament and plate can be energized from an ordinary 60-cycle lamp socket. This development, which will be discussed at greater length in a later issue of the ELECTRICAL WORLD, places radio-receiving sets in the class of domestic energy-consuming devices that can be served from the lamp socket. Thus the innovation, combined with the carrier-current method of broadcasting and reception already noted in these pages, makes it possible for the public to look to the lamp socket not only for the power to operate the usual electrical household conveniences but for entertainment as well. No antenna or storage battery is required with the set if it be connected to the lamp socket through a small-capacity condenser such as is available on the market at the present time. The set may, however, be used with the ordinary elevated wire antenna, coil antenna or a special form of antenna.



THREE RADIO AMPLIFIERS, A CRYSTAL DETECTOR AND TWO AUDIO AMPLIFIERS ARE USED IN THIS RECEIVING OUTFIT, WHICH DISPENSES WITH A STORAGE BATTERY

Aside from the fact that the electron-tube filament and plate may be energized from a 60-cycle source, the set is unusual in that it uses a crystal detector and no vacuum-tube detector. The electron tubes are used chiefly as radio and audio amplifiers, but also as a 60-cycle rectifier. A diagram of the outfit, including the means of supplying current to a loud-speaking telephone receiver, is shown here.

The Bureau of Standards has the following to say about this new development:

"The storage battery ordinarily required to light the filament of electron tubes is a drawback to the general use of radio sets. The battery must be charged from time to time, it is bulky and heavy, and the acid in it is a source of danger and damage in a household. In this amplifier both the filament storage battery and dry battery used in the plate circuit are replaced by a special transformer and an electron-tube rectifier and accessories, the aggregate bulk and weight of which are less than that of the battery. It uses a small 10-volt dry battery in the plate circuit, which is required to deliver only a very small current and should have a life practically equal to the life of the battery if not used at all; that is, at least several months. In order to reduce the hum of the alternating current, there are more adjustments to make than in the ordinary amplifier supplied for batteries.

"Of the parts in this amplifier which replace the storage battery in the ordinary amplifier, the special transformer is the only one the cost of which would approach the cost of a storage battery. The cost of the transformer would probably be mainly the labor of assembling. A statement was made in an early announcement of this amplifier that the storage battery is the most expensive part of the home-made radio receiving set. This may have been somewhat misleading, as the aggregate cost of the electron tubes and amplifiers which employ several tubes may exceed the cost of the battery. The cost of the battery, however, plus the cost of the usual necessary battery-charging apparatus, generally exceeds any other item even in an elaborate amplifier.

"A few details of the amplifier, which utilizes 60-cycle current supply for both the filament and plate of the electron tube, are as follows: This amplifier has three radio-frequency stages and two audio-frequency stages and uses a crystal detector. The 60-cycle current when used in an ordinary amplifier circuit introduces a strong 60-cycle note in the telephone receivers and makes reception impossible. This has been practically eliminated by the balancing resistances, grid condensers and special grid leaks of comparatively low resistance, by a telephone transformer in the output circuit, and by the use of a crystal detector instead of an electron-tube detector. In the final form of the amplifier there is only a slight residual hum which is not objectionable. The amplification obtained with alternating-current supply was as good as that obtained with the same amplifiers used with direct-current supply. The complete outfit is compact and portable. The amplifier as constructed operated most satisfactorily for wave lengths of 200 m. to 750 m. By using suitable radio-frequency transformers this range can be extended to receive any radio wave."

Secondary Construction of Proved Value

Based on an Extensive Study Made by the Chillicothe (Ohio) Company Prior to Rebuilding Distribution System, Its Excellence Has Been Demonstrated by Experience

By **L. C. PETERMAN**
Formerly Electrical Engineer Ohio Utilities Company, Columbus

PREPARATORY to rebuilding and modernizing its entire distribution system in 1918, the Chillicothe (Ohio) Electric Railway, Light & Power Company made a thorough study of the available methods of supporting secondary circuits. Since the methods which were adopted have now been in service about four years with entire satisfaction, some of the details may be of interest to other companies.

In selecting the form of support careful consideration was given to the following factors: Initial cost and installation expense, life, appearance, ease and cost of connecting service wires, protection from falling wires and lightning, and amount of stock that would have to be carried. After considerable investigation it was decided that steel brackets with the wires mounted in a vertical plane would be most desirable. However, when it came to the actual work of installing the secondary racks, it was found that the linemen and line foremen were almost totally unfamiliar with such construction and that there were no adequate specifications covering it. The available information was limited largely to the rather meager data in manufacturers' catalogs, and it was found desirable to conduct a few experiments to develop specifications which would eliminate hit-and-miss construction, to standardize on desirable methods and to utilize to the full the desirable features of rack construction. The points which required the most study were (1) dead-ending, (2) turning corners and (3) transformer wiring (on poles), as it was soon found that these operations must be performed in an entirely different manner from that customary when cross-arms are used. Following are the major points of the specications as finally drawn up, with notes giving reasons for the conclusions reached:

NEUTRAL AT TOP OF RACK

All three-wire, single-phase secondary mains should have the (grounded) neutral tied to the top insulator of the rack.—The chief reason for this is to provide protection against falling primary wires as well as bare telephone, telegraph and signal wires of other companies, preventing in the first case the entrance of high voltage on house services and in the latter the grounding or short-circuiting of transformers. This protection is not available when secondaries are supported on cross-arms, but when racks are used it is easy to secure and becomes one of their chief advantages. When running three-wire services the neutral will be carried to the building in the same relative position, and if the house neutral is brought out of the service condulet in the center of the cover, the service gang may find it advantageous to remove the cover and thread the neutral through one of the end holes.

The average lineman will soon develop several methods of preventing crosses and maintaining proper clearance between wires (Fig. 1 A). For two-wire residence services the electrical contractors were instructed to bring the neutral wire through the service condulet and service cut-out box in the same relative position for all jobs, permitting rapid and correct connecting of meter and service drop. With two-wire services placing the neutral on the top insulator of the rack presents exactly the same conditions as when cross-arms are used.

Another reason for tying the neutral to the top spool of the rack is the protection afforded from lightning in the case of extended secondaries in the outlying, sparsely settled districts. In one case, on an unprotected hill where lightning is particularly severe, nearly every electrical storm had been responsible for one or more transformer and meter burn-outs, in spite of a rather high density of arrester installations. In rebuilding, the transformers were removed as far as possible from the brow of the hill and were installed in lower and better protected areas, the secondaries, somewhat longer than usual, being solidly grounded at every second span. The ensuing summer season saw a material improvement in service, and transformer renewals were considerably decreased in number.

Racks on tangent poles should have wires tied on the outside of the insulator spools, i.e., on side away from pole (Fig. 2 upper left center).—If this is not done, a wire riding down off the insulator, as often happens even with cross-arm construction, would ground the secondary on the metal of the rack. If this happens, the displacement of the wire from the proper position would not be over 1½ in. (3.87 cm.), making detection difficult. Further, if the wires are strung inside the rack, on the pole side of the insulator, the wires must be laboriously pulled through each rack or the rack must be completely disassembled, considerable time being consumed in the operation. When the wires are pulled tight, unless extreme care is exercised, the linemen are apt to leave a rack here and there with the tie wires unattached. If the wires are tied on the outside, failure to tie in firmly will cause them to fall entirely away, making preliminary inspection and subsequent "trouble shooting" easy. As racks need not be disassembled, a saving in construction time is also apparent (Fig. 2 left). In turning corners and at angles in the line the position of the wires on the insulators will depend on the direction of the strain (Fig. 2 left center).

DEAD-END LONG SECONDARIES AT CORNERS

In turning corners secondaries longer than two spans in either direction should be dead-ended in both directions at the corner (Fig. 3).—This construction is specified to prevent chafing of the insulation and crystallization of the copper as the pole sways slightly in the wind, and to provide construction less susceptible to the communication of physical influences affecting adjacent spans. When dead-ends are made in both direc-

Good and Bad Practices in Secondary-Service Construction

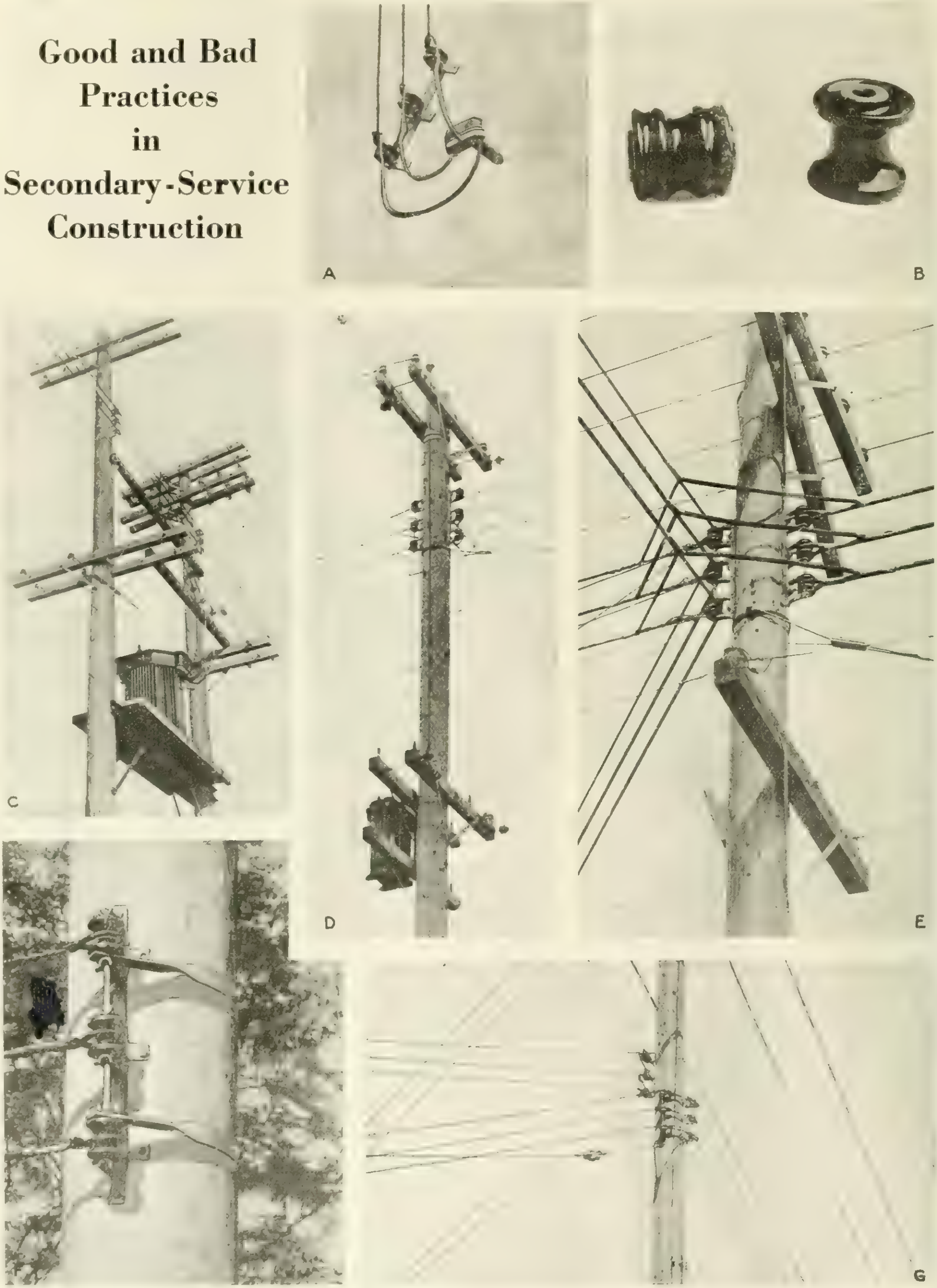


Fig. 1—A—Placing house-service neutral at top protects against falling primary and signal wires. B—Insulator at right provides ample space for service pull-offs. C and D—Low-hung transformers connected with secondaries at top of pole. E—Heavy secondary construction that affords free climbing space. F—No. 6 wire dead-ended on light rack. G—Faulty construction in which too light rack is used and no climbing space.

tions, subsequent change of position or renewal of rack can be very easily made without cutting the secondary.

Dead-ends should be made on bare copper and soldered (Fig. 3).—When an insulated wire is dead-ended on a single insulator, the free end will start to unwrap and twist back on the span wire as soon as the pulling blocks are eased off, if the tension is appreciable. With cross-arms double-arm construction affords adequate support at dead ends, but in vertical construction dead-ends are of necessity made on a single insulator. Since rather small sags are employed with a considerable stress on dead-end supports, some method must be employed to maintain the sag selected. If the insulation is removed, a rigid twist made on bare wire and solder then applied, more than twice the pull can be exerted before the end will start to unwrap. It should not be understood that any dependence is placed on the solder for mechanical strength. The main support of the span wire depends on the twist given to the free end at the insulator. Solder is used only to insure greater adhesion of the bared copper and to improve the rigidity of construction.

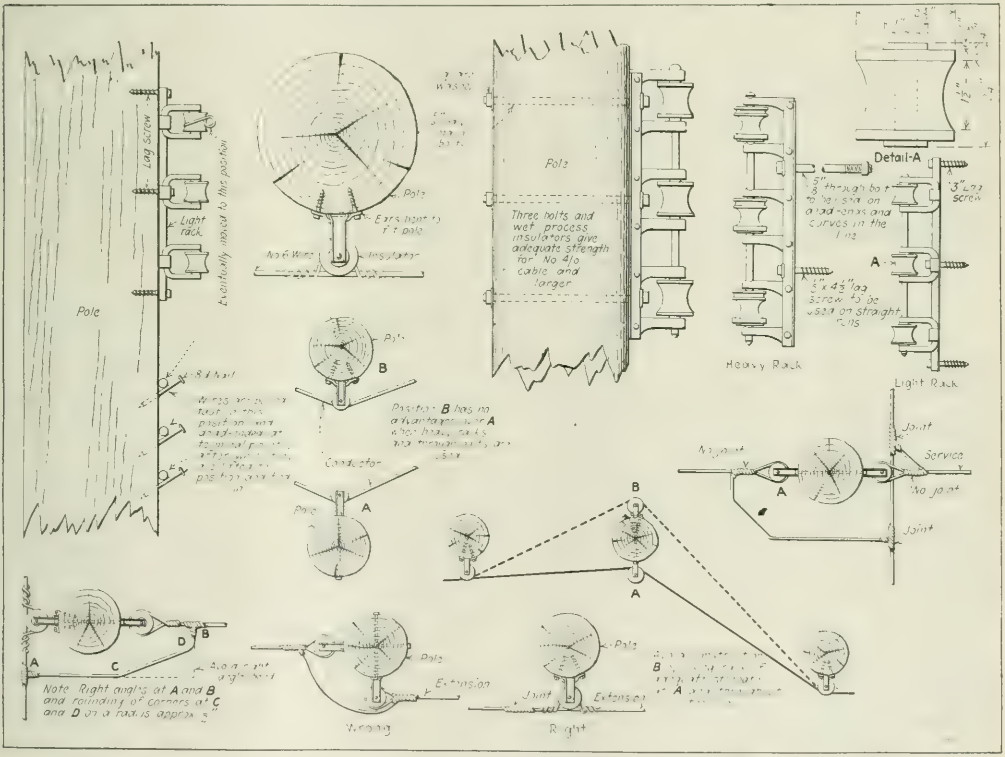

Lag screw
Light rack
Eventually moved to this position
Pole
8d Nail
Pole
Ears bent to fit pole
No 6 Wire
Insulator
B
Position B has no advantages over A when heavy racks and through bolts are used
Conductor
A
Pole
Three bolts and wet process insulators give adequate strength for No 4/0 cable and larger
Heavy Rack
Detail-A
5/8" through bolt to be used on dead-ends and curves in the line
3" lag screw
A
1/2" x 4 1/2" lag screw to be used on straight runs
Light Rack
Joint
Service
No joint
A
Joint
B
A
B
D
A
C
Note Right angles at A and B and rounding of corners at C and D on a radius approx
Pole
Extension
Wrong
Pole
Joint
Extension
Right

FIG. 2—SOME FORMS OF CONSTRUCTION WHICH WERE FOUND PREFERABLE TO OTHERS

Dead-ends should be supported on racks only, not on strain insulators.—Since racks with adequate strength for any purpose can be obtained, it was decided that there was no reason for dead-ending on strain insulators, where the eye-bolts, thimbles, guy-wire, etc., required would make none too neat a job and cost considerably more to install. At any rate, a rack would be required for service pull-offs, and by using wet-process insulators, which are specified by this company for all heavy racks, one rack would provide for both the heaviest secondary dead-ends and any service pull-offs required. Where wires heavier than No. 2 are used three through-bolts are installed at dead-ends (Fig. 2 top center).

USE RACKS OF PROPER STRENGTH

Racks having adequate strength for the purpose intended should be used.—Specifically, the light rack shown in Fig. 2 (right) is used only for No. 6 secondaries. It is felt to be a decided mistake to use this rack for heavier wires. All sizes over No. 6 are installed on the heavy rack shown in the same figure. For No. 6 dead-ends the rack is installed on the side of the pole, to facilitate extensions and to remove the direct strain from the lag screws (Fig. 1 F). For larger secondaries the heavy rack is placed on the face of the pole, to prevent twisting or splitting of the pole and to develop its full strength and the full strength of the supporting bolts (Fig. 1 E). If an extension be later required, the rack is moved to side of pole as shown in Fig. 2 (bottom), the alternative method not being permitted because unworkmanlike and objectionable in appearance.

Racks should be installed with lag screws and bolts, no nails or screws to be permitted.—Bolts and lag screws are used, as shown in Fig. 2 right, to develop the full strength of the rack.

Racks and brackets should be confined to the particular use for which they are specified.—Fig. 2 right shows pole rack and brackets, while the bracket shown in Fig. 1 A is intended exclusively for supporting service wires at the building. The latter are not permitted on poles on account of considerations of strength. For house use, however, the "loop-through" construction is advantageous, and it is economical in first cost. Therefore, for the sake of uniformity, the light pole brackets are under no circumstances used for house brackets. Promiscuous interchanging of the functions of the various brackets is not permitted.

Only one set of secondaries should be strung on racks on a given pole.—If two secondaries (*e.g.*, a single-phase and a polyphase power secondary) are required, they may be advantageously placed on cross-arms. Two racks mounted one above the other take up considerable space on the average pole, while if they are mounted on opposite sides of the pole inadequate climbing space is left (Fig. 1 G) unless extension brackets are used, strength and rigidity of construction being usually sacrificed in the process.

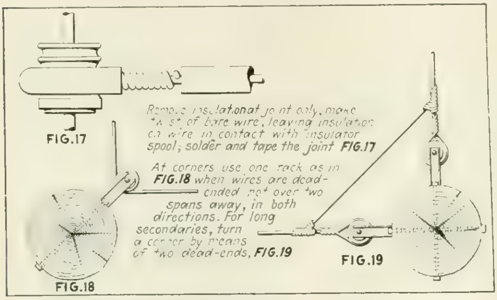


FIG.17
Remove insulation at joint only, make twist of bare wire, leaving insulation on wire in contact with insulator spool; solder and tape the joint FIG.17
At corners use one rack as in FIG.18 when wires are dead-ended not over two spans away, in both directions. For long secondaries, turn a corner by means of two dead-ends, FIG.19
FIG.19
FIG.18

FIG. 3—FORM IN WHICH INSTRUCTIONS ARE ISSUED TO LINEMEN

Racks should always be placed on the same side of the pole throughout the run and on that side of the pole from which most of the services are run.—This is done even if the pole line offsets or changes direction, with wires falling into the strain position shown in Fig. 2 (lower right). Maneuvering to obtain position B is not justified if proper racks are used and properly attached.

Wider-Spaced Racks Best

Racks having a spacing of 8 in. (20.3 cm.) between wires are used exclusively by the Chillicothe company. The only advantage discovered for the occasionally used 4-in. (10.2-cm.) spacing was the lower reactive drop in the wire. Computation on several typical secondaries showed a negligible saving in voltage loss of the order of 0.01 volt to 0.03 volt. On the other hand, the wider spacing is of advantage in maintaining proper clearance between conductors under unfavorable weather conditions, and it is of great advantage when running services and in soldering connections, where a slip of the hand may bring a lineman's pliers or solder ladle across the bared wires, an interruption to service as well as injury to the workman resulting. This is particularly true where the wires are large and the transformer is fused heavily.

Wiring of transformers on poles is still a subject of study by the company, particularly where it is desired to mount heavy transformers at say 15 ft. (4.5 m.) from the ground, while the secondary must of necessity be mounted at the third or fourth gain of a 45-ft. (13.7-m.) or 50-ft. (15.2-m.) pole. If the vertical buses are left unsupported, even solid wire will not make a sightly job, while the use of cross-arms is unsightly and expensive. Transformer installations where this difficulty was encountered are shown in Fig. 1 C and D. The company would appreciate any suggestions on how to obviate the trouble.

The specifications mentioned were prepared in the form of small blueprints measuring 4 in. x 7 in. (10 cm. x 17.5 cm.), the same size as the meter and service specifications of the company, described in the Electrical World for Feb. 28, 1921, page 359. They were supplied to the line foreman and other employees concerned, and in a few cases both sets of specifications were bound together for the use of inspectors, draftsmen and others. An example of the form of specifications is shown in Fig. 3. These specifications are presented largely in the hope of inspiring constructive criticism and to call attention to the fact that the problems of rack construction are real and require study. Inspection of rack construction in a number of cities and towns leads to the belief that the operating company has permitted racks to be installed without the engineering department having previously given any study or attention to the matter, the usual result being failure to utilize to the full the advantages of this type of construction.

J. C. Martin is general manager of the Chillicothe company and F. K. Sexauer resident manager.

Records of Material in Stock Should Be Simple

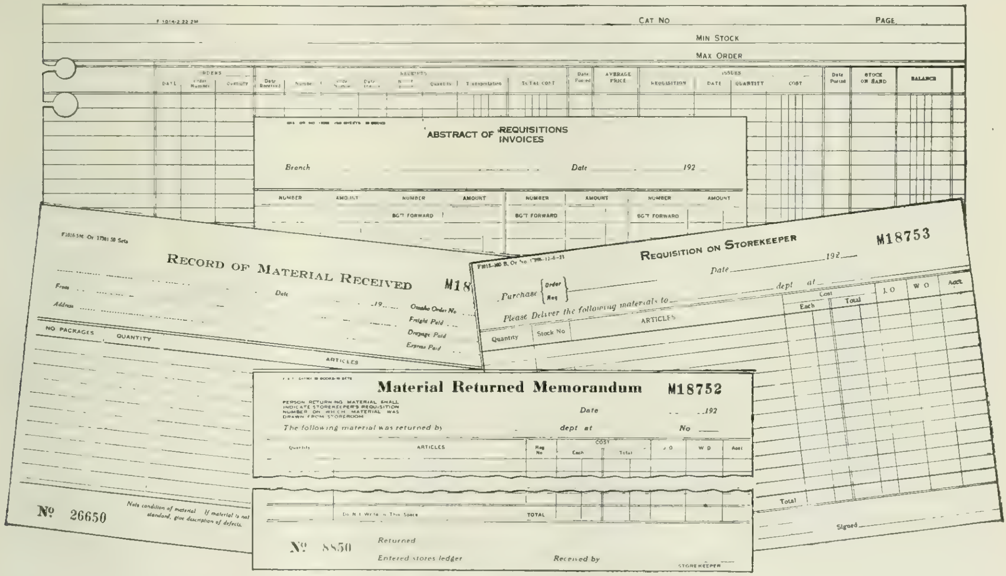
Only Four Forms and Two Book Records Used in Accounting for Storeroom Stock of the Nebraska Power Company

By Roy Page
General Superintendent Nebraska Power Company, Omaha, Neb.

A simple and yet comprehensive system of accounts is necessary to maintain an accurate record of material and supplies. Without such a record a considerable expense may be incurred in the course of a year, through loss, theft, breakage and the like. The three principal elements of such a system are the stock on the shelves, the stock ledger and the stock-control account. These three items should be kept in continuous balance, and it was for the purpose of maintaining such a balance that the system to be described was put into operation at the Nebraska Power Company's store.

Four forms are used in handling receipts and issues of material—the receiving, requisition, return and invoice abstract forms. The receiving form is made in triplicate (6 in. x 9 in.) by the storekeeper, a separate slip being made to cover each shipment of material received, regardless of whether such shipment comes from a manufacturer or is returned to the storeroom by some department. The original is sent to the purchasing agent, the duplicate to the stock-ledger clerk and the triplicate retained by the storekeeper. The requisition form is made in triplicate (6 in. x 9 in.) by any one desiring to withdraw material from the storeroom, and no material may be withdrawn except by such a requisition. The original is presented at the storeroom when the goods are withdrawn, the duplicate sent to the stock-ledger clerk and the triplicate retained in the maker's file. The return form is also made in duplicate (6 in. x 9 in.) and is in the nature of a journal entry, charging stores and crediting an operating or construction account. The original is sent to the stock-ledger clerk and the duplicate retained in the maker's file. An invoice abstract form is used to abstract totals of invoices or requisitions posted in the stock ledgers for the purpose of making entries in the control account. It is made in duplicate (8 in. x 11 in.). The original accompanies the invoices or requisitions and the duplicate is retained by the stock-ledger clerk.

Only two book records are used in covering stores transactions—first, the control ledger, which deals in totals only and is debited from the abstracts of invoices and credited from the abstracts of requisitions; second, a combination detail stock ledger and stock record. No record of stock is kept at the storeroom; in fact, no records are kept by the storekeeper other than a file of purchase orders and the receiving-slip duplicates. On his copy of the purchase orders he keeps a record of shipments received, filing the order away as "filled" when all shipments covered by it are complete.


CAT NO
PAGE
MIN STOCK
MAX ORDER
ORDERS
DATE
RECEIPTS
TOTAL COST
Date Posted
AVERAGE PRICE
ISSUES
REQUISITION
DATE
QUANTITY
COST
Date Posted
STOCK ON HAND
BALANCE

ABSTRACT OF REQUISITIONS INVOICES
Branch Date 192
NUMBER AMOUNT NUMBER AMOUNT NUMBER AMOUNT NUMBER AMOUNT
BG'T FORWARD BG'T FORWARD BG'T FORWARD

RECORD OF MATERIAL RECEIVED M18
From Date 19
Address Omaha Order No.
Freight Paid
Drayage Paid
Express Paid
NO PACKAGES QUANTITY ARTICLES
Nº 26650
Note condition of material. If material is not standard, give description of defects.

REQUISITION ON STOREKEEPER M18753
Date 192
Purchase {Order / Req}
dept at
Please Deliver the following materials to
Quantity Stock No ARTICLES Cost Each Total J. O. W. O. Acct.
Total
Signed

Material Returned Memorandum M18752
PERSON RETURNING MATERIAL SHALL INDICATE STOREKEEPER'S REQUISITION NUMBER ON WHICH MATERIAL WAS DRAWN FROM STOREROOM
Date 192
The following material was returned by dept at No
Quantity ARTICLES Req No COST Each Total J. O. W. O. Acct.
Do Not Write in This Space TOTAL
Nº 8850
Returned
Entered stores ledger
Received by
STOREKEEPER

FIVE FORMS FOUND HELPFUL IN KEEPING STORES RECORDS

The detail stock ledger and stock record is the full and complete record of orders, shipments received, invoices, prices, issues and stock on hand. The stock-ledger sheet is divided into three main heads—orders, receipts and issues. The stock-ledger clerk receives copies of all purchase orders covering material which will be charged to "stores" (those covering material which will be charged to an operating or construction account direct being omitted) and enters such orders in the columns provided. When material has been received in the storeroom, he enters from the "receiving slip" the date and quantity received, in the proper columns. Invoices received later to cover these shipments are posted in the columns provided. Requisitions which have been filled by the storekeeper are sent to the stock-ledger clerk daily and are posted under "issues." In a column headed "stock on hand" is carried forward a continuous record of the quantities of material still in stores (*i.e.,* quantities on hand plus receipts minus issues), and monthly or at other necessary intervals the quantity and money balance is extended to a "balance" column.

The basis upon which this system is founded is that a "store number" shall be given to each successive stores transaction, whether receipt or issue, by the storekeeper. These numbers are consecutive and are applied to both "receiving slips" and "requisitions" with a numbering stamp. From that time on, all documents relating to that particular transaction are marked with this "store number," and this number is used for posting, reference and all other records. For example, a purchase order is placed for a hundred machine bolts. The first shipment received on this order is fifty bolts. A "receiving slip" is made for the fifty bolts and is stamped "Store No. 451." This number appears on the original sent to the purchasing agent and on the duplicate sent to the stock-ledger clerk. The latter, upon receipt of his copy, posts in the proper columns under "receipts" the "Store No. 451," date, order number and quantity received. Later, when the invoice is received by the purchasing agent to cover the shipment, the same "Store No. 451" is transferred to the invoice and the invoice sent to the stock-ledger clerk. The latter again uses this number (451) in posting and listing the invoice on his "abstract of invoices."

The advantages of this "store number" system are three: First, it insures that every transaction taking place in the storeroom must eventually be entered on the books; second, it insures that every transaction entered on the stores ledger shall be entered on the control account; third, it fixes the date of each stores transaction regardless of when requisition or other papers were dated, which is very helpful during inventory or when balancing detail against control accounts. It is only necessary to know the first and last number posted and that the same "store numbers" have been posted to both detail and control accounts to know whether or not a clerical error has been made.

Instead of the usual annual inventory, with the attending extra labor of counting, pricing and extension, a perpetual inventory is kept in operation by the following means: Whenever material is received a count is made by the storekeeper and entered on the "receiving slip" covering such material. This count, when received by the stock-ledger clerk, is checked against the stock on hand as shown by the ledger, and errors are run down and corrections made when necessary. The "store number" on the "receiving slip" will provide a means of knowing that all transactions to date have been posted. This arrangement reduces the work of inventory and in addition keeps the ledger in much closer agreement with the stock on the shelves.

Corrections are made much more often on rapidly moving stock than is possible with any other system. Shortages will be discovered in time to investigate before they become "stale," and rapidly moving stock is inventoried frequently while slower-moving stock is counted less frequently, which is desirable. An annual inventory, while interesting, is seldom of great value owing to the fact that before such an inventory can be priced and extended and entered on the books errors have already been taking place which tend to throw the ledgers and stock out of balance.

On each ledger sheet a space is provided for the "minimum allowable stock" and the "maximum allowable order." These quantities are fixed by some one familiar with the requirements of the system and are based on the quantities used per unit of time, the time necessary to obtain shipments, standard-package discounts and such other items as may enter. Items for which a "minimum stock" and "maximum order" have been fixed are ordered through the purchasing agent by the stock-ledger clerk, who places an order for the "maximum" when his books show that his stock has fallen to the specified "minimum." Material not regularly used is usually marked with a "minimum," and the name of the head of the department which uses such material is inserted under "maximum order." When such stock reaches the specified minimum, the department head is notified, and he may instruct that additional material be ordered or that such material shall no longer be used.

Labor Used in Building Power Plant Is 10.62 Man-Days per Kilowatt

ON THE Kerckhoff and Kern Canyon projects, the two hydro-electric developments most recently completed by the San Joaquin Light & Power Corporation of Fresno, Cal., the total labor charges on the jobs were divided by the average wage, and this figure in turn was divided by the number of kilowatts of installed capacity to determine the number of man-days used in installing one kilowatt. On the Kerckhoff job the figure of 9.55 man-days was obtained on an installation of 42,600 kw., while on the Kern Canyon job, which was the enlarging of an old project and presented more difficulties, the figure of 14.90 man-days per kilowatt was obtained on an installation of 10,600 kw. Adding the total man-days on these two jobs and dividing by the total kilowatts of the two installations gives an average of 10.623 man-days per kilowatt.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Hawthorne as an Electrical Prophet

To the Editors of the ELECTRICAL WORLD:

One of my hobbies is the collecting of books of quotations, and from these books I have been for some time selecting passages that interest me particularly. In one of my collections I have come across the following:

"Is it a fact—or have I dreamt it?—that by means of electricity the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time? Rather, the round globe is a vast head, a brain, instinct with intelligence; or shall we say it is itself a thought, nothing but thought, and no longer the substance which we dreamed it?"—*Nathaniel Hawthorne.*

When one remembers that Hawthorne's day was that of Emerson and Thoreau, long before the marvelous electrical development of the last thirty years, one marvels at the far reach of his imagination. You can almost see the prophecy of the radio telephone in his vision of the future. J. ROBERT CROUSE.

Cleveland, Ohio.

Yellow or Amber Glasses Best When Welding

To the Editors of the ELECTRICAL WORLD:

On page 485 of the March 11 issue of the ELECTRICAL WORLD appear a number of safety rules for arc welders adopted by a Pacific Coast industrial concern. A formal set of rules such as this is very valuable, in that the instructions to the operator are put in brief form, are concise and make it easy to call the operator's attention to points that should be absorbed. They also serve as a constant reminder and tend to prevent the operator becoming careless.

The subjects are very well selected, but the first two are, I believe, based on false premises. It has long been known that blue glasses reduce the glare of ordinary light to a very great extent. For this reason a welder feels that they will do the same with the light from the arc. This is not the case, however. In the December, 1918, issue of the *General Electric Review* W. S. Andrews discusses this question, illustrating his article by numerous spectra. One illustration, showing the spectrum of the "Mazda" lamp compared with that of an iron arc, proves that the "Mazda" lamp has more of the red radiation and not so much of the ultra-violet as the iron arc. This is logical from the fact that the iron arc is at a much higher temperature than the filament of the "Mazda" lamp. The spectrum, comparing various glass screens, is based on the use of the "Mazda" lamp, and in comparing these glasses for welding service it should be borne in mind that the range of light will extend further into the ultra-violet than is shown by the illustrations. Another illustration (spectrum C) shows the light from a "Mazda" lamp as viewed through a sheet of clear colorless glass. This shows very little absorption, the range being practically the same as without the glass. There is comparatively small absorption of the ultra-violet. In the same illustration (spectrum G) is shown the result of using a cobalt-blue glass. This glass absorbs considerable of the radiation in the red and yellow, but transmits practically all the radiation in the ultra-violet.

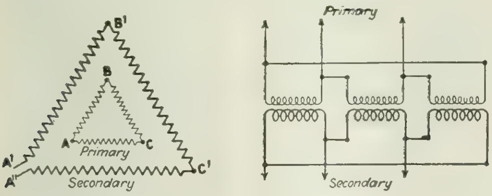
The false feeling of security engendered by using blue glass for welding has caused more than one pair of sore eyes. A much better practice is to use yellow or amber-colored glasses in goggles. This glass cuts off the ultra-violet, as shown in spectrum E of this same illustration. At the same time it permits greater visibility of the objects about the room, a very desirable quality since the operator wears these glasses at all times.

H. L. UNLAND,
Power & Mining Engineering Department.
General Electric Company,
Schenectady, N. Y.

Checking Transformer Connections

To the Editors of the ELECTRICAL WORLD:

Referring to the article on "Two Methods of Checking Transformer-Bank Connections," by Eustace C. Soares, in the ELECTRICAL WORLD of Feb. 18, the voltage measured across $A'A''$ in the delta connection is not always as he states, namely, either zero or twice normal secondary-phase voltage. The voltage at these points before closing the delta may be 20 or 30 per cent of phase voltage due to harmonics, and yet the connection would be correct. If a slight load is applied, however, to these two points with the voltmeter still attached, the voltage will collapse and on closing the delta would be apparent only in a very small negligible circulating current. If there is no possibility of a small section of the winding being reversed, as might be the case when such sections are installed for slight increases in line voltages to overcome line drops, then it would be considered safe to connect the points $A'A''$ if a voltage less than half normal secondary-phase voltage existed across the two points previous to connecting them together.



LEFT, SECONDARY LEFT OPEN FOR CHECKING VOLTAGE $A'A''$. RIGHT, STANDARD DELTA-DELTA CONNECTIONS

The incorrect connection—one or two phases reversed—would be more readily noticed because of the much higher voltage present in that case. This peculiarity, due to harmonics and occasionally to slight variations in coil windings, is not so noticeable when phasing out for series or parallel connections so the voltmeter method can then be depended upon absolutely.

A lamp bank is generally more preferable for phasing out low-voltage transformers than Mr. Soares' second method of blowing a fuse. If the lamps light when connected to points $A'A''$ instead of the fuse, it would, of course, indicate that there is a current flowing which would be due to unequal voltages caused by incorrect phase connections. This method, however, must be applied with intelligence and lamps must be used in series to correspond to voltage of the transformer.

Franklin Union, Boston, Mass. EDWARD A. GIBBS.

Destruction of Wooden Poles by Insects

To the Editors of the ELECTRICAL WORLD:

R. E. Cunningham, superintendent of distribution for the Southern California Edison Company, Los Angeles, called attention to the destruction of wooden poles, cross-arms and pins in a letter published in your columns on April 8. Mr. Cunningham refers to the ravages by termites, sometimes called "white ants."

Different species of termites have been found in latitudes as far north as Massachusetts and New Hampshire, and very serious destruction has been wrought by them. However, destruction of wooden poles is by no means limited to the work of these insects. We have recently examined a large number of telephone poles which have been almost totally destroyed by the work of another insect, popularly called the black ant or carpenter ant, *camponotus herculaneus pennsylvanicus*, indigenous to the eastern section of the United States.

This ant appears to be one of the most destructive and most cunning in its habits. A series of telephone poles on one street alone were attacked in a manner very similar to that shown in the picture by Mr. Cunningham. The ants hollow out entire trees, cherry, chestnut and even hard maple. They usually nest in these trees and from these nests send out foraging parties, which finally establish themselves in other habitations. They live partially on the wood but dig out the wood with their powerful mandibles and build for themselves most elaborate tiers and tenements.

On first noticing this destruction, which had extended also through the main supports of several wooden houses, Dr. L. O. Howard, in charge of the Department of Entomology of the Department of Agriculture in Washington, was consulted. The advice rendered by Dr. Howard indicated a most effective method of dealing with these insects. They appear to be almost indifferent to the harshest poisons known to man, but it has been found possible to asphyxiate them by means of the vapor of carbon disulphide, CS_2. Impregnation of wood by means of creosote and other coal-tar preparations does not appear to be of much value, though it appears to spoil the taste of the wood for the insects for some time.

There is no doubt in the writer's mind that the menace from these insects is incalculable and that we are only beginning to enter into a period where the destructiveness of the ants will be carefully observed and their work traced to the source. It is a fair prediction that in the future man will have to contest with the ant for the possession of structures which contain wood, and, in fact, it would appear unwise to utilize wood where it is exposed to insects' attacks.

The wholesale destruction of telephone and telegraph poles which occurred in New England during the severe sleet storm in the early part of last winter indicated very clearly the deterioration of the timber wrought by both the white ants and the black ants.

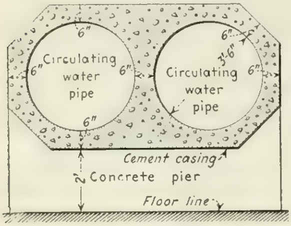
B. A. BEHREND,
Boston, Mass. Consulting Engineer.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Repair Condenser Circulating-Water Pipe with Concrete

TO SAVE the cost of a shut-down of a 12,000-kw. steam turbine at the Redondo station of the Southern California Edison Company while the circulating water pipes were being repaired, the expedient of incasing the entire pipe in concrete was used. Serious leaks had developed from inside corrosion caused by the circulating sea water, but the turbine could not be spared from service for the month that would have been required to replace the old steel pipe with a new one. The pipe was, however, too badly corroded to permit of successful patching. After investigating various methods of making repairs, it was found that it could be incased in concrete for about one-half the cost of renewal.



INCASING LEAKING CIRCULATING-WATER PIPE IN CONCRETE CUTS COST OF REPAIRS IN HALF

A form was built around the pipe, the pipe itself being used as the inside form, and the concrete was poured to the shape shown in the accompanying cut. Throughout the work the turbine was in operation. One hundred and seventy-five feet of piping was repaired by this method, and this pipe has been in successful operation for a number of years without any leaks having developed.

J. W. ANDREE,
Engineer Operating Department.
Southern California Edison Company,
Los Angeles, Cal.

Park Cable Laid Across Marshland in Shallow Trench at Low Cost

PARK cables of unusually great length and high voltage have recently been installed between Flushing and Forest Hills, Long Island, covering a distance of about 2½ miles between ends of existing conduit systems. Two similar cables are laid in a trench 12 in. wide and 18 in. deep. They serve as parts of tie lines between the Flushing and Jamaica substations of the New York & Queens Electric Light & Power Company.

Three-conductor, 15,000-volt cables are used in the above installation. The conductors are sector-shaped, and the insulation is impregnated paper protected against moisture by a lead sheath. The armoring consists of two galvanized-steel tapes with a layer of asphalted jute over and under the armor. The cable is, in fact, an ordinary paper-insulated, lead-covered cable such as is installed in underground conduits, with the addition of steel-tape armor to protect it against mechanical injury after it has been laid in the trench.

The reasons for laying the cables in a trench rather than constructing either an aërial or a conduit line in this particular case are:

1. The cables are entirely within the limits of the city of New York and the municipal authorities will not permit aërial construction for such high voltages. Underground construction is therefore imperative.

2. The route which the cables traverse is practically open country, the lowlands being marshes and the higher ground farmland. The marshland is being gradually filled in and is, moreover, intersected by numerous small creeks and the following conditions render conduit construction undesirable:

(a) The difficulty and expense of constructing conduit in marshland.

(b) The creeks which have to be crossed call for armored cable of some kind, and park cable is entirely adequate for these. It is an easy matter to dig a trench at low tide to the edge of the water and lay the cable through it without splices. If conduit construction with plain lead-covered cable had been employed, it would have been necessary to splice the sections of armored cable at these crossings.

THIS TRENCH METHOD OF LAYING CABLE SAVED THE EXPENSE OF CONSTRUCTING CONDUIT

Left—Cable unwound from reel on truck and laid in trench by six men. At the same time one man straightens out bends while another brakes the reel as the cable is unwound. Right—In crossing a creek the trench was dug to water level at low tide and the cable laid across.

(c) Although the route of the cables is along highways or streets, some of them have not yet been cut through. This, together with the fact that all of this territory is still in an undeveloped condition, makes it at present impracticable to determine the ultimate levels of either proposed or existing streets.

(d) If later on it becomes necessary to take up the park cable when this section is more fully developed, the armor may be stripped off, leaving an ordinary lead-covered cable which can be installed in conduit. It is, however, expected that there will always be considerable use for park cable in this territory.

When paralleling a highway the trench has to be dug along one side as shown in the illustration. At several points, however, it has been possible to reduce distances materially by leaving the main highway and cutting across swamps and farms. In such cases proposed streets are always followed, although they may not be cut through for many years to come.

Considerable ingenuity had to be exercised to get the large electric trucks carrying heavy reels of cable across the soft ground. It was frequently necessary to construct temporary roadways of planks, and where swamps were crossed the cable had to be pulled by means of a winch on the truck with the aid of tackle attached to convenient trees, etc. The picture on the left shows how the cable is unwound from the reel on which it is shipped and laid in the trench. Although the cable is heavy, six men can lay it in the trench with little difficulty. When conditions are favorable, as along improved highways, where the electric truck can be operated without difficulty, six 500-ft. reels of cable can be laid in a day.

Up to the present time the use of this type of cable has been almost exclusively confined to ornamental street and parkway lighting, but there are a great many other services in which it may be employed to good advantage. It may reasonably be expected that the use of park cable will be greatly extended in the near future, not only in the entirely new fields produced by the inevitable abolition of the isolated plant and the increased utilization of central-station power, but also in those fields where it is now used to a limited extent. The fact that one of the largest and most highly developed power companies has seen fit to resort to the use of park cable on a large scale is a fact of much significance. F. A. Westbrook,
Habirshaw Electric Cable Co., Field Engineer.
New York.

Standards for Testing Welds

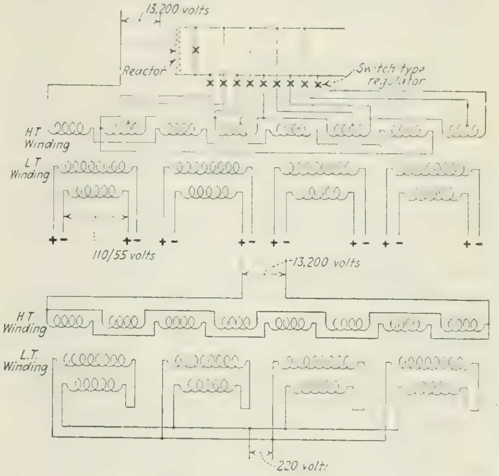
Standardization of the procedure in making a test of any kind is obviously necessary before results obtained by different observers can be compared. This is particularly true of welds because of the non-homogeneity of the welded specimens and the irregular section of the added metal. Because of these two factors and differences in details of test procedure widely divergent results and comparisons are frequently made. Consequently the usefulness of much of the research work recorded is restricted, and in many cases the statements are actually misleading.

To correct this condition a committee of the American Welding Society has drawn up specifications for standard tests of welds, comprising shop standards, commercial standards and research standards. These specifications are available in bulletin form and may be obtained from the society.

New York. Field Editor Electrical World.

Special Transformers Reconnected with Increased Capacity

There are many transformers in plants about the country which were built specially for particular duties during the war and are now set aside and looked upon as obsolete. If these were carefully examined, many could be salvaged at little expense by reconnection and rearrangement of their coils so as to be of service for some other duty for years. A change of this kind was made successfully by an electric furnace company which had on hand some special transformers bought for supplying furnaces. Not only were they saved, but also by reconnection the capacity of each was doubled.



FURNACE TRANSFORMERS SALVAGED FOR INDUSTRIAL MOTOR LOAD BY RECONNECTION

These were single-phase, 600-kva. transformers of the regulating type, 13,200 volts primary and 55/110 volt secondary. The range from 55 volts to 110 volts on the secondary was accomplished by a regulator which selected tap after tap on the primary winding and thus regulated the secondary voltage by means of cutting in or out certain sections of the high-tension winding. These transformers were designed and built expressly for the one duty and were not considered available for any other service. After the war three of these transformers were placed out of service. When business conditions changed the plant commenced to require considerable more power to operate its small industrial motors. At first glance it did not seem possible that the furnace transformers could be adapted to this service on account of the poor efficiency they offered at any reasonable load and voltage connection. However, upon more complete investigation it was found that they could be reconnected to supply the load efficiently.

In this investigation it was found that the primary and secondary windings each consisted of eight coils. In operating in conjunction with furnaces, to secure 110 volts on the secondary only four coils on the primary were used. The steps down to 55 volts were made by cutting in series across the 13,200-volt supply the other coils by means of a switch-type regulator. These connections are shown at the top of the accompanying illustration. The secondary coils were all connected in parallel for supplying the furnaces. The four regulating coils of the primary were of the same capacity as the main coils, so by simply cutting out the regulating device and connecting these coils in series, paralleling them with the main coils as shown in the lower part of the illustration, the capacity of the transformer was increased from 600 kva. to 1,200 kva. as the capacity of the primary was now doubled and the secondary coils before the change were capable of carrying the full load of 600 kva. at 55 volts. The connection shown at the bottom of the illustration is for 220 volts. By other combinations 110 volts or 440 volts may be obtained.

ALFRED L. WILLIAMS,
Niagara Falls. Consulting Engineer.

Closed-Circuit Generator Ventilation and Prevention of Fires

DURING the past year there have been completed three installations in which generator cooling is accomplished by the passage of air through water sprays in a closed circuit, according to the report of the electrical apparatus committee presented at the recent convention of the National Electric Light Association at Atlantic City. These installations have been designed to obtain cleaner windings, decreased liability of internal fire and lessened combustion, and in one case the conserving of the heat losses from the generator. The experiences of one company along this line were brought out in the discussion, a part of which is given in the following paragraphs.

Nicholas Stahl, Narragansett Electric Lighting Company, Providence, related his experience with the closed-circuit system of ventilation for generators, in which the cooling water is used for boiler feed. He pointed out that when the power factor of the generator is low and the heat losses consequently high it is usually necessary to recirculate the cooling water, because more is required for ventilating purposes than for boiler feed. When a unit is started up after cooling down considerably, the cooling water is not started for several minutes in order to avoid condensation of moisture on the windings. Such successful results have been obtained that this system will be installed on later units.

Results of tests using carbon-dioxide to extinguish generator fires were also discussed by Mr. Stahl. In the installation referred to carbon-dioxide is stored in the tanks under 200 lb. pressure and is released into the closed-circuit ventilating air passages in case of fire. Two thousand cubic feet of carbon-dioxide is admitted into the ventilating space, which has a volume of 33,000 cu.ft. In tests recently made the percentage of carbon-dioxide at the end of one minute was 35 and at the end of thirty minutes was 0.6. The question is whether the concentration is great enough and of long enough duration to stifle combustion. Theoretically 10 per cent of carbon-dioxide should not support combustion. This condition is maintained for ten minutes in the installation referred to. Further knowledge on the subject is necessary.

A. E. Bettis, Kansas City Power & Light Company, cited experience with two generator fires, one of which caused sufficient current unbalance to cause the generator to be disconnected by differential relay protection before serious damage occurred. In the other case the generator was shut down before a short circuit occurred, although the insulation was badly disintegrated and the copper crystallized by overheating of a loose connection.

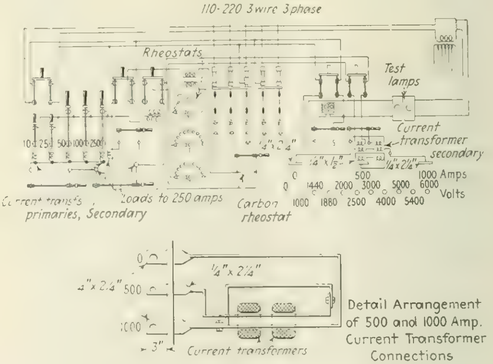
Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Compact Test Board Makes Tests Easy and Economical

A COMPACT test board requiring not more than 2 kw. for operating and suitable for making tests with alternating current up to 1,000 amp. and 6,000 volts is being used by a number of Pacific Coast central station companies for testing relays, switches, ammeters, current and potential transformers, coils and the like.

Five small transformers for obtaining and metering the current and a high-voltage transformer for insulation and ratio tests are the only special apparatus used. A small carbon rheostat is used to vary the current from 1 amp. to 1,000 amp. and a single 5-amp. ammeter for accurately reading the current.

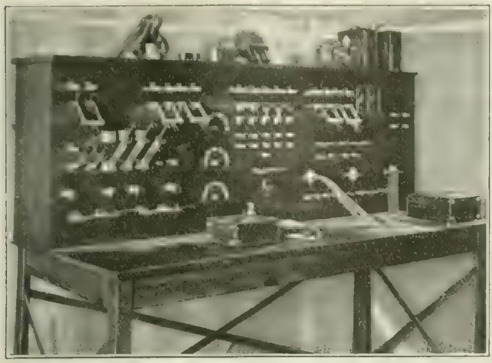
The high-voltage transformer has taps to conform to standard tests for 220, 440 and 2,200-volt apparatus. Taps are also brought out for standard ratios up to sixty to one for potential transformer ratio tests, etc. A fixed resistor is connected in series with the low-voltage winding, which reduces the line voltage from 110 to 100 and serves to limit the current flow when the high-voltage terminals are short-circuited. A lamp connected to the terminals of the resistor is lighted to full candlepower when the insulation of the apparatus under test fails. The control switch for this transformer, which is placed on the opposite end of the board from the transformer terminals, thus eliminating danger of shock to the operator, opens automatically when pressure on the handle is released. The diagram of connections for the instrument and test transformers is shown in Fig. 1.



A WIDE RANGE OF TESTS MAY BE MADE BY COMBINATION OF THESE INSTRUMENTS

The board also has a testing circuit to indicate grounds, open coils, etc. A small lamp in series with this circuit is lighted when the circuit under test is complete. For very high resistances a sensitive bell is used which rings through as much as 30,000 ohms. The five-pole switch in the center of the board connects a five-wire, 110-220-volt, three-phase, three-wire circuit to binding posts below. This circuit is convenient for testing voltmeters, small motors and electromagnets.

The frame of the testing panel is of steel and the



A SUBSTANTIAL TEST BOARD OF GREAT USEFULNESS

back and top are of asbestos ebony wood, making a safe, fireproof and substantial piece of apparatus, as shown in Fig. 2. The panel height is 5 ft. 5 in. and the length 6 ft. The cost, including all the apparatus and two instruments, did not exceed $750.

Brown & Pengilly, J. G. Moojen,
Los Angeles, Cal. Electrical Engineer.

Common Metals and Acids Cause Little Injury to Storage Batteries

The extent of the injury due to the presence of various impurities in the electrolyte of a storage cell was recently studied by Helen C. Gillette, according to a paper presented before a meeting of the American Electrochemical Society at Baltimore. The results of these tests indicate that, contrary to the general belief, most of the common metals and acids may be present in appreciable quantities without causing serious injury to the cell.

The characteristics of storage-battery performance which might be adversely affected may be classified under four headings: (1) The ampere-hour capacity or output of the battery on discharge; (2) the voltage characteristics on charge and discharge; (3) the rate of self-discharge of the charged battery upon standing, and (4) the life of the active material, which is conditioned mainly by the rate of mechanical disintegration in successive cycles.

The effect of the impurities on the output and voltage characteristics was much less than anticipated. In the case of the output the tests showed that the discharge capacity was unaffected except in three cases, namely, silver, manganese and platinum. In each of these cases a marked decrease of capacity was noted. When potassium permanganate was added to correspond to 0.025 and 0.05 per cent of manganese, after four weeks the batteries could not be charged. The addition of silver in water solution of silver nitrate with 0.5 per cent contamination resulted in the immediate precipitation of silver sulphate, short-circuiting the cells and reducing the capacity to 18 per cent normal. An addition of platinum even so slight as 0.00001 per cent caused immediate gassing with greatly reduced capacity. Observations of the voltage characteristics showed that antimony lowered the charge voltage for a few cycles only, while the other impurities, except silver and platinum, showed very little influence.

When considering the self-discharge of the battery and the life of the active material a much more varied behavior is apparent, as may be observed in the table. The self-discharge, or loss of capacity on standing, was determined by allowing the cells to stand after charging for intervals of one day, one week and four weeks respectively before discharge. They were then discharged at the five-hour rate. Since the same relative loss in capacity was observed for each of the periods. the four-week period only is recorded. This is the third column in the table, expressed as percentage of the previously determined capacity of the cell.

EFFECT OF IMPURITIES ON SELF-DISCHARGE AND LIFE OF CELLS

All metallic impurities were added one-half hour before completion of charge. Foreign acids were added with the original electrolyte on assembly of cells.

Impurity Percentage of Electrolyte Weight	Compound in Which Introduced	Percentage Former Capacity After Standing Four Weeks	Life Tests—Performance of Uncontaminated Cells Considered 100 per Cent
Magnesium... 0.05	$MgSO_4.7H_2O$ Sulphuric acid solution	92.5	85.7
.0.5		87.9	79.5
Manganese... 0.005	$KMnO_4$ Sulphuric acid solution	62 8	80 8
...0 01		65 4	42 8
...0.025		30 1	*
0 05		56 5	†
...0.05	Water solution	†49.2	*
...0 5		† 6 15	*
Zinc 0.05	$ZnSO_4$ $7H_2O$ Water solution	90.0	100.
.........0.5		95.5	104.5
Cadmium..... 0.05	$CdCl_2.2H_2O$ Water solution	77 2	110.
....0.5		84 1	50.
Iron......... 0.01	$FeSO_4$ $7H_2O$ Water solution	75.	105.2
........0.05		77.75	92 5
.........0.1		77.4	80 4
Nickel 0.05	$NiSO_4$ $6H_2O$ H_2SO_4 solution	76.8	109
.......0.5		76 8	103.5
Tin.......... 0.05	Metallic tin dissolved in sulphuric acid	85.5	94.95
..........0.5		74.4	92.43
Arsenic....... 0.05	As_2O_3 dissolved in HCl, digested with H_2SO_4 to expel Cl	76.	86.7
.... 0 5		59.5	86.2
Antimony.... 0.05	$SbCl_3$ in HCl solution	71.7	85.5
....0.5		47.3	51.1
Mercury...... 0.05	$HgSO_4$ water solution	93.5	104.
.....0.5		92.5	67.75
Silver, First test... 0 005	$AgNO_3$ in water solution	74.2	125.6
.0.05		83.9	112.9
...0.5		59.7	97.5
Silver, Second test. 0.01	$AgNO_3$ Solution digested with H_2SO_4 to expel nitric acid	83.	100
.0.05		74.3	100.
.0.1		69.6	106.8
.0.5		33.5	89.5
Platinum... 0.00001	$PtCl_4.5H_2O$ Water solution	. .	‡48.5
.0.01			‡16.4
Hydrochloric acid........ 0.01	HCl	¶	81.28
.......0.05	HCl	¶	86.3
.......0.1	HCl	¶	96 8
.......0.5	HCl	¶	77.25
. 1 0	HCl	¶	47.3
.......5.0	HCl	¶	20 42
Nitric acid.... 0.1	HNO_3	81.0	100 8
....0.5	HNO_3	84.0	98 8
1 0	HNO_3	92.5	100.
Acetic acid.... 0.1	$HC_2H_3O_2$	¶	101.
....0.5	$HC_2H_3O_2$	¶	101.8
....1.0	$HC_2H_3O_2$	¶	98
5 0	$HC_2H_3O_2$	¶	36 6

* Cells too low to put in life test.
† After standing one week.
‡ Loss to these figures in six cycles.
¶ Not tested.

The life test consisted of consecutive charges and discharges until the capacity fell to a definite fraction of its former value. Rating the performance of the uncontaminated cells as 100 per cent, the relative performance is tabulated in the last column.

New York. Field Editor Electrical World.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Central Stations and Contractor-Dealers Should Pull Together

By H. D. Stokes

Chairman Worcester District, Massachusetts State Association of Electrical Contractor-Dealers, and Power Engineer Worcester Electric Light Company

A DISPOSITION on the part of the contractor-dealer to recognize the functions and logical capabilities of the central-station company is much to be desired in the interests of harmonious working. On the other hand, a willingness on the part of the central-station company to appreciate the contractor's difficulties and to help him make a success of his business is equally essential to the prosperity of these two branches of the electrical industry. It is a privilege to be in a position to see both sides of the fence at the same time, and perhaps it would not be amiss to say here that there should in reality be no fence, no formal line, between the central station and the man who does wiring and sells electrical devices, for both are engaged in electrifying the community to mutual advantage.

The central-station company can well afford to take the leading part in making the contractor busy and prosperous. The latter has no easy job. He meets competition to a degree unknown to the central station, and altogether he has a hard row to hoe. All too real are the difficulties the contractor has to meet in the way of carrying on a merchandising business, in raising capital to maintain stocks of supplies, in handling a class of labor highly susceptible to turnover, and in adapting himself to the requirements of the central station, reasonable though these may be.

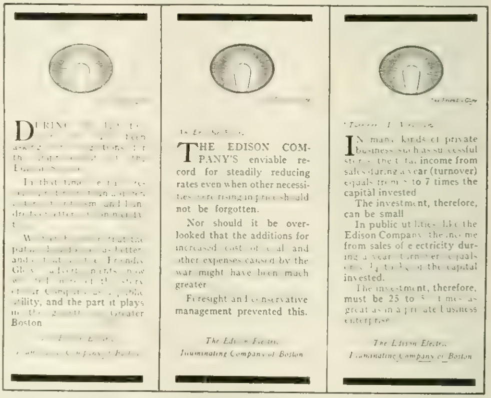
There is a real opportunity for helpfulness in the relation of the central station to the contractor-dealer. Selling appliances at list is a practice that should require no extended argument. By taking the contractor-dealer into our confidence we as central-station men need not give up the idea of selling electrical conveniences in competition with other agencies, but we can at least throw the field open to all on even terms. The pioneering of new and untried devices is peculiarly our province. The sale of fast-moving supplies to the public is the contractor's opportunity as well as the central station's, and, of course, we do not handle wire, armored conductor, loom and many other items of wiring materials of which the contractor usually has exclusive control in small-quantity sales to the man in the street.

Better business methods should be sought by the contractor, and the central station can assist here if it will and if the contractor is disposed to make the most of his opportunities. Through co-operative sales campaigns whole communities can be stimulated toward greater purchases of things electrical. Radio interest offers a common ground upon which to build better and larger local trade. The response of the public to the radio appeal shows clearly enough that both the central station and the contractor-dealer have failed to utilize to the full their mutual opportunities to sell electrical conveniences and service. Now the public is in the retail market talking in electrical terms as never before in the history of our business. To capitalize this willingness to buy, the central station and the contractor-dealer should put behind them all petty jealousies and play the game for all it is worth.

By bringing to the contractor's attention the latest developments in industrial lighting, for instance, aiding him in tests and foot-candle measurements, advising as to outlet locations and other layout points, much good can be done. If the contractor-dealer will on his part get rid of the animosities which sometimes hamper local trade development and if the central station will "go to it" to see that this hard-working brother in the industry has a fair field and every opportunity to "make good," the development in such communities as practice these relations will be of surpassing value.

Boston Edison Company Telling Its Story to the Public

A SERIES of advertisements remarkable for the compact brevity of their message has been started in the press of the Boston metropolitan district by the Edison Electric Illuminating Company of Boston, in harmony with the company's policy of letting the public know the facts regarding its work, service and place in the life of the community. The management has decided that it should clear up many misconceptions on the part of the public of the fundamental relations which exist between public utilities and those whom they serve.



THE EDISON COMPANY'S enviable record for steadily reducing rates even when other necessities were rising in price should not be forgotten.

Nor should it be overlooked that the additions for increased cost of coal and other expenses caused by the war might have been much greater.

Foresight and conservative management prevented this.

The Edison Electric Illuminating Company of Boston

IN many kinds of private business such as successful stores the total income from sales during a year (turnover) equals from [illegible] to 7 times the capital invested.

The investment, therefore, can be small.

In public utilities like the Edison Company the income from sales of electricity during a year (turnover) equals [illegible] of the capital invested.

The investment, therefore, must be 25 to [illegible] times as great as in a private business enterprise.

The Edison Electric Illuminating Company of Boston

TYPICAL ADVERTISEMENTS IN BOSTON EDISON COMPANY'S "FRIENDLY GLOW" SERIES

For about two years the company has been "running" advertisements under the title "The Friendly

Glow" in the local press, and these have sought constantly to encourage comment and suggestions as to the betterment of service and of public relations through increased contact of customers and others with the company's organization. Criticisms have been welcomed and many good ideas have come to the company from this series, which has previously been reviewed in the ELECTRICAL WORLD. Now, however, the company feels it desirable to go further into the subject of public relations, and it will be seen from the typical advertisements reproduced that even he who runs may read and learn a good deal about the "whys and wherefores" of public utility operation.

The advertisements which are to follow are designed to tell the company's story in language as simple as possible, to emphasize its management by home people, its ownership by thousands of the general public, and its service activities, aims and achievements. This publicity was originated and is being directed by L. D. Gibbs, superintendent of the company's advertising department.

Portable "Home Electric" Demonstration for Scattered Territory

TO BRING the "home electric" idea to the people in the smaller towns served by the Oklahoma Gas & Electric Company, O. A. Jennings, new-business manager of the company, recently instituted a traveling show which could be quickly folded together and transported on a 1-ton Ford truck. Movable sets representing a five-room house were prepared in five days by a stage carpenter of one of the Oklahoma City theaters. Two trunks contained the necessary electrical appliances, banners advertising the show, motion-picture films, stage braces and advertising cuts.

A schedule of the towns to be visited was planned by the divisional manager who arranged the dates and advance advertising in each town and the necessary local representative to sponsor the exhibits. Two representatives from manufacturers of electrical machinery and appliances accompanied the show and assisted in demonstrating the appliances. The show was set up in a school building, hotel lobby or storeroom and remained in each town two days and two nights. Interest was stimulated by distributing electric irons and shaving mugs to the registered holders of lucky numbers. The various chambers of commerce, business men's associations and women's clubs gave their support to the demonstrations.

Publicity was obtained by using the N. E. L. A. film "Back of the Button" and through advertising in the local newspapers. The morning that the show opened 500 handbills were distributed on the main street of the town, the banners were hung up and the appliances and furniture which had been loaned by the local dealers were arranged. Following the show special house-wiring campaigns were announced in the local papers and letters were sent to all the registered names.

What Other Companies Are Doing

Norman, Okla.—Municipal ownership received another setback when the City Council of Norman at a recent meeting, by a vote of three to one, passed a resolution revoking bonds voted two years ago for the installation of a municipal light plant.

New Orleans, La.—The New Orleans *Times-Picayune's* "home electric" is fast approaching completion. It was expected to be ready for opening by June 4. The best of material and skill are being combined in the building of the house, which will illustrate the ability already acquired by science and craftsmanship to provide the acme of household comfort and convenience. The house is being planned by the *Times-Picayune* in co-operation with New Orleans electrical dealers.

Worcester, Mass.—That business is showing a marked improvement is indicated by the records of the Worcester Electric Light Company's appliance department. For eight successive weeks the gross sales have exceeded those of the corresponding week of the previous year. The sales of the week ended April 29 amounted to $3,609.01, the banner week thus far in 1922. During the month of April, the leading articles that were sold were vacuum cleaners and flatirons, 99 and 147 respectively.

VIEWS OF OKLAHOMA GAS & ELECTRIC COMPANY'S FIVE-ROOM PORTABLE "HOME ELECTRIC"

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Waste Elimination Possible in Electric Wiring Devices

By Howard R. Sargent
Manager Wiring Supplies Division, General Electric Company

H. R. SARGENT

THEORETICALLY every man in the electrical industry believes in the elimination of waste. The program which Secretary Hoover has instituted in the Department of Commerce has already led to the development of many practical economies in many industries. The United States Chamber of Commerce has given the idea strong support. Its analysis of the savings which may be wrought through reduction in the number of excess varieties in any line was published in the ELECTRICAL WORLD recently and is most convincing. There is an excellent opportunity to apply these principles in the electrical industry — one that may well have the consideration and support of every electrical man. For a very real practical service would be rendered to manufacturers, jobbers, contractor-dealers, fixture manufacturers and the public as a whole if the line of wiring supplies could be simplified.

We have on our list about 3,500 catalog numbers. These devices have about fifteen parts upon which an average of five operations have been performed, in addition to the many operations connected with assembling, testing, packing and so on. It will be appreciated, therefore, that if a standard line of devices could be established which fulfilled all practical applications, considerable economies would result not only in manufacturing but in stocking and distributing. To be specific, I may mention a few examples. They are found in the various lines of sockets which any manufacturer who puts out what might be termed a complete line is obliged to carry.

UNNECESSARY SIZES

It would seem that the $\frac{1}{8}$-in. and $\frac{3}{8}$-in. caps would take care of all conditions and that the $\frac{1}{2}$-in. and $\frac{1}{4}$-in. sizes could be eliminated. This would effect a saving of a great many devices, yet they continue to be made because the trade orders them. The rubber-ring sockets were condemned by the underwriters many years ago, but there is still a limited demand for these which is being met, although it could with advantage be switched to the more standard sockets.

In the receptacle line there are the wooden molding devices, which could be well done away with. There are also the receptacles for pancake bases without porcelain rim. These could be abolished as the porcelain rim is very thin and inconspicuous and there are many porcelain receptacles of the cleat type which practically duplicate them, merely differing in the spacing of the wires. Yet people buy them and they continue to be made. The sign receptacle line is also capable of considerable reduction.

Then, when we arrive at snap switches, the code states that they must be installed with sub-base for cleat wiring, and it would therefore be logical to suppose that all of the switches having slots for the wires in the bases could be eliminated and we could standardize on one line of solid-base switches. But the habits of the trade have not made it possible.

A further reduction could be made in cutting out either the miniature or one of the larger-size base lines of snap switches. These two changes would also put an end to a very large number of devices and would not penalize the market in any way whatsoever.

BENEFITS OF STANDARDIZATION

There are in addition many different types of convenience outlets which have been on the market for many years but are in very little demand and could be eliminated in view of the standardization of the parallel-blade plug.

The link-fuse ceiling rosette also could be abandoned without working any hardship. When we come to the inclosed-fuse situation, we have all of the ampere capacities from 1 amp. to 12 amp., and it is readily seen that at least six or seven of these could be cut out without affecting the protection of other equipment.

I have mentioned a few of the places where economy could be effected, but, of course, the method of bringing this about is a horse of another color. There can be no agreement among manufacturers to manufacture only certain lines of goods, and it is, of course, only human nature to continue to manufacture material for which there is a continued demand; therefore, even though a manufacturer might think it wise to curtail his line, the demand would still exist and other manufacturers would continue to produce the material and sell it if he did not. So he keeps on.

The distributers and contractor-dealers have it in their power to influence the situation greatly by purchasing only the goods which are essential, or, rather, by avoiding the purchase and sale of lines that duplicate more vital stock, thereby reducing expense through less handling, purchases and shipments in larger quantity and less inventory work, with the possibility of lower prices as a result of the economies such a practice would bring in the processes of manufacture. For if the distributer ceased to buy and sell these excess lines, they would soon be abandoned.

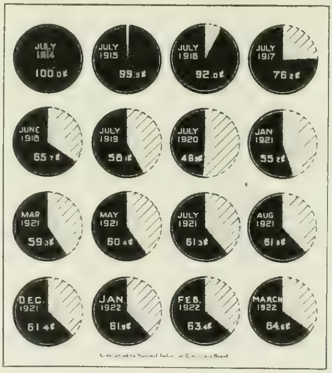
It will be very difficult for the manufacturers of electrical wiring devices themselves to bring about an effective elimination of waste through a reduction in the number of varieties. But if the jobber, the contractor and the industrial plant will habitually purchase the varieties that have become popular through their inherent advantages and avoid other slightly dissimilar varieties, these duplicating lines will soon languish and disappear from stocks and from the factories.

The Jobbing Craze Among Dealers

By a Manufacturer

It is surprising the number of electrical dealers who want to be and are trying to be jobbers. This situation is true in small towns as well as in the larger cities. Just why this condition exists I do not know unless the electrical dealers are beginning to think along the line of many other retailers, that the jobber does not function properly. The dealer wants to buy direct. There are several reasons for this. Many electrical household specialties are being sold direct to the dealer, and it looks as though more and more are going to adopt this policy, especially manufacturers of the larger items, washers, ironers, cleaners, etc. This gives the dealer the idea of buying *all* merchandise direct.

The Increased Purchasing Power of the Dollar



Few people realize that the value of the dollar has risen 32.1 per cent since its low point of 48.9 cents in July, 1920. This diagram is based on the cost of living and provides a bit of evidence that may be of interest to men who still continue to "talk poor."

In many cases this dealer wants to be a jobber because a cleaner manufacturer, for instance, gave him a little more than the necessary retail profit—no doubt to help him promote the sale of his product—but he believes he can afford to sell it to other smaller dealers and make a fair profit and increase his volume for better discount.

There is another situation that is causing this jobber's craze. Take the Jones Electric Washing Machine Manufacturing Company. It has a good product and is doing fairly well in some territories. The officials then decide to expand and find that in many territories, and in large cities, they cannot sell through the recognized jobbing outlets for they already have Brown's and Smith's washers. So Jones does the next best thing—in his estimation—and places his washer with the largest and livest dealer in that city, giving him jobber's discount in order to get his line in, giving him limited territory and causing him to believe he has a fine thing and is a jobber now.

Having obtained this special price on one article the dealer thinks, "Well, why can't I do like the other jobbers—let the retailer do the work?" So he conceives the idea of getting a number of small dealers all through his limited territory to sell washers for him, he making a profit on their efforts. This sounds good, but in my estimation it is the beginning of the end for a good, thriving electrical dealer. He becomes so enthusiastic about being a jobber—being in big business—that he gives all his time to promoting his jobbing interests and of necessity neglects his retail business, which begins to go down for lack of the old interest. Besides, buying in wholesale quantities and carrying small dealers' accounts strains his financial standing and may result in failure of his retail store. If this happens, he finds himself on a jobbing basis with only a few items in a restricted territory, not enough to make it a real worth-while jobbing proposition, and another retailer—a thing so necessary in the electrical game today—is out of business. If this keeps up, of course, there will be too many jobbers compared with the sales possibilities, and a large percentage of failures will result.

To a certain extent the jobbers themselves are responsible for this jobbing craze among dealers. If a dealer shows activity and begins to go out and sell to the curbstoner—the purchaser of one or two flatirons—making a very small profit, but selling to the little fellow the jobber does not reach, or to small industrial plants, the jobber makes him a so-called sub-jobber, giving him just a little better than the maximum dealer's discount. This sub-jobber then with this start builds a fair volume of business—perhaps owing to the lack of aggressiveness and fine-tooth-comb selling by the jobber—and then with this start the sub-jobber goes to the manufacturer for a jobbing arrangement direct. He has built up only a fair volume, but it is all his. He alone knows where it is going, and the manufacturer is tempted to take him on and keep the volume he has built up for him. If he turns him down, his competitor is very apt to jump at the chance to add this volume to his sales, and he usually gets some line or other. This is not theory—I have actually seen it worked out.

Another way the dealer gets his sub-jobber start arises from the policy of so many jobbers who travel out of their own natural geographical territory. It is always hard to sell in foreign fields. The salesman runs against so many natural obstacles that he meets them with price and freight allowances. The jobber usually thinks this business is all velvet, and, inasmuch as he only hits the larger towns, the high spots, he really does not object to this sub-jobbing business just outside of his own territory, for he would not get this small-dealer business any other way.

If the jobbers would discontinue this "far-distance traveling" and the special price deals, they would not have so much cause for complaint on their profit. If they would make more effort in their natural distributing territory, they could, I believe, increase their volume and make a better percentage of profit as well as a larger net profit. In other words, by trying to cover too much territory the jobber defeats his own ends.

I understand that the hardware business has gone through the same stage we are now entering in the electrical industry, but that the many small hardware jobbers did not continue in business. Some failed, some returned to the retail business, and a few held on. Are we coming to this period and condition in the electrical industry?

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Asynchronous Start of Synchronous Machines.—A. Böhm.—The theory of synchronizing machines which are started asynchronously is derived in this article, and a relation is shown whereby the necessary exciting current is proportional to the square of the starting torque, to the square of the slip and to the first power of the moment of inertia. For difficult starting conditions due to high starting load and a high moment of inertia it is recommended that the machine be not started with direct current, but by exciting the rotor with alternating current of the slip frequency, taking the excitation from the exciter, which is built and connected as a frequency changer. Connection diagrams and oscillograms for both methods are given.—*Elektrotechnische Zeitschrift,* March 30, 1922.

The Size Factor in Steam Turbines.—A study of the factors affecting the size of rotor in steam turbines, such as bending stresses on the shaft, output, speeds, "whipping" and the dead weight of the rotor.—*Engineering,* March 31, 1922.

Development of the High-Frequency Generator in Russia.—V. Wologdin.—Up to 1915 the author built for radio operation 20,000-cycle generators based on a somewhat altered Alexanderson principle, in capacities of 2, 3 and 6 kw. In spite of almost insurmountable difficulties in obtaining the necessary raw materials, a 50 kw., 20,000-cycle generator was finished during 1916 and gave good service in actual radio work. A 150-kw., 15,000-cycle generator for 3,000 r.p.m. has been completed successfully, the frequency being stepped up to 30,000 cycles in a stationary transformer. Work has been started on a 500-kw., 12,500-cycle machine.—*Elektrotechnische Zeitschrift,* March 30, 1922.

Starting and Operating Polyphase Induction Motors—Leroy A. Francis.—Methods of starting and operating polyphase induction motors by connecting them directly to the line, by inserting internal resistance in the rotor circuit and by inserting external resistance in the rotor circuit are described in the first part of the article appearing in the December issue. In the second article the author takes up the starting of polyphase motors by the star-delta method, by the use of a transformer having low-voltage taps and by the use of a compensator.—*Electrical Record,* March, 1922.

Lamps and Lighting

Merchandising Illumination.—W. L. Goodwin.—The author points out the need for applying illuminating engineering knowledge and skill to a larger proportion of the lighting installations now being made. The whole lighting industry must help to make illumination selling and illuminating engineering profitable in a money sense. The giving of free engineering service is a fundamental error of policy which has the result of closing up the field of the independent consulting illuminating engineer. So important and varied are the applications of electric lighting that almost any plan or scheme to bring them into general use by the public would be justified. An illumination merchandising plan is outlined in which proved methods have been adopted and applied.—*Transactions of the Illuminating Engineering Society,* April, 1922.

Generation, Transmission and Distribution

Safety Factors for Different Types of Suspension Insulators.—P. Testard.—The different problems which present themselves in making a choice of the best type of chain insulators are mentioned in a general way in this paper. The commonly demanded mechanical safety factor of five is considered too high. A factor of two and one-half to three is held to be ample. As an electrical test the author suggests use of the ratio between the puncture of the disk under oil and the dry flashover in air. This ratio should not be less than two and one-half for normal frequency and not less than two for high-frequency tests. This safety factor and the mechanical safety factor suggested above are of about equal importance. Most types of these insulators show a premature mechanical decay due to cracks which develop at certain sections of the porcelain disk. This the author ascribes to the different amounts of compression in the different parts of the porcelain during the molding process. One type of insulator (denoted as C below) was tested which avoids this fault. Three models of disks have been tested carefully, and the following results were found:

Type	Dry-Test Voltage, Kv.	Puncture in Oil, Kv.	Safety Factor	
			Electrical	Mechanica
A	67	75	1.08	2.68
B	70	105	1.43	3.0
C	85	200	2.12	2.4

Taking the average of electrical and mechanical safety, it is seen that the type C insulator gives the most satisfactory performance. The further fact that this type is being made in France is emphasized as an incentive to more general use of this insulator on French lines.—*Revue Générale de l'Electricité,* March 18, 1922.

Water Purification for Boiler Feed.—F. J. Crolius.—A consideration of the water side of boilers with particular reference to the cost of water treatment by various methods.—*National Engineer,* April 1922.

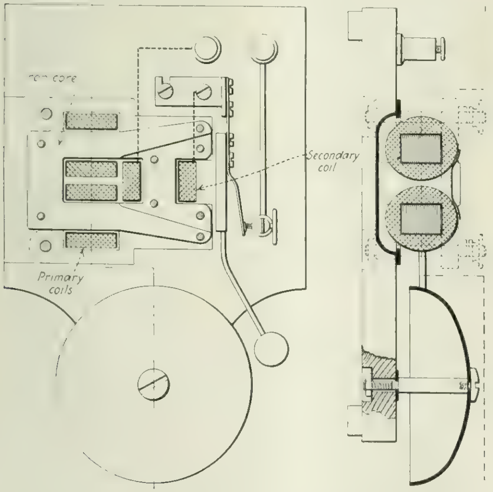
Present Status of the Overvoltage Problem.—J. Biermanns.—After discussing the nature and behavior of what are called in general overvoltage phenomena on high-voltage lines, the author describes the various forms of present-day protective devices.—*Elektrotechnische Zeitschrift,* March 9 and 16, 1922.

Graphic Solution of Alternating-Current Load Problems.—J. A. Van Tilburg.—A graphic means for solving the various problems arising in daily alternating-current practice is described by the author. Seven examples are given, among which one is the addition of two inductive loads to a circuit, another is the addition of non-inductive to inductive loads, and a third is the addition of inductive load with lagging power factor to a load with leading power factor. He also gives specific examples of its application.—*Electric Review (London)*, March 31, 1922.

Development in Power-Station Design.—In this section of a continued series of articles the design of condensers and their auxiliaries is considered. A scheme is described for a condenser plant forming a complete condensing, make-up and feed-heating system.—*Engineer (London)*, March 31, 1922.

Installations, Systems and Appliances

Doorbell with Built-in Transformer.—M. KERBAKER.—This contrivance is a combination of a bell-ringing transformer and a bell and is suitable for operation on any alternating light circuit. On a peculiarly shaped iron core there are placed two high-voltage coils connected permanently to the light circuit and one 4-volt to 5-volt coil, the ends of which are carried over the self-interrupter of the bell to the push-button. Complete data are given for the dimensions of the core and for winding such a bell. To guard against overheating due to a short circuit in the low-voltage wiring, a strip of low-melting metal is used as connection between the two high-voltage coils.—*Elektrotechnik und Maschinenbau*, April 23, 1922.



NO-LOAD ENERGY LOSS OF BUILT-IN BELL TRANSFORMER ONE-HALF THAT OF BELL-RINGING TRANSFORMER

Fitting the Electric Motor to the Machine in the Rubber Industry.—This is the first of a series of articles that will deal with the application of electric motors in the various industries. In the present one the motor requirements for basic operations in the rubber industry are explained. Other points taken up are the selection of motor voltage and size, intermediate-process power applications, the control of calenders, source of power for calender operation, and motor requirements in finishing process.—*Electrical Record*, April, 1922.

Electric Crane Controllers.—J. F. SCHNABEL.—The author discusses the character of the controllers best suited for trolleys and hoists under various conditions. The paper also deals fully with the problems concerning the selection of ohmic values for the resistors and covers very completely the connection arrangements and resistance values involved in the dynamic braking control of lowering loads.—*Journal of the A. I. E. E.*, April, 1922.

Hydraulic Equipment as Affecting Power-House Design.—MAX V. SAUER.—A paper read at a water-power symposium at the University of Toronto on the improvement of hydraulic equipment. Present tendencies show a marked increase in turbine efficiency. Various features affecting installation of main units and auxiliary equipment are described.—*Canadian Engineer* March 7, 1922.

Hydro-Electric Possibilities in the Dutch East Indies.—According to the third annual report of the official water-power and electric power supply administration of the Dutch East Indies, a careful survey of all existing water powers rated at over 1,000 hp. shows that there are available, on Java 302,850 hp., on Sumatra 1,198,400 hp., on Celebes 498,000 hp. and on Borneo 375,000 hp. There are at present in operation or in the state of erection on Java plants rated at 47,050 hp. and on the other islands combined plants rated at 2,000 hp. A lease for the use of 200,000 hp. for the erection of a large nitrate plant on Sumatra and one for 50,000 hp. for another nitrate plant on Java have been granted to two Dutch companies. Three-phase current of from 2,000 volts to 12,000 volts is used now, but the newly planned high-power stations are to use 70,000 volts and 110,000 volts. The Dutch East Indies, with their dense population (Java is more densely populated than China), their large water-power resources and their great riches in minerals and fertile lands, should offer a great market for American machinery, although all existing plants are of Dutch origin.—*Third Annual Report of the Official Hydro-Electric Power Administration of the Dutch East Indies.*

Traction

Roller Bearings for Traction Motors.—H. MECKE.—Experience with ball bearings on various kinds of motors dates back twenty years and has resulted in the design of very serviceable bearings even for motors of heavy duty. For heavy-duty and large traction motors roller bearings are preferable. The roll gives in addition a broader contact surface and a mechanical stress always at right angles to the direction of the fiber. Greater efficiency of the motors, dependable service, smaller permissible air gap and great savings in the lubrication are among the chief advantages claimed for roller bearings on traction motors. The article contains ten drawings of different types of ball bearings and twelve constructions of roller bearings.—*Zeitschrift des Vereines Deutscher Ingenieure*, March 25, 1922.

Electrification of Industrial Plant Railways.—D. M. PETTY.—The author discusses the advantages of five methods of supplying the current to the motors on the locomotives. These methods are (a) overhead trolley system, (b) third rail, (c) contact system, (d) storage batteries, and (e) a combination of storage batteries and one of the other four. He also describes substations and recommends a voltage to be used.—*Paper presented before the Association of Iron and Steel Electrical Engineers*, March, 1922.

Rectifiers Used on a Large Scale in Europe.—K. Bally.—A very rapid increase in the use of large mercury-arc rectifiers can be noticed in Europe. Today there are in operation 175 plants, with a total rating of 93,000 kw., built and installed by one company alone. The highest direct-current voltage is 1,700, and the largest single output is 1,200 kw. To demonstrate ability to withstand a sudden heavy short circuit, a test was made on an 1,800-volt direct-current rectifier, the oscillogram of which is reproduced. The calibration of the oscillogram revealed a short-circuit output of 36,500 kva., which was opened through a guide break switch. The satisfactory operation of the rectifier was not affected by this test. Comparing the operating cost of a rotary converter with an equivalent rectifier, annual savings as high as 10 per cent of the initial installation cost are not uncommon. Several interesting photos of existing plants accompany the article.—*Brown-Boveri Mitteilungen,* April, 1922.

Electrophysics and Magnetism

Sound-Proof Partitions.—F. R. Watson.—The demand for quiet rooms in hospitals, hotels and office buildings, the desirability of insulating music studios and other rooms where disturbing sounds are produced, and the necessity for solving other problems for the control of noise, have led to repeated requests from architects and builders for reliable information on effective methods for insulating sound. Although present knowledge of the subject is incomplete, nevertheless, on account of the pressing need for guidance in such matters, the author has collected the available information in a systematic way, giving the methods and results of various investigations relating to the action of materials and sound, describing practical sound-proofing installations and setting forth in accordance with existing knowledge recommendations that may be applied where sound insulation is wanted. Although many things may be learned from further experience and much may be gained from additional theory, enough has been revealed to give encouragement to the belief that sound-proofing may be undertaken in the future with some of the certainty that now attends the acoustic design of auditoriums.—*Bulletin No. 127, University of Illinois.*

Units, Measurements and Instruments

Development of Meters Since the War.—K. Schmiedel.—A great number of improvements and new designs of alternating-current induction meters have been introduced into Germany since the war, aiming principally at the smallest energy consumption and highest accuracy under widely varying load. The author deplores the lack of much-needed improvements on direct-current meters. The paper contains fifteen drawings and photographs of new meter models of different concerns.—*Zeitschrift des Vereines Deutscher Ingenieure,* April 1, 1922.

High-Voltage Electric Meter with Fault Indicator.—A. Kaeppele.—If electric meters are used on high-voltage lines and current and potential transformers are interposed between the line and the meter, it happens quite often that one of the fuses on the potential transformer either burns out or falls out of its contacts. Under this condition the indications of the meter might be as much as 70 per cent too small. Such a fault is not obvious to the meter reader, and it may be months before the accounting office discovers the discrepancy. The author has patented an arrangement whereby two auxiliary windings are placed over the existing potential coils of the meter mechanism. These feed two miniature low-voltage lamps, which can be switched on simultaneously and for an instant only by means of a push-button inaccessible to the customer. Unless the connections are in perfect condition these two lights will not burn with equal brightness.—*Elektrotechnische Zeitschrift,* March 9, 1922.

Electrochemistry and Batteries

Manufacture of Electrolytic Iron.—G. F. McMahon.—General data for a commercial plant manufacturing pure iron for electrical purposes are given. The effects of composition, temperature and circulation of the electrolyte upon the physical properties of the deposited metal were investigated and the results given.—*Chemical and Metallurgical Engineering,* April 5, 1922.

Hydrogen Overvoltage and Current Density in the Electrodeposition of Zinc.—U. C. Tainton.—The overvoltage of the alloys examined lies between the overvoltages of their constituents. In the case of zinc deposits containing impurities the overvoltage is very high as long as the zinc surface is clean and growing. However, the overvoltage of an impure, corroded zinc surface is found to be very low, and so once corrosion begins it tends continually to spread.—*Paper presented before the American Electrochemical Society, Baltimore,* April 27, 1922.

Telegraphy, Telephony and Signals

The Thermionic Triode as Rectifier.—E. B. Moullin and L. B. Turner.—The performance of the triode rectifier arrangements used in wireless telegraphy with signals of various strength and with or without a superimposed local heterodyne oscillation are investigated theoretically and experimentally. The results are illustrated numerically by reference to a well-known pattern of triode, and in the more fundamental cases the theoretical deductions are compared with precise experimental measurements made at low frequency. The agreement is found to be very close.—*Electrician (London),* April 14, 1922.

Radio-Telegraphic Antennas of Airships.—Algeri Marino.—The substantial difference between aëronautic antennas and those used on land and on sea are treated mathematically and graphically, the electrical and magnetic fields and the relative effects coming in for examination.—*L'Elettrotecnica,* April 15, 1922.

Miscellaneous

The Cost of Plowing.—A. Delmaree.—The author gives the detailed costs of plowing fields by means of horsepower, ox power, gasoline tractor and electric power. The electric method is found to be the cheapest especially if deep plowing (35 cm.) is done. For light work, such as cultivation and plowing only about 18 cm. to 22 cm. in depth, the difference is small. The accompanying tabulation, based on present French costs, is of interest.—*Revue Générale de l'Electricité,* March 18, 1922.

ELECTRIC PLOWING CHEAPEST FOR HEAVY WORK

Depth of Furrow	Horses	Oxen	Gasoline Tractor	Electric Power at 0.70 Franc per Kw.-hr.
18 cm. to 22 cm., francs	203	147	134 to 142	130
30 cm. to 35 cm., francs (for wheat)	403	291	....	150

New Books

Reviews of the latest contributions to technical, industrial and commercial literature of particular interest to members of the electrical industry.

AMERICA'S POWER RESOURCES. By Chester G. Gilbert and Joseph E. Pogue. New York: The Century Company. 326 pages.

A monograph like this, devoted to a study of the economic significance of coal, oil, natural gas and water power, must command the deep interest of every engineer; and back of the professions lie the great public utilities whose very existence depends on the proper employment of the raw material out of which power is manufactured. Taking as apparently quite well founded the assertion of the authors that it would require the labor of three billion hard-working slaves to accomplish the service received annually by the United States from our energy resources, the startling result is reached that every man, woman and child in this country enjoys through the utilities in some form the work of about thirty servants. As the average family is about four persons, this figures out at in excess of more than a hundred servants per family. There is an enormous waste in all this, just as there was in slavery and is now in all industrial activities and in household operations. Herbert Hoover in his stirring protests against such waste is still merely a vociferous prophet unheeded in the wilderness of extravagance. This book is a magnificent "alarum" in support of his vaticinations on economy and how to go after it—or perish!

PRACTICAL ELECTRICAL ENGINEERING—DIRECT CURRENTS. By Harry G. Cisin. New York: D. Van Nostrand Company. 305 pages, 68 illustrations.

The keynote of this book is simplicity, the basic principles of direct-current electrical engineering being presented without the use of symbols or algebra. First the fundamental units are defined, then the underlying laws and properties of electric and magnetic circuits are explained, and finally the construction and operation of various types of apparatus are discussed. The book is in such form that it is especially suitable for elementary courses in industrial or evening schools and also for home study.

ELEKTRISCHE FÖRDERMASCHINEN. By Prof. W. Philippi. Leipzig: S. Hirzel. 304 pages, 136 illustrations.

It may be said that in the development of the large electric mine hoist a degree of standardization has been attained. The Leonard system, with or without a flywheel, has definitely established its superiority over any other system for heavy hauls. For a medium load, however, it is still necessary to study each individual case in order to find the most satisfactory solution. Moreover, the economical comparison between steam and electric drive has, to a certain extent, reached a definite state. The experience of the last twenty years has at least shown the limits of the controversy and has restricted the field of argument. In preliminary consideration electric drive has always the great advantage of permitting an exact calculation of the operating cost. The book is divided into thirteen chapters, dealing with the mechanical parts, the characteristics of the different suitable electric motors, the best arrangement of the electric parts, the calculation of the hoists and their controlling machinery, advantages of electric drive, energy consumption, questions of economy, and the detailed description of two typical hoists, one in Germany and one in Holland. The chapter on the calculation of mine hoists is very elaborate and contains a large number of actual examples to illustrate concretely the author's theories.

TECNICA DEGLI IMPIANTI ELETTRICI PER LUCE E FORZA. By Emilio Piazzoli. Milan: Ulrico Hoepli. Seventh edition. First volume. 700 pages, 321 illustrations.

The first of the two handbooks which compose this treatise now appears in its seventh edition, brought up to date and enlarged by the author. His principal purpose is to give to practicing engineers a complete and comprehensive handbook to which they can refer for the solution of everyday problems. The first volume is divided into seven chapters, the first two of which deal with symbols, units and fundamental principals of electricity and their applications and are completed by tables and other useful data. The other five give a detailed account, from a practical standpoint, of the principles and use of metering instruments, motors, dynamos, transformers and batteries, and of their construction, installation, test and operation. The author's sound technical knowledge and his wide experience in the construction and operating fields, which gave him opportunity to investigate a great number of problems, made it possible for him to illustrate the different chapters with examples and notes based on first-hand experience. For this reason the volume is exceptionally interesting and comprehensive. The other volume, which will soon be published, will contain nine chapters dealing with their subject in the same comprehensive way.

PROTECTIVE RELAYS. By Victor H. Todd. New York: McGraw-Hill Book Company, Inc. 264 pages, illustrated.

There has long been need of a textbook on relay practice, and this volume therefore is a welcome contribution to technical literature. Starting with the first principles of relay protection, the author describes the various types of commercial relays and accessory apparatus and then discusses their application to motors, transformers, generators and transmission and distribution circuits. Special attention is devoted to the protection of parallel, radial-ring and network systems. Two chapters deal with tests of direct-current and alternating-current relays, but we hope that in the next edition of the book the author will give more space to this subject as well as to handling some of the operating problems that arise with the use of relays. Methods of determining the settings for relays might also be more extensively discussed to advantage, since the application and operating problems are very much more important than the construction of apparatus. None the less, the information contained so far excels any previous compilation that the book deserves to be in every electrical engineer's library.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Generators Rated at 65,000 Kva. for Niagara Falls Power Company

THE Niagara Falls Power Company has placed an order with the General Electric Company for two 65,000-kva., 12,000-volt vertical waterwheel generators, the largest ever built, to be used in an extension to the generating company's power house No. 3, at Niagara Falls, New York.

These generators will be driven by 70,000-hp. hydraulic turbines made by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company, Philadelphia. Each generator will weigh about 700 tons and is to be 35 ft. in diameter and 26 ft. high. It is interesting to note that the new generators are twice the capacity of the three 32,500-kva. generators now contained in Station No. 3, which at the time of their installation were considered the largest in existence.

Hartford Has First Commercial Mercury Turbine Installation

PIONEER developments are again bringing the Hartford (Conn.) Electric Light Company into the center of the engineering stage, arrangements having been agreed upon with the General Electric Company for the immediate installation at Hartford of the first commercial mercury boiler and turbine plant in the world. To a representative of the ELECTRICAL WORLD T. H. Soren, vice-president of the Hartford company, stated last week that the company is installing a complete unit of about 2,000-kva. capacity at the Dutch Point generating station, and that this installation will be provided with every facility for analyzing its performance. Fuel oil will be burned and will be weighed instead of measured; recording instruments will be installed to enable the energy consumption of auxiliaries to be studied, and feed water and other items will be measured. The equipment is housed in a 26-ft. x 45-ft. structure now being erected by Stone & Webster outside the plant proper. It is hoped to cut down the fuel consumption per kilowatt-hour by approximately 50 per cent through the use of the mercury turbine and utilization in steam production of heat given up in the mercury condensation process.

The general arrangement of the apparatus is to install a 2,000-kva. mercury turbo-generator on the top of an oil-fired mercury boiler containing a charge of about 30,000 lb. of mercury. The mercury vapor at rather low pressure operates the turbine. The exhaust from the mercury turbine produces steam in a modified water boiler, and this steam will be introduced into the steam lines of the plant.

It is understood that the company is prepared to expend about $250,000 in this installation. William Le Roy Emmet of the General Electric Company will have charge of the development from the manufacturer's standpoint, and Mr. Soren will share in the investigation and installation on behalf of the Hartford company.

Keen Competition for Niagara Power Foreshadowed in New Application

THE American Superpower Corporation, which represents substantially the same interests as those which were behind the Niagara Power & Development Company, has applied to the Federal Power Commission for a preliminary permit covering the use of 12,000 cu.ft. per second, or one-half the additional diversion of water in the Niagara River recommended by the Board of Engineers. The application was filed with the distinct understanding that no action whatever would be taken on it until after the additional diversion shall have been arranged. It is thought the application was made solely for legal purposes in connection with the controversy between the federal government and the State of New York over the water-power act.

The application proposes the construction of a transmission line from Lewiston, in Niagara County, to Yonkers, where connections would be made with lines supplying New York City. The estimated cost is $27,457,000. The power canal from La Salle to Lewiston is, by the provisions of the application, to be made available for water transportation and, in addition, a waterway is to be made possible from the upper Niagara River to the lower Niagara River.

The applicant proposes to construct an open-prism canal 62½ ft. wide with 40 ft. of water and suggests the use of this canal for navigation purposes. It estimates that $34,188,000 will be required for the construction of the works necessary for the generation of 450,000 hp., under a head of 301 ft. at 88 per cent efficiency. The power house would be equipped with nine units of 50,000 hp., to be stepped up to 110,000 volts for local distribution and to 220,000 volts for transmission to New York. The power taken from the line at intermediate points would be stepped down to the required voltage. The transmission line to New York would consist of four circuits, each capable of carrying 75,000 kw. at 220,000 volts, three-phase, 60 cycles. There would be two independent lines on a right of way 350 ft. wide.

The chief engineer of the Superpower Corporation is Frederick W. Ballard of Cleveland. The officers and directors of the new company are as follows: President, Edward C. Randall of Buffalo; vice-president, Paul T. Brady of the Westinghouse Electric & Manufacturing Company of New York City; directors, Floyd C. Furlow, president of the Otis Elevator Company of New York; Richard W. Gardner, vice-president of the Otis Elevator Company of New York; J. Boardman Scovell of Lewiston. and A. M. Layton of Buffalo.

This application competes with one already filed by

Col. Hugh L. Cooper and other interests, but differs in constructional features. Colonel Cooper proposes to use an underground tunnel for the water instead of the open canal.

Indications are favorable for action on the new diversion treaty with Canada before the year is out, and Eastern power and light interests are watching developments closely.

Laboratory Glassware Will Not Be Placed on the Free List

THAT any effort to place laboratory glassware on the free list is foredoomed to failure is indicated by the vote in the Senate on May 31, when an amendment by Senator Jones of New Mexico attempting to reduce the duty from 75 per cent ad valorem to 45 per cent ad valorem was rejected by the decisive vote of 40 to 26. Only committee amendments are being considered at this time. It is probable that amendments will be brought forward later in the consideration of the bill which will propose reductions in the duty on this item. In view of the vote already taken, it is very generally conceded that the 75 per cent rate will stand.

Secretary Hoover's Efforts to Keep Coal Prices Down Bear Fruit

NEW proof of Secretary Hoover's ability to get results is had in his handling of the coal price situation. When the operators gathered for the general price conference on May 31 there was a minority among them which did not look with favor on the plan of applying the Garfield scale to their free coal when most of their output is moving on low-priced contracts. The opposition, however, was won over by Mr. Hoover.

Operators controlling nearly 85 per cent of the output in the bituminous producing fields, Mr. Hoover said, after the conference, have agreed to accept $3.50 a ton for run-of-mine coal as a maximum, with differentials fixed according to the Garfield plan.

Operators of non-union mines and other producing mines who have been at Washington in consultation with Secretary Hoover have asserted that when the demand comes they probably can deliver 6,000,000 tons or more of coal each week. Should business activities continue to advance on the present scale, this, even in addition to the coal in storage, would not meet the requirements but would, it is thought, prevent a crisis.

On Monday of this week retail coal dealers, as represented by officers of the National Retail Coal Dealers' Association, met Mr. Hoover at Washington and were asked by him to co-operate in an effort to keep down the price of coal to the consumer when the pinch caused by the strike is felt.

In a report made to the Senate Secretary Hoover stated that all efforts on the part of the government to bring about negotiations looking to a settlement of the coal strike had failed; that stocks of bituminous coal on hand had been reduced to about 32,000,000 tons, with an additional 10,000,000 tons in transit, and that while steps taken by the administration to prevent prices to the consumer from soaring to panic levels had been successful in part, the government was without power to use other than moral suasion to handle the situation.

House Committee Reports Bills Favoring Ford's Muscle Shoals Offer

ALTHOUGH Henry Ford refused to eliminate the Gorgas steam plant from his offer for the government's Muscle Shoals property, the majority of the House committee on military affairs decided to report a bill for the acceptance of his offer with the Gorgas plant omitted and with certain changes in the language relating to the manufacture of fertilizers, these changes having been agreed upon with Mr. Ford's representatives. Two bills proposing the acceptance of the Ford offer are to be introduced, one by Representative Wright of Georgia, a member of the committee, but acting independently of the minority, and the other by Representative Almon of Alabama, in whose district the property is located.

The Senate on Friday of last week passed the army appropriation bill with an amendment carrying $7,500,000 for a continuation of the work on Dam No. 2 of the Muscle Shoals project. Mr. Almon's bill provides that the House shall concur in this appropriation.

As the ELECTRICAL WORLD goes to press, its Washington representative telegraphs expressing the view that the Muscle Shoals project is not likely to come up again, unless incidentally, on the floor of the Senate this session. If the House concurs in the appropriation for a continuation of the work on the Wilson Dam, this will shelve the whole question until next session, when the various offers for the project will have to be taken up anew. It is by no means certain that Mr. Ford would accept the bill eliminating the Gorgas plant, even though his representatives have agreed to the fertilizer clause in this bill.

The House committee is split into three parts—the technical majority, with a presumable vote of twelve members; the nine Republicans who oppose the Ford offer, and the minority group headed by Representative Wright of Georgia who favor its unconditional acceptance. The report of the committee will probably be ready by Monday, but unless a special rule can be had from the rules committee it is unlikely that it will ever be reached on the calendar, and the session may end without any action.

Negotiations between the Alabama Power Company and the War Department for the purchase for $2,500,000 of the government interest in the Gorgas steam plant are continuing, and members of the military committee who voted to exclude the Gorgas plant from the Ford proposals are pointing out that this tender for this one plant item is half of the $5,000,000 Mr. Ford is offering for all of the government's properties.

State Attorneys-General Asked to Discuss Constitutionality of Power Act

THE Attorney-General of New York State has issued invitations to attorneys-general of all the states of the Union to meet at Albany at a date in July to be set later to discuss contentions as to the constitutionality of the act which set up the Federal Power Commission. With the invitations he also sent copies of the bill of complaint which he has filed with the United States Supreme Court. The court has granted a motion in his behalf which will permit him to bring an original action to test the law's constitutionality.

Amplification of 300,000 Claimed for New Super-Regenerative Circuit

A NEW process of amplifying incoming radio impulses, using only two tubes and securing an amplification up to 300,000 times the strength of the impressed emf., was described and demonstrated by Edwin H. Armstrong at a meeting of the Institute of Radio Engineers Wednesday evening in New York The principle of operation of this new circuit, which was classed as "super-regenerative" by the inventor, is based on the free oscillation, which is quantitative and without a lower limit. It has been discovered that if a periodic variation be introduced in the relation between the negative and positive resistances of a circuit containing inductance and capacity in such a manner that the negative resistance is alternately greater and less than the positive resistance, but that the average value of resistance is positive, then the circuit will not of itself produce oscillations. However, during those intervals when the negative resistance is greater than the positive the circuit will produce great amplification of the impressed emf. The free oscillations which are set up during the periods of negative resistance are directly proportional in amplitude to the amplitude of the impressed emf. The forced oscillations produced by the exciting emf. and the free oscillations caused by any normal variation in tube operation are both small.

Absence of spark interference is a feature of the new circuit which was demonstrated by Mr. Armstrong by receiving the broadcasting program of the Westinghouse station in Newark, N. J. The amplifying power of the circuit was demonstrated to be far superior to that of an ordinary two-stage amplifier set by receiving broadcasting through a loop antenna inside the steel structure of the Engineering Societies Building.

Northwest's Needs and Depreciation Reserve Topics at Boise

A WELL-ATTENDED meeting of the Northwest Electric Light and Power Association was held at Boise, Idaho, on Wednesday, Thursday and Friday of this week. The occasion was the fifteenth annual convention of the association, which is affiliated with the National Electric Light Association, and President-elect Frank W. Smith and Executive Manager Aylesworth of the national association were in attendance and made addresses.

In his opening remarks W. R. Putnam of the Idaho Power Company, president of the association, dwelt on the subject of taxation. The utilities in the Northwest, he said, are paying from 7 to 14 per cent of their gross earnings in taxes, whereas the average merchant pays only six-tenths of 1 per cent of his gross earnings for that purpose. Necessarily utility taxes will bear a higher proportion to gross earnings than do the taxes of merchants, but, in Mr. Putnam's estimation, the present difference is too great. Customers of utility companies, he said, must recognize that taxes on utility property are paid out of rates and that one of the means of decreasing the cost of utility service is to decrease the taxes levied against the public utilities.

An excellent address of nation-wide interest was delivered at Wednesday morning's session by George Erb, president of the Public Utilities Commission of the State of Idaho. In this address Commissioner Erb dwelt on the natural advantages possessed by Idaho and said that in order for the state to take the place in the production of the products of the soil to which she is entitled immense sums of outside capital must be attracted to it. "We need," he said, "and must have large reclamation and irrigation projects, additional miles of railroad, immense hydro-electric development and a greatly increased network of telephone and telegraph lines. Other cities and villages will come into existence requiring waterworks. In carrying out these developments it will be necessary to market not only municipal but utility securities, and should we in Idaho place such restrictions upon money invested in public utilities as would result in a very small return or none at all, beyond question the result would be that foreign capital seeking investment would pass us by and go to territory where more liberal treatment would be met with."

A liberal policy alone, he said, can guarantee to the present consumers a continuity of adequate and efficient service. In Mr. Erb's estimation, there is altogether too much antagonism by the users and prospective users of utility service toward the agency which affords them this service. To remedy this condition he suggested an open-door policy with reference to depreciation reserves. Commissioner Erb said that many utility companies and their managing officials looked upon this fund as becoming the property of the utility as soon as it was earned. The depreciation fund, he claimed, is, on the contrary, the property of the patrons until actually used for the purpose of replacing property destroyed, worn out or outgrown. Until so used it is a trust fund for which the utility management is to be held responsible. A proper realization of the character of the depreciation reserve on the part of the utility management would go far, in Commissioner Erb's estimation, toward allaying suspicion, distrust and antagonism.

Mayor Shank Recedes from Stand for the Abolition of Commission

A CONFERENCE between Major Shank of Indianapolis and Governor McCray of Indiana has, it is believed, put a stop to efforts on the part of the Mayor to abolish the Public Service Commission of the state. Two amendments to the commission law will, instead, be prepared for submission to the next Legislature, Major Shank said after the conference. One amendment will provide that when the commission sits on a case of importance to a community the hearing shall be held in that community. The other amendment will provide that the board of works, town board, county commissioners or other public representatives shall sit with the commission during its consideration of matters pertaining to any case in which the community is interested.

The amendments which Mayor Shank says he and the Governor have agreed upon are in line with suggestions for changes in the law made some time ago by the Corporation Counsel of Indianapolis. Mayor Shank said he thought the enactment of the proposed amendments would fill the pledge of the Republican state platform adopted recently, which pledged the party to abolish the law creating the commission or to amend it so as to make it more "responsive to the welfare of the people."

Electric Power Club Makes Progress at Annual Meeting

A REOPENING of the question of temperature ratings of motors and generators was one of the interesting and valuable features of the annual meeting of the Electric Power Club (which represents 98 per cent of the manufacturers of electrical power apparatus and control equipment), held this week at Hot Springs, Va. The discussion and action on this subject thus far, as every one knows, have resulted in the two standards of temperature rating—the double-rating 40-degree-55-degree standard and the single-rating 50-degree standard. At the Power Club meeting this week the Motor and Generator Section unanimously recommended that a committee be appointed to try once again to harmonize the views on this question and to attempt to work out an agreeable single standard of rating "such as 40 degrees without overload rating or any other single-standard basis." The club authorized the appointment of the committee.

Simplification Practice Recommended

Advance in transformer standard ratings was also noted at this meeting. The Transformer Section has definitely recommended, and the club has approved, the adoption of certain "preferred standards" as "recommended practice to take effect Jan. 1, 1923." There are now nearly 10,000 recognized standards, including all the various ratings as to capacity, voltage ratio, etc., and the object of this latest action is to select from the groups of single-phase distribution transformers and of single-phase power transformers certain sizes and ratings which, it is recommended, shall be the sizes to concentrate on. Eventually it is purposed to eliminate others from production.

Tables showing the ratings which have been selected by the section as "recommended practice" will be printed in next week's issue. The club recognizes this move as being in line with the "simplification" practices recommended by Secretary of Commerce Hoover. Standards of transformers for voltages heretofore not covered were also adopted. These standards cover voltages from 44,000 to 220,000 primary and 6,600, 11,000 and 13,200 secondary.

The Transformer Section announced that the apparatus committee of the National Electric Light Association joined heartily in making these recommendations.

There was also noted a tendency of the club to recognize a responsibility for standards of installation and operation, as well as of rating, test, etc. This move is occasioned by the feeling that the manufacturer's responsibility does not end with the mere delivery of the apparatus, but that the customer's best interests are served by being advised as to approved and efficient methods of installation and operation. No accomplishment is to be noted as yet, but the club has actually started a considerable amount of work along this line.

Electric Tool Section Makes Progress in Standardization

The Electric Tool Section reported some remarkably good progress in tool standardization. The committee has completed a set of standards of electric tool specifications which is the first constructive standardization work ever done in the electric tool industry. This report of standard sizes will be made public as soon as the required formality of approval has been taken care of.

There was also reported substantial progress by all other sections and committees of the club, and the harmonious manner in which the club is making progress in its work was generally commented upon during the meeting. One of the reports of interest was that of the cost-accounting committee, which will be treated at greater length in an early issue.

Nicholson Discusses Manufacturers' Council

In an intimate discussion of the functions and activities of the Electrical Manufacturers' Council, S. L. Nicholson, its chairman, dwelt on what the manufacturing branch of the industry is doing through the council to better all conditions in the industry. He pointed out that the relations of electrical manufacturers to all other bodies are on a better basis because all the parts of the electrical manufacturing branch of the industry have reached a common understanding in the council.

Mr. Nicholson also mentioned that the advisory board of the council had recommended and the council had adopted a policy of joint representation on committees of the industry rather than one of minority representation on committees appointed by other associations and organizations. Thus all questions before such joint bodies have to be approved by the Manufacturers' Council or by one of its three constituent bodies if it concerns only one of them, before they become effective as an agreed policy. Already a joint committee with the N. E. L. A. on power factor and starting currents of induction motors has been appointed and is at work, and a joint committee on standardization of service voltages is now being appointed.

Better Business Practices

In an address devoted largely to better business practices, President Russell encouraged the members of the club to push ahead in accord with the spirit of the times. He stressed two points principally. First, he recommended that the standards of the club be gone over carefully by each section to determine if there are any "commercial non-essentials" in the standards and ratings and, if so, to suggest possible ways for their gradual elimination. Electrical manufacturers, particularly those of power apparatus and control equipment, he said, must be more and more quantity manufacturers rather than operators of job shops—this in the interest of the buying public and buying industries. Second, Mr. Russell specially emphasized that there are many commercial practices of electrical manufacturing concerns which the majority of the business world does not consider sound. Therefore, in the interest of the electrical manufacturing business, and especially of the public served, each manufacturer should sit down and take stock of his individual commercial practices and eliminate those which the public might in general call economically unsound. One particular point he mentioned was that when a contract is made it really should mean something to both parties—it should call for delivery by the manufacturer and it should be more than an option for the purchaser—it is a purchase and sale agreement to be executed.

On recommendation of President Russell, the board of governors voted to move the headquarters of the club from St. Louis to Cleveland. It was brought out that twenty-six members are in Ohio and that sixty-five are within an overnight trip from Cleveland and the others not more than eighteen hours away, making Cleveland a logical center. The actual transfer of the office will take place some time within the next two months.

The club adopted a resolution opening its membership to Canadian manufacturers on the same basis as manufacturers within the United States.

The meeting this week was well attended by more than eighty representatives from the seventy-eight member companies. The usual sports at Hot Springs were interspersed with the business sessions. The annual banquet was held Tuesday evening. The final session was not closed as these pages go to press and announcement of offices elected will be made later.

Pacific Coast Association Again Holds Successful Industrial Conference

FOLLOWING the experiment made last year at the annual convention of the Pacific Coast Electrical Association of bringing into the convention representatives of the business and industrial interests of the state to place before them the policies and problems of the industry, this year's convention, held last week in Los Angeles, organized a similar industrial conference Friday afternoon and evening. The whole convention was an unqualified success. The registration was large and the sessions were well attended. As was to be expected, most of the speakers devoted themselves principally to discussing and reiterating various phases of the proposed California water and power initiative act, but in addition to this important subject opportunity was taken further to acquaint those from outside electrical circles with the importance of the industry, and in this work the association struck a new stride.

A report of the opening session on Wednesday was printed in last week's issue of the ELECTRICAL WORLD. The technical session on Thursday morning was devoted principally to the discussion of meters, meter testing and special devices for facilitating meter testing. The latter subject is one of particular importance in California because of the forthcoming rules of the California Industrial Accident Commission, which will require all wiring for industrial establishments to be inclosed in metal, thus necessitating special facilities in order safely and easily to test meters. The report of the committee on this subject was rendered by W. R. Frampton of the Southern California Edison Company.

The other subjects discussed at this meeting were hydraulic power and underground systems. The committee report on the first of these topics, which was made by F. O. Dolson of the Southern Sierras Power Company, proved to be unusually interesting in that the committee had compiled physical statistics of all of the important hydro-electric installations in the West. The report of the underground-systems committee, which was given by R. R. Cowles, Pacific Gas & Electric Company, included a survey of progress during the past year, noting particular features of new installations and methods.

The final technical session was held on Friday morning, when reports on overhead systems and safety rules were presented and briefly discussed. The overhead-systems report was rendered by L. M. Klauber, of the San Diego Consolidated Gas & Electric Company, and the safety rules committee report was presented by W. F. Jordan, Southern California Edison Company.

The final meeting of the Commercial Section was held Thursday morning and was devoted entirely to the discussion of illumination. Two papers were presented, one by G. T. Bigelow of the Southern Sierras Power Company on "Why City Streets and Highways Should be Better Lighted," and one by W. L. Frost, Southern California Edison Company, on "Some Undiscovered Markets for Electricity in Illumination." Considerable discussion revolved around the intensity of illumination which should be recommended, particularly for residence interiors. Although it is appreciated by illuminating engineers that an intensity of from 2 ft.-candles to 5 ft.-candles would be desirable, yet the present accepted intensities are so much less that the ideal intensity was held to involve too great a step to attempt at one time. Furthermore, although it would be desirable to have the general public familiar with the terms generally used by illuminating engineers, it was thought by some that quicker and fairly satisfactory results would be obtained if lighting were sold in terms of watts per square foot of floor area. It was held that for the present it would be satisfactory to secure an intensity of 1 watt per square foot and that the use of this term would be readily understood by both contractors and owners.

CONFERENCE ON INDUSTRIAL NEEDS

On Friday afternoon the Pacific Coast industrial conference already alluded to was held and was presided over by W. E. Creed, president of the Pacific Gas & Electric Company. The following program was presented: "The Industrial West," by Robert Sibley, editor of the *Journal of Electricity and Western Industry;* "National Finance and Some Lessons of the Past," by H. F. Beebe of the Harris-Forbes Company and president Investment Bankers' Association of America, a forceful presentation of the fundamental relationship of national financing and utility financing, with particular reference to the importance of selling securities to customers and others in the territory served by the utility; "The Farmers' Interest in the Water and Power Bill," by J. A. Teagarden, regional director of the Farm Bureau of California, an indorsement of the service rendered by the utilities of California and a condemnation of the folly of turning from them to an experiment under state ownership, and an address by John B. Fredericks, president of the Los Angeles Chamber of Commerce, on "Government and Industry."

At the banquet Friday evening John B. Miller, president Southern California Edison Company, was toastmaster and introduced Charles F. Stern, vice-president First National Bank of Los Angeles, who spoke on the financing of the electrical industry in the future. Dr. E. C. Moore of the University of California, C. K. Field, editor *Sunset Magazine*, and C. H. Rowell of the California Railroad Commission also spoke.

During the final business session, which was held Friday morning, M. H. Aylesworth, executive manager National Electric Light Association, gave a vigorous address on the state of the industry and pointed out its opportunities for the future. J. B. Black, general sales manager of the Great Western Power Company of San Francisco, was elected president for the coming year; L. M. Klauber, general superintendent of the San Diego Consolidated Gas & Electric Company, first vice-president, and William Baurhyte, vice-president Los Angeles Gas & Electric Company, second vice-president.

Canadian Electrical Association Issues Program for June Meeting

MEETING at the Chateau Laurier, Ottawa, Ontario, on June 15, 16 and 17 for its thirty-second annual convention, the Canadian Electrical Association will follow this program, with additional special features:

THURSDAY, JUNE 15

Morning.—President's address; report of secretary and treasurer; report of membership committee, M. K. Pike; report of Public Relations Section, J. B. Woodyatt.

Afternoon.—Report of Commercial Section, L. W. Pratt; report on power sales, P. R. Labelle; report on merchandising, Reo L. Atchison; report on industrial lighting, J. H. O'Hara.

FRIDAY, JUNE 16

Morning.—Report of Technical Section, R. J. Beaumont; report of meter committee, E. Holder; report of electrical apparatus committee, J. S. H. Wurtele; report of underground systems committee, L. A. Kenyon; report of overhead systems committee, A. P. Doddridge; report of hydraulic power committee, R. M. Wilson; report of inductive-interference committee, J. T. Trimingham; report of lamp committee, Watson Kintner.

Afternoon. — Report of Accounting Section, Lieut.-Col. D. R. Street; report of accident prevention committee, Wills Maclachlan; address by Charles B. Scott, manager Bureau of Safety Chicago; report of rural-lines committee, P. T. Davies.

New Englanders Get Behind Electric Vehicle Movement

TWO HUNDRED central-station men, manufacturers' representatives and users of electric trucks gathered at the Boston City Club May 24 under the auspices of the Electric Vehicle Bureau of the New England Division of the National Electric Light Association to listen to addresses upon the latest developments in electric transportation and testify anew their interest in this development and faith in its prosperity. President C. L. Edgar of the New England Division occupied the chair and E. S. Mansfield of the Boston Edison company acted as toastmaster.

Iowa Section, N. E. L. A., Meets at Lake Okoboji on June 20

SUBJECTS ranging from studies of the use of electricity on farms to a report on inductive interference will be discussed at the annual convention of the Iowa Section, N. E. L. A., to be held at the Inn Hotel, Lake Okoboji, from June 20 to 23. The first day's session will be held jointly with the Iowa Electric Railway Association, but the N. E. L. A. section will hold separate sessions on Wednesday, Thursday and Friday mornings. The afternoons of these days will be devoted to recreation. The convention banquet is scheduled for Wednesday evening. The tentative program follows:

TUESDAY, JUNE 20

Afternoon.—"The Preparation of a Valuation for Rate-Making Purposes," by L. R. King; "Valuation of Public Utility Property," H. M. Engh; "Group Insurance for Employees," Peter F. Bouquet; "Customer Ownership of Public Utility Securities," H. E. Weeks; "Recent Court and Commission Decisions Affecting Public Utilities in Iowa," John A. Reed, William Chamberlain and George A. See; report of Iowa Committee on Public Utility Information, F. J. Hanlon and Joe Carmichael.

WEDNESDAY, JUNE 21

Morning.—Reports of sections and committees.

THURSDAY, JUNE 22

Morning.—Report on committee on electric service rates, O. W. Harrod; "Electric Service Rate," J. B. Hill; "Analysis of the Costs of Producing Electrical Energy," W. J. Greene; "The Essentials of Electric Cooking Rates and Service," N. T. Wilcox; "Reduction in Output Due to Low Voltage," A. H. Ford.

FRIDAY, JUNE 23

Morning. — "Lightning Protection of High-Tension Circuits," a representative of the General Electric Company; "Metering of High-Tension Current," a representative of the Westinghouse company; report of rural lines committee, F. H. Brooks and V. L. Hein; "Observations Regarding the Use of Electricity on the Farm," C. A. Baumgart; "Liability Insurance for Electric Transmission Lines," A. W. Jones; report of inductive-interference committee, Austin Burt, John M. Drabelle and A. B. Campbell; election of officers.

BANQUET OF NEW ENGLAND ELECTRIC VEHICLE ENTHUSIASTS

Telephones in South Africa.—South Africa is particularly proud of the rapid increase in its use of the telephone. In the last ten years, advices to the Department of Commerce say, the number of exchanges has increased 420 per cent, the number of subscribers 274 per cent, the mileage of telephone wire 177 per cent, and capital expenditures 333 per cent. Throughout the Union of South Africa there is now one telephone for every twenty-seven white persons.

Water-Power Conference in North Carolina.—A conference on water powers in the southern Appalachian region is to be held at Asheville, N. C., June 20 to 22. It is announced that Secretary of Commerce Hoover will address the conference on "Power and Progress." The Governors of Tennessee, South Carolina and Georgia, O. C. Merrill, executive secretary of the Federal Power Commission, and several prominent engineers and industrial company executives will speak.

Progress at Copco Power Plant.—Work preparatory to the installation of a second unit at the California-Oregon Power Company's Copco plant, begun last December, is progressing favorably. Practically all excavation work, including a penstock tunnel, has been completed, and the power-house foundation is in place. The generating equipment, an 18,000-hp. unit, is on the ground, having been there in storage for several years. It is expected that the work will be completed before next December.

War Department Seeks to Acquire Kentucky Transmission Line.—The Senate military affairs committee has reported a bill authorizing the acquisition by the War Department of necessary easements for the power-transmission line from Louisville to Camp Knox, Ky., which was originally built on leased land. The estimated cost of acquiring the right-of-way for the line is given by the department as $15,000. In case the right-of-way is not acquired, the cost to the government of removing the transmission line and its reconstruction, together with damages to owners, would be much more than the proposed appropriation.

Power Development in Northern Ontario.—The potential energy of the Abitibi River and its tributaries in the far north of the Province of Ontario has in large part been allotted by the authorities. A large development, the *Canadian Engineer* understands, is to be made by the Temiskaming & Northern Ontario Railway, which contemplates electrifying a portion of its lines near Cochrane, and further reservations of 30,000 hp. between New Post, the railway's first objective in its step toward James Bay, and its final terminal at the tidewaters of the Atlantic are contemplated. Another company has applied for 40,000 hp. at Three Carrying Places Rapids. It has been virtually decided to reserve the Long Sault Rapids, where 60,000 hp. can be produced, for future disposition.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Municipal Plant Project Abandoned.—The city commissioners of Enid, Okla., have abandoned their plans for a municipal light and power plant and have reached an arrangement with the Oklahoma Gas & Electric Company whereby the city will secure reductions in lighting and power rates approximating nearly $5,000 yearly.

Regulating Radio.—The Philadelphia Fire Underwriters' Association has issued in pamphlet form its tentative regulations for radio signaling apparatus. These regulations are intended to reduce the life and fire hazard of radio apparatus and are issued to secure field experience in advance of their consideration as a revision of the rules on radio signaling apparatus contained in the National Electrical Code.

Finland's Largest Water-Power Plant.—An electric power plant erected in the middle of a waterfall has just been completed at Voikka, Finland. The plant, according to information just received by the Department of Commerce, is the largest in Finland. The site for the power house was blasted out of the rock, and the turbine room will be 25 ft. below the brink of the fall. The new plant supplements two existing power houses using water from the same fall. It contains three 4,500-hp. turbines.

Seven Years' Growth of the Pacific Gas & Electric Company.—The sixteenth annual report of the Pacific Gas & Electric Company shows a gain for 1921 over 1920 of $2,464,000 in gross operating revenue, of $1,636,070 in net earnings, of 29,600 in the number of consumers and of 4,200 in the number of stockholders. Sales of electricity fell off by 20,400,000 kw.-hr. compared with the high-water mark of 1920, but reached 1,021,821,000 kw.-hr., an increase of 126 per cent since 1914. In this seven-year period gross operating revenue increased 118 per cent, number of consumers 58 per cent and number of stockholders 528 per cent.

Memorial Day Exercises Carried by "Loud-Speaker System" to Vast Throng.—The speeches and music at the Memorial Day exercises held in Washington, D. C., when President Harding dedicated the new Lincoln Memorial, were heard over an area perhaps larger than any ever reached by human voice before. For more than a month more than one hundred experts of the Bell System were at work installing a "loud-speaker system" which carried the words and music for half a mile to every corner of the vast open space in front and on the sides of the building. If it had been possible to gather a million people at the exercises, they could, it is said, have heard every word distinctly. The amplifying apparatus donated by the American Telephone & Telegraph Company was hidden in the recesses of the Memorial and all that the throng attending saw was a tiny box on the platform, the transmitter and some inconspicuous white wooden horns along the top of the structure.

A New Use for Wireless.—Fire alarms by radio may be an outcome of the rapid growth in the use of wireless transmission in New York City, according to a reporter of firemen's doings. The men in many of the firehouses have received permission from the department to install receiving sets at their own expense, and though up to the present these have been used for amusement only, the firemen are ready to respond to any call to duty which may reach them in this way.

Fixation and Utilization of Nitrogen.—The final report of the nitrate division of the Ordnance Office of the War Department, assisted by the fixed-nitrogen research laboratory of the Department of Agriculture, has just been issued. It contains, besides a comprehensive introductory chapter, chapters on the utilization and sources of inorganic nitrogen, the development of nitrogen fixation in the United States and foreign countries, nitrogen fixation processes, nitrogen conversion processes, the results and possibilities of research, and the activities of the United States in the development of fixed nitrogen, with appendices describing the United States nitrate plants.

Associations and Societies

Empire State Gas and Electric Association.—The annual convention of this association will be held at the Lake Placid Club, Lake Placid, N. Y., on Thursday and Friday, Oct. 5 and 6.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A. Geographic Divisions—North Central, St. Paul, June 13-15; Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7.
Canadian Electrical Association—Ottawa, Ont., June 15-17.
Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25. (For program see issue of June 3, page 1139.)
Society for the Promotion of Engineering Education—Urbana, Ill., June 20-23.
American Society of Civil Engineers—Portsmouth, N. H., June 21-22.
American Association for the Advancement of Science—Salt Lake City, June 22-24.
American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.
Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.
A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30. (For program see issue of May 13, page 968.)
American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.
National Council Lighting Fixture Manufacturers—Cleveland, June 28-29.
Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of May 13, page 972.)
A. I. E. E., Pacific Coast Convention—Vancouver, B. C.—Aug. 8-11.
International Association of Municipal Electricians — New Bedford, Mass. Aug. 22-25.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Enforcement of Contract with Municipality Cannot Be Interrupted by Claim that It Will Bankrupt Utility.—The Arkansas Corporation Commission at first granted and afterward rescinded an order permitting the Central Light & Power Company to advance its rates in the town of Pocahontas. In a suit of the company against the town to enjoin the enforcement of the old rates, the circuit court found that the company had never surrendered its franchise rights to the commission, and that the rates were confiscatory. The circuit court fixed new rates, and the town carried the fight to the Supreme Court of Arkansas, which has reversed the finding, declaring that an act of the municipal corporation passed after the abolition of the Corporation Commission and putting in force the franchise rates was not reviewable by the courts, and that the enforcement of the contract could not be interrupted on the ground that it would result in the bankruptcy of the central-station company. (239 S. W. 1.)[*]

Obligation to Serve Competitor.—In its finding in North Carolina Public Service Company vs. Southern Power Company, in which the latter company was forbidden to discontinue service to the former at Greensboro and High Point, N. C. (see issue of May 27, page 1088), the United States Circuit Court at Richmond, Va., thus deals with the issue of compulsory service to a competitor, which was raised by defendant company: "Defendant's claim stated in its nakedness is based on the assertion of fact that the North Carolina Public Service Company and other independent vendors are competitors in business of the Southern Power Company, and on the legal contention that as such competitors they are not entitled to claim service as parts of the public—that in respect to independent vendors of current the North Carolina Corporation Commission has no power to regulate rates. If the Southern Power Company and the North Carolina Public Service Company are competitors at all, they are so in a restricted sense. . . . There is high authority for the general proposition of law that one competitor in business cannot demand service of another in promotion of its business. But when a corporation has definitely undertaken and entered upon a particular service authorized by a charter, which confers the right of eminent domain, the obligation to perform the service is complete, its rates and terms are subject to regulation by public authority, and it must serve all alike. In such public service it cannot pick and choose its customers. In this instance the Southern Power Company has definitely undertaken, entered upon and continued the service of transmitting electrical energy to independent vendors thereof under the authority of its charter, and for that purpose has exercised the power of eminent domain conferred by the state. It cannot now be heard to say that it owes no public duty with respect to that service, and that it may pick and choose its customers, and arbitrarily discriminate among them."

Permissible Instructions in Damage Suits.—In affirming a verdict for damages because of the death of a telephone lineman from contact with power transmission wires while making repairs (Cawley vs. People's Gas & Electric Company), the Supreme Court of Iowa found the following instructions given by the lower court to the jury, and to which exception had been taken, to be unobjectionable: That the defendant was obliged to have consideration of the rights, safety and comfort of any one who might be in the vicinity of its line; that the defendant was obliged to exercise care in the use of an agency "which is a source of peril to others rightfully within its vicinity"; that if the jury found that the defendant maintained its high-voltage wires without sufficient clearance over the telephone wires and knew of such condition and the victim was killed without contributory negligence, the jury should find for the plaintiff (this instruction neither placing on the defendant the duty of furnishing a safe place to work to one not in its employ nor imposing upon it a duty to inspect not raised in the pleadings); that the decedent was required to exercise "such care and caution as a man in his calling would exercise under like circumstances"; that the jury should determine whether the decedent reasonably supposed that he could safely work upon the pole in question; that "expert testimony is most useful in cases of conflict between witnesses as corroborating testimony," and that "the value of such testimony depends upon the circumstances of each case, and of these circumstances the jury must be the judge"; that when expert witnesses testify to matters of fact from personal knowledge, then their testimony should be considered as that of other witnesses, and that "alleged verbal statements or admissions should be received with great caution." Nor was it an error to receive rebuttal testimony of a witness who made observations of applicant's lines during the trial. The Supreme Court, however, held that the amount of damages, $15,000, was excessive and required a reduction by the amount of the award made under the workmen's compensation act—$3,441. (187 N. W. 591.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Commissioner May Publicly Criticise Company without Forfeiting Right to Sit at Hearing.—The right of a member of a public service commission to comment adversely in public on the practice of utility corporations in applying for higher rates and then to sit at the hearing to determine the need for such rate, has been upheld by the Public Utilities Commission of Louisiana. Objection was made to the presence of a commissioner at a hearing for increased telephone rates on the ground that he had commented severely on the demands for higher rates by public utility corporations when they at the same time are demanding a reduction of wages. The commission overruled the challenge. After pointing out that the duties of a public service official, according to the Louisiana constitution, are legislative, not judicial, it quoted from the Supreme Court record showing that in such a case a petitioner can make no contest, especially where there is no allegation that the commissioner is interested in the outcome other than as a public official.

Reduction in Rural Rates.—A reduction in the agricultural rates of the Southern Sierras Power Company has been ordered by the California Railroad Commission. The reduction for the average operation, it is estimated, will amount to as much as 20 per cent, while the general average reduction for agricultural service on the entire system is computed to be approximately 5 per cent. The new rates will benefit all agricultural consumers receiving service at 2,200 volts or over and also those receiving service at 220 volts or 440 volts whose consumption exceeds 500 kw.-hr. a year. There will be no change in rates for those using less than the latter amount. In addition to the reduction ordered the form of rate has been changed to the advantage of consumers. The company is directed to replace the present demand and energy rate with an energy form of rate with a minimum charge in which both the energy charges and the minimum charges are based upon the annual consumption. The new schedule also contains an optional demand and energy rate in which both the demand and energy charges are based on annual consumption, besides a provision to the effect that if any consumer at the end of the year finds that any of the optional schedules would have been more advantageous to him the company will be required to adjust his bills to this lower schedule.

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Gen. George H. Harries, vice-president of H. M. Byllesby & Company, has been decorated with the distinguished service medal of the navy. The presentation was made April 12 by Secretary Denby at the Navy Department in Washington. General Harries had previously received a distinguished service medal from the army, this double decoration having been won by only eight other officers in either service. General Harries is now on the list of reserve officers after many years in the active military service of the nation. During the world war he was in charge of the Fifty-ninth Depot Brigade of the Thirty-fourth Division. He then commanded the One Hundred and Eighty-sixth Infantry Brigade and took this organization overseas. He was commander of Base Section No. 5 at Brest and directed all the construction work at that port. Following the signing of the armistice, he was placed in command of the Eighty-seventh Division and was relieved of that charge to become chief of the United States military mission, in which capacity he was the first American officer to enter Berlin after the war.

G. H. HARRIES

J. E. Harsh, recently elected president of the Nebraska Section, N. E. L. A., is the vice-president and general manager of the Lincoln Gas & Electric Light Company. Mr. Harsh first entered the utility field in 1903 as meter reader with the Denver Gas & Electric Company. After a year he entered the new-business department and in 1908 was sent to the Empire District Electric Company at Joplin, Mo., as new-business manager. He remained there until 1912, when he was transferred to the City Light & Traction Company at Sedalia, Mo., to organize a new-business department, this property having been taken over by the Doherty interests. The next year saw Mr. Harsh as manager of the Salina (Kan.) Light, Power & Gas Company. His election to the vice-presidency of the Lincoln Gas & Electric Company dates since 1917.

S. B. Williams, who for the past two and a half years has been assistant managing editor of the ELECTRICAL WORLD, resigned on June 8 to become managing editor of the *Electrical Record*, published by the Gage Publishing Company, New York. Mr. Williams has been with the ELECTRICAL WORLD since his graduation from Princeton as an electrical engineer in 1914. He is responsible for the development of several of the ELECTRICAL WORLD'S service features, such as the trade and markets section, the legal section and the present news section. During his eight years with the WORLD he has held the positions of editorial representative, statistical editor, commercial editor, news editor and assistant managing editor. In this last capacity he continued also to act as news editor. For the past three years he has been the editor of the popular National Electric Light Association convention daily. Mr. Williams is the author of "Cutting Central Station Costs," published by the McGraw-Hill Book Company; "Electrical Development 1910-1920," new edition Encyclopædia Britannica, and "Effect of War on Electrical Apparatus in the United States," prepared for the International Labor Office of the League of Nations.

L. W. W. Morrow, who has been assistant professor of electrical engineering at Yale University for the past four years, has been appointed associate editor of the ELECTRICAL WORLD. Professor Morrow is a graduate of Cornell University in electrical engineering. After teaching at that institution for two years he went to the University of Oklahoma, where he became director of the school of electrical engineering in 1916. While a resident of Oklahoma Professor Morrow was secretary of what is now the Public Utilities Association of Oklahoma and was also associated with various Oklahoma utilities in a consulting capacity. Since he has been at Yale University Professor Morrow has acted as consulting electrical engineer for several companies in the East. He served as special editorial representative on the staff of the *Electric Railway Journal* during part of 1920 and 1921 and has made editorial contributions from time to time to the ELECTRICAL WORLD, *Power*, the *Electric Railway Journal* and *Bus Transportation*. He is the author of a storage-battery manual published by the War Department.

J. H. Brown, sales manager of the Lafayette district of the United Gas Improvement Company, Philadelphia, has been appointed sales manager of the Counties Gas & Electric Company of Ardmore, Pa.

Arthur G. Gibbony has entered the engineering department of the Ohio Power Company as superintendent of substations in the southern division. Mr. Gibbony was for several years with Stone & Webster in the Middle West, prior to which he was connected with the Aluminum Company of America.

Prof. Charles L. Norton has been appointed head of the department of physics at the Massachusetts Institute of Technology, Cambridge, effective next fall and in succession to Prof. Edwin B. Wilson, who has resigned to take the chair of vital statistics at the Harvard School of Public Health. Professor Norton has been connected with the institute staff since his graduation in 1893 and for some years has been professor of industrial physics. During the past two years he was director of the division of co-operation and research, which conducts the so-called "Technology plan" of research for industrial and business enterprises that turn to the institute laboratories for assistance. Professor Norton has a wide reputation in the fields of heat insulation and fire prevention and was among the first to advocate the use of X-rays in medical diagnosis. During the world war he was an adviser to the Naval Consulting Board and inventions committee of the War Department and United States Signal Corps, besides devising a process and constructing a plant for the production of metallic magnesium, previously obtained almost

C. L. NORTON

exclusively from Germany. He will continue as director of the division of co-operation and research.

H. M. Cunnington, who has been in the business news department of the McGraw-Hill Publishing Company, has been made trade and market editor of the Electrical World, succeeding H. H. Stinson.

H. H. Stinson, who has been editor of the trade and markets section of the Electrical World since last fall, resigned on June 1 to become associated with the Brunswick Company of New York in publicity work and to engage in free-lance literary work. Mr. Stinson was the first Electrical World editorial representative in St. Louis. He started the St. Louis market letter in the fall of 1920, and later went to Chicago, where he was assistant Western editor of the paper.

B. A. Plimpton has been appointed sales manager of the Locke Insulator Corporation of Victor, N. Y. This is in correction of a personal which appeared in the May 27 issue in which the address of the Locke Insulator Corporation was given as Le Roy, N. Y.

Lon Jourdet has been appointed Western manager for the Torrington Company, Torrington, Conn.

Obituary

Emerson McMillin, head of the banking house of Emerson McMillin & Company, New York, chairman of the board of the American Light & Traction Company and president of a dozen other lighting and traction concerns throughout the country, died on May 31 at his country estate, "Darlington," near Mahwah, N. J., after a few days' illness, of pneumonia. Being what is known as a self-made man, Mr. McMillin had a varied experience, perhaps only possible in this country of unlimited opportunities for the man able to grasp them, and his successful career could serve as an inspiration to any seeking to win Fortune's favors by their own personal efforts. Mr. McMillin received the education of a country school from the time he was six years old until he was ten, when he began to work about the steel furnaces. At the age of seventeen he enlisted in the Union Army and was commissioned second lieutenant for gallantry in service, having been wounded five times. After the war he went into merchandising and later into iron and steel manufacturing on an extensive scale. In 1883 he became interested in the gas business, gaining control of small works throughout the West. In 1889 the amalgamation of the four warring companies of St. Louis into the Laclede Gas Light Company demonstrated to capitalists Mr. McMillin's skill as an organizer. In 1891 he went to New York and established the banking firm of Emerson McMillin & Company. In 1901 the American Light & Traction Company was organized with Mr. McMillin as its president. He was an indefatigable worker, and after several years of unceasing attention to the business of this new company he was compelled to take a period of rest in Italy. To make his absence possible the office of chairman of the board of directors of the American Light & Traction Company was created, and Mr. McMillin held this office till the time of his death. He was also president and director of the Southern Light & Traction Company, the San Antonio Gas & Electric Company, the San Antonio Traction Company and several gas companies and vice-president and director of the Muskegon Traction & Lighting Company. He belonged to numerous economic and social clubs.

EMERSON MC MILLIN

Frank W. Edwards, sales engineer Dayton Engineering Laboratories Company, manufacturer of lighting and starting equipment, Dayton, Ohio, died recently at his home in that city, at the age of forty-one.

S. P. Coale, aged forty-five, professor of theoretical electricity at the Bliss Electrical School, North Takoma Park, D. C., was killed while on his way home on May 30 by being struck by an automobile. He had been connected with the school since 1902.

Frank E. Dunbar, vice-president of the Lowell Gas & Electric Company, died at his home in Lowell, Mass., on May 18. Mr. Dunbar was a native of Pittsfield, Mass., and a graduate of Amherst College. When a young man he located in Lowell and took up the practice of law. He was president of the Boott Mills and the Appleton Mills, both of which are textile plants. Mr. Dunbar was prominent in politics and at one time was a candidate for the Republican nomination for Congress.

Arthur B. Stitzer, vice-president and chief engineer of the Republic Engineers, Inc., New York, died from hemorrhage of the stomach on May 26, while on a business trip. Mr. Stitzer had for many years taken an active part in the work of the National Electric Light Association and in the American Electric Railway Engineering Association. He was chairman of the power generation committee of the latter association during 1921 and was its third vice-president in 1922. Mr. Stitzer was born on July 20, 1877, and was graduated from the University of Pennsylvania in 1899. Ten years later he received the degree of electrical engineer from that university. Upon graduation he became connected with the Union Traction Company of Philadelphia and later with its successor, the Philadelphia Rapid Transit Company, with which he remained until April 25, 1910. He then resigned to become electrical engineer for Ford, Bacon & Davis, with whom he remained until 1917, when he was appointed chief engineer of the Republic Engineers. On Feb. 10, 1919, he was elected a director of that company.

A. B. STITZER

Louis F. Strothman, vice-president and general manager Richardson-Phenix Company, Milwaukee, division of the S. F. Bowser Company, Fort Wayne Ind., died three weeks ago after an illness of five months.

E. Parley Cliff, superintendent of the Heber City Light & Power Company died on May 18 of pernicious anemia. Mr. Cliff was born at Mount Pleasant, Utah, and had been prominent in civic affairs for many years.

William B. Vansize, a patent attorney, who made a specialty of legal work for telephone, telegraph and electrical companies, died on June 1 at his home in Brooklyn, N. Y. At different times he was connected with the General Electric Company, the Commercial Cable Company, the American Marconi Company, the Radio Corporation and other concerns. Mr. Vansize was a member of the board of directors of the A. I. E. E.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

New England Collections Gradually Improving

RESPONDING to the improvement in general business and to easier money, collections in New England are decidedly better than was the case three or four months ago. Cash discounts are being taken by many large customers in purchasing from jobbers, and central-station payments as usual are on a highly satisfactory basis. No particular trouble is being experienced at present from New England manufacturers, barring some slight tendency toward slower settlements in communities hard hit by labor difficulties. In general, jobbers are cleaning up accounts on a sixty-day basis or less. Strict attention is being paid to taking on new accounts, and credit relations with contractor-dealers are being carefully followed.

Cost of Living About Stationary, Labor Statistics Bureau Shows

THAT the cost of living is about stationary is shown by monthly figures of the Bureau of Labor Statistics, which says that the prices of all commodities during April were 52 per cent above the average of 1913, compared with 52 per cent in March, 51 per cent in February, 48 per cent in January and 49 per cent in both December and November. Three of the nine individual groups show a rise in the table compared with March. Five items recorded slight recessions. While metals are only 17 per cent above the 1913 level, the average of all the others is more than four times above the 1913 level.

Conduit Prices Stiffen as Increased Demand Brightens Market

SLIGHTLY heavier demand for conduit brought on by greatly increased building construction has caused the tone of that market to become more firm. Pipe is moving more slowly than a week ago, manufacturers have noted, and there is a rather wide range in quotations. Prices on rigid conduit showed the following range this week: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1 in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft. Owing to a serious labor condition in the Connellsville coke district, skelp is becoming less plentiful for pipe manufacturers, and it is thought if some agreement is not forthcoming in a few weeks there will be a serious shortage in the rigid-conduit market.

Predictions are to the effect that the market in conduit and flexible armored cable will soon be so active that prices will be much higher than the present levels.

Business Failures Numbered 407 Last Week

RETURNS of failures this week show 407 defaults in the United States as compared with 451 last week, and reveal a considerable increase over the 264 insolvencies reported to R. G. Dun & Company for the corresponding week of 1921. Of the current week's failures, 244 involved liabilities of $5,000 or more in each instance, which represents 60 per cent of the aggregate number. Last week, when there were 280 defaults, for $5,000 or more in each case, the ratio was 62.1 per cent, while the ratio a year ago, with 141 similar insolvencies, was 53.4 per cent.

Lighting Articles Duty Causes Protest by Importers' Association

THE American Importers' Association of Lighting Specialties has filed a brief with the Senate finance committee concerning the proposed rate of duty on illuminating articles of every description, including chimneys, globes, shades and prisms. In this brief it is pointed out that the total imports of illuminating glassware, as compared with the production of these articles in the United States, are not more than 5 to 10 per cent of the total consumption, and that the amount of illuminating glassware exported from the United States equals, if it does not exceed, the importation of similar foreign-made merchandise into the United States. It is emphasized in the brief that the domestic manufacturer enjoys advantages over the importer, such as being in a position to extend refunds in case of breakage, prompt shipments and a much larger volume of business compared with the sale of imported goods.

Request is made, therefore, that the proposed rate of 70 per cent ad valorem be changed to 45 per cent ad valorem, which is the rate now in force.

Metal Market Situation

COPPER prices remain unchanged, with demand continuing strong here and abroad. A rise above 14 cents will be slow, it is believed, as producers prefer to see consumption increase rather than to get higher prices.

Domestic demand is widespread, being fair from wiredrawers, brass founders and rollers. Inquiry is mainly for July, with some buyers still in the market for June. August demand, however, is larger than June inquiry at present. Agencies in a position to make large sales of July copper are not much more numerous than those with stocks of June metal on hand.

Demand for steel products continues heavy, particularly for sheets, and prices are comparatively firm. Orders on hand are reported to be large, and a good volume is expected indefinitely.

NEW YORK METAL MARKET PRICES

Copper:	May 29, 1922	June 7, 1922
London, standard spot	£ s. d. 62 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.87@14.00	14.00
Electrolytic	13.75	13.87½
Casting	13.37½	13.37½
Lead, Am. S. & R. price	5.65	5.65
Antimony	5.37 -5.50	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	5.62½	5.70
Tin, straits	30.75	32.62½
Aluminum, 98 to 99 per cent	17.87½	19.10

OLD METALS

	May 29, 1922	June 7, 1922
Heavy copper and wire	11.50 -11.75	11.50 -11.75
Brass, heavy	5.50 - 6.00	5.50 - 6.00
Brass, light	4.87½- 5.25	5.00 - 5.25
Lead, heavy	4.70 - 4.80	4.70 - 4.75
Zinc, old scrap	2.87½- 3.00	2.87½- 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

INCREASED demand throughout the country for wire and motors is the feature of this week's electrical market. Industrial requirements show the most activity in a market which for the last three weeks has been termed dull and unresponsive to the opportunities which are afforded by the great amount of residential and commercial building construction.

Jobbers express the belief that the new amount of business is only beginning to reach them, and that with many buildings now approaching completion they soon will have more orders than their none-too-full stocks will allow them to handle.

Conduit has shown much activity during the past week. The South and West report stocks in good condition, while the Eastern and Middle Western districts fear that increasing orders will soon take their reserves unless shipments from the manufacturer can move more quickly.

Central-station outputs are larger than a year ago, and more line construction is under way. Radio enthusiasts are buying less in the wire and instrument market because of static conditions, dealers say. It is said that the radio market will not show any great activity again until well into the fall months.

Daylight saving has not cut into retail lamp sales as much as had been expected. Prices are firm and much replacement buying is noted.

NEW YORK

The long-looked-for renewal of activity along industrial lines in the electrical trade is beginning to materialize. There have been many indications that this class of business was showing signs of life, but until the last two weeks actual increases in business from industrial plants were very slight.

Local jobbers who specialize on this class of customers appear to be very busy and express their satisfaction with this turn for the better. New industrial building and additions to existing industrial plants so far this year show an increase of about 100 per cent over the same period a year ago, and there is more confidence in the whole industrial situation than at any time since the latter part of 1920.

The demand for wiring material remains steady at about the same level as last week. No price changes were reported, and jobbers' stocks generally are in good condition.

There has been a marked falling off in the demand for radio equipment. This is due partly, of course, to the static conditions prevailing during the summer months. However, a great number of retailers have entered this business, and the supply of material is much nearer the demand than at any time since the first of the year. Jobbers expect that by fall the radio business will be on a much more stable foundation.

Rigid Conduit.—Demand is confined mostly to small lots, as the large users have protected their requirements by placing orders for future delivery under the previous schedule. Prices show quite a wide variation, although there is more of a tendency to hold out for the higher quotations.

Rubber-Covered Wire.—While there is only a moderate demand for wire, indicatons point to higher levels in the near future. Quotations are stiffening, and there is little inclination to cut prices to secure business. No. 14, rubber-covered, single-braid, shows a range of from $6 to $6.50 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—No change in prices or demand for this material was noted this week. No. 14, two-wire, single-strip, sells for $42.50 and $43 per 1,000 ft., and double-strip for $45 to $47 per 1,000 ft. in that quantity.

Outlet Boxes.—Black boxes in standard-package lots are quoted at 60 to 62 per cent off list, and galvanized boxes in the same quantity at 55 to 57 per cent off list. Demand is fair and stocks are good.

Dry Cells.—No. 6 regulars in barrel lots of 125 are quoted at $29 per 100, and igniters in the same quantity at $30 per 100.

Fans.—Sales have been exceptionally good so far this season, jobbers reporting increases of from 20 to 25 per cent over last year. The 16-in. oscillator is in greatest demand, and dealers are reporting satisfactory business.

Washers.—Little improvement has been noted in the demand for washing machines, although prices are much lower than last year.

CHICAGO

Business in the electrical trade during the past week moved along on the even plane it had established the week previous. The strengthened copper market reflected a slight advance in rubber-covered wire. Building activity is still calling for a good volume of conduit and wire. Armored conductor is a close second. The motor industry for May on the whole showed activity practically equal to April's business, although a few variations were found. The transformer field was a bit slow.

Conduit.—Pipe is selling satisfactorily, but quotations vary, since price competition is still existing. While the ½-in. black pipe is quoted at $43 per 1,000 ft. in 5,000-ft. lots, better prices are sometimes offered in order to obtain orders. There are some jobbers, however, who attempt to maintain these figures since they prefer to lose orders rather than accept them and lose money on the deal. Stocks are in good condition.

Flexible Armored Conductor.—The demand for this conductor is continuing steadily, and quotations have not changed. The No. 14 two-wire, single-strip sells between $42.50 to $43 per 100 ft. in 5,000-ft. lots.

Wire.—Building construction is creating an active market for rubber-covered wire. A stiffened price following the rise in copper was noted on the No. 14 rubber-covered during the week, since it now sells for $6.10 per 1,000 ft. in 5,000-ft. lots. Stocks are good. The bare and weatherproof wire market has not changed noticeably although the demand has been steady.

High-Tension Equipment.—Another week of active business was reported by manufacturers of this equipment. One company mentions a sale of several 25,000-volt air-disconnecting switches to a Western utility. Another firm has listed orders for a 2,400-kva., 13,200-volt outdoor substation for steel mills and for four 600-kva., 22,000-volt outdoor substations for the Southwest. Farm-lighting equipment is also moving well.

Motors.—The motor market for the past month has been spotty. Though the weekly averages have not fallen below April's figures one company reports that most of the sales have been on medium-sized installations. Another firm states that it has received a fair volume of orders on medium sizes, and still another explains that its May sales were not as good as April's. Most of the sales have been for maintenance work.

Transformers.—While distribution transformers are leading in this field, some of the companies report little change during the month. Other firms say that the market has been a trifle slow.

Insulators.—Active trading on both suspension and pin-type insulators has been reported by manufacturers. One manufacturer who recently increased his working schedule from a three-day week to a five-day week is now working six days. Prices are firm.

BOSTON

Business conditions are brightening in New England, although no striking change occurs from week to week at present. Central-station outputs are substantially larger than a year ago, and more line construction is under way than for some time. The demand on wholesalers for radio-telephone equipment has slumped decidedly within a fortnight, and deliveries are now much improved on virtually all supplies except tubes. House wiring is progressing finely and wiring materials are moving actively. Building and engineering contracts for the week ended May 29 in New England totaled $4,690,100 against $4,998,000 for the corresponding week last year. In only four weeks of the past twenty years corresponding to these seven days has this total been exceeded. An important step was taken Monday by a number of large cotton textile mills in New Hampshire, when these were opened on the basis of the fifty-four-hour week and 20 per cent wage reduction specified by the manufacturers at the outbreak of the strike last winter. In Rhode Island striking employees have been gradually returning to work for some weeks, and it is reported that a third of the mills in that state are now operating on full time. Conditions are good in the paper-making industry; leather factories, while dull for the time being, are optimistic, and the metal-working plants are doing better.

Wire.—Competition is extremely sharp in rubber-covered and weatherproof wire. The former is moving at $6.25 per 1,000 ft. in 1,000-ft. lots, ample stocks being in hand. Weatherproof wire has stiffened about ½ cent per pound, the base Monday being about 16 cents. Central-station buying has improved noticeably. Bare-copper-wire sales are dull, and the demand for radio aerials appears to have fallen off somewhat.

Lamps.—Replacement orders are coming in well, and sales of lamps for summer cottage and resort hotel service are beginning to be more active. Daylight saving has not cut into retail lamp sales, owing probably to vigorous merchandising of modern illumination during the past few months.

Motors.—Sales by jobbers are very dull, although occasional moderate-sized orders for one or at most a few units are put through after careful shopping about by purchasers. Prices are firm.

Loom.—Within a fortnight sales have picked up encouragingly. Stocks are far ahead of the demand, however, and prices are steady and subject to much complaint as to low profits.

Flexible Armored Conductor.—Brisk sales are reported in some quarters, with stocks easily meeting requirements. New building operations are absorbing much of this material. No. 14 double-strip was quoted at $47 per 1,000 ft. in Boston Monday.

Pole-Line Material.—Cross-arms and hardware are moving better, though orders are still of moderate size. Six-pin 5½-ft., long-leaf, yellow-pine arms sell at $1 each in lots of less than 100, usual orders not exceeding fifty or sixty arms. Eucalyptus pins sell according to quality at $4 to $5 per 100. Hardware is moving correspondingly well.

Radio Apparatus.—Some producers note a recession in demand, and jobbers also are not receiving the avalanche of orders formerly in the mails. Static troubles during warm weather no doubt affect the market somewhat. It is apparent that high-quality sales effort will be required in maintaining the ultimate normal demand.

ATLANTA

Weather conditions are not only materially interfering with agricultural and building activities, but unless the rains cease in the next day or so considerable damage will result to cotton, peach and melon crops in the northern part of Georgia. Precipitation in the month of May is in excess of any month recorded by the Weather Bureau since 1879, with the result that a week or more of bright weather is necessary before any farm work can be undertaken. This inclement weather is materaily injuring the prospect for a good cotton crop, as it is conducive to additional boll-weevil damage. In fact, reports indicate that this insect is already at work on the new plants in some localities.

Despite these unfavorable conditions, retail trade for the month shows a continued improvement. Sales by department stores in thirteen of the largest cities in the Sixth Reserve District show an increase over the preceding month, the total sales being for the first time in many months almost equal to those of the same month last year. Textile interests report an increase in the number of unfilled orders on hand, and improvement is to be noted in the iron and steel industry in Birmingham, three additional furnaces being in operation in this locality. Electrical jobbers report business as a whole improved, radio equipment especially being in brisk demand, while a heavy movement of wiring supplies within the next three months is anticipated.

Poles.—The movement of poles is reported as showing some improvement, recent inquiries for fair to good purchases being reported by jobbers. Prices as a whole are steady, though odd lots are being offered at figures considerably below market quotations. Pole-yard stocks are in good shape.

Pole-Line Hardware.—A fair to good volume of business is reported in this line, orders coming mostly from the larger central stations, though increased activity is to be noted in the municipal plant field. Prices have remained fairly steady for some time.

Lightning Arresters.—Sales of this specialty are on the increase, local contractors, jobbers and central-station companies purchasing for summer requirements. The compression type leads in popularity, with prices steady and stocks ample.

Rigid Conduit.—Business in this line is reported as good, with a price advance of from 2 to 5 per cent recently announced. No one partcular size seems to be unusually active, the demand being divided proportionately among sizes up to 4-in., both in black and galvanized. Stocks are in good shape.

Flexible Non-Metallic Conduit.—This item continues its steady movement, stimulated by the wiring of old houses and ordinances abolishing knob and tube work in the business districts. Present quotations in lots of 5,000 ft. for two-wire, No. 14, are $51 per 1,000 ft.

Sewing Machines—This appliance is not responding to the usual spring demand, owing in all probability to inclement weather and the reduced purchasing power of the average householder.

Washing Machines.—Campaigns and aggressive sales work have not served to stimulate materially the movement of this article, sales being reported only in isolated instances and then only after aggressive sales effort. Jobbers' stocks are fair to heavy.

ST. LOUIS

That construction work in this territory is getting back into its stride is indicated by the building permits issued in St. Louis during May. The valuation placed upon them amounted to $2,396,880, as compared with $2,111,596 the month before and $1,087,195 in May, 1921. By far the greater portion of the work being done is residential, but new manufactories and workshops are increasing in volume. The permits for the latter class of construction last month amounted to $105,000 and covered five new buildings.

Retail conditions continue to show improvement except in the coal-mining districts, where the strike is in progress. There seems to be more confidence in values and in the future of business than at any time in the last eighteen months. From this confidence there are two notable results—retailers are stocking more than in the past, and agriculturists are entering with greater enthusiasm into heavier production of crops and live stock.

None of the industrials and central stations is as yet suffering from the coal strike, as mines in this district still have a large number of unconsigned loaded cars, and there have been fair shipments from Kentucky and other fields. There is a possibility, however, of considerable trouble when the fall demand begins, because of transportation difficulties, unless the strike be terminated in the interim.

Lightning Arresters.—The demand has been quite active in the past few weeks, especially for 2,300-volt and 4,000-volt distribution circuits. The advantages in more complete lightning protection are being more fully realized by the municipal plants as well as the larger central stations. Local stocks are in good order and immediate shipment usually can be given.

Motors.—With improvement in industrial conditions, motor business is slowly gaining ground. There is a growing tendency toward individual drive, especially in the woodworking industry, and as a consequence most of the industrial motors being sold are smaller than 25-hp. in size.

Wire.—The demand showed little change last week, and no sensational orders were in sight. No. 14 rubber-covered had a steady call at $6 to $6.25 per 1,000 ft. in 5,000-ft. lots. The weatherproof base is around 16 cents per pound, and that of bare around 17 cents per pound. Ample stocks are on hand.

Fans.—Prevailing moderate temperatures have held back the early retail demand, and as a consequence movement all along the line has been quiet. Stocks are very conservative, so that a sudden hot spell would cause a rush on both the jobbers and manufacturers.

Sewing Machines and Motors.—Sewing machines have been slow movers, and the motors have not met with much demand until recently. A comparatively good amount of business in the latter item was reported last week.

SAN FRANCISCO

Sudden floods have inundated parts of the San Joaquin Valley. Many crops have been lost, but all in all, because of better irrigation, the crops, while not bumper, will rank high. Farmers are buying well and interior towns and cities report good business. Collections show a slight improvement, but new orders are carefully scrutinized by credit departments to cut down the very large outstanding accounts.

The value of the building permits for May, 1922, is: Los Angeles, $9,327,504; San Francisco, $4,377,066; Oakland, $2,167,322, and San Diego, $677,580. The corresponding values for May, 1921, were: Los Angeles, $7,433,760; San Francisco, $1,097,151; Oakland, $1,033,323, and San Diego, $416,298.

Farm Plants—Steadily improving sales are reported, well distributed among the sections covered, and a better averaging of sales is noticeable.

Rubber-Covered Wire.—No. 14 single-braid, solid, is selling in 5,000 ft. lots for $6.75 per 1,000 ft., with an approximate 10 per cent advance in coil lots. The recent 5 per cent advance caused brisk buying.

Pole-Line Hardware.—Prices generally have advanced about 10 per cent. An excellent movement well proportioned is reported in this line; judged by its showing over the past four seasons, it is a staple wth a demand that can be accurately forecast.

Bare Copper Wire.—The new base is $19 per 100 lb. Stocks are better. Radio business has caused a widespread stocking in small sizes and in small packages, and for a time the comparatively limited sources of supply could not cope with demand.

Tapes.—Commercial-grade ¾-in. friction tape is now bringing about 33½ cents per pound in 100-lb. lots for half-pound rolls. Rubber tape in the same assortment brings 30 cents per pound. Manson tape in 100-lb. lots sells for about 65 cents per pound and Okonite for about 85 cents. Local stocks are good, after several shortages in friction tape.

Household Material.—It is a little early to forecast the result of "June Bride" week, but the dealers are all making good displays and are realizing that they will get returns in proportion to the enthusiasm and sales effort they put into the event. At any rate, some method of calling popular attention to electrical devices is urgently needed.

PORTLAND—SEATTLE

Owing to unusually dry weather during the past month, together with the hot spell of the past week, a number of forest fires gained headway and burned standing timber, mill sites and railway property in western Washington, resulting in property damage estimated at something over $500,000. Because of the increased demand for lumber and lumber products a number of mills in the Puget Sound region have put on night shifts, beginning the first of June.

In some mills the minimum wage for common labor has been increased from $3 to $3.40 per day. Lumber production is still increasing and for the week ended May 27 was 12 per cent above normal. New business exceeded production by 10 per cent.

Building permits in Portland for May were 11 per cent greater in number than for May, 1921, and exceeded the value of permits for the same month this year, which was 37 per cent greater than last year. Electrical permits were 42 per cent in excess of those for May last year, and fees collected were the greatest in the history of the department.

During the first four months of 1922 Seattle's net increase in the wholesale sales covering four major lines was about 23 per cent. This is a good index of returning prosperity.

Electrical jobbers report business slightly improved. The warm weather of the past week has materially stimulated fan business, and with prospects for a warm summer, this business is expected to be exceptionally good for the next two or three months. As compared with the normal summer season, jobbers did not lay in a large stock of fans and the prospects are that stocks will run short.

Conduit.—One-half-inch black is quoted at $6.15 and galvanized at $6.70 per 100 in 10,000-lb. lots; ¾-in. black is quoted at $7.90, and galvanized at $8.70 per 100 lb. in similar quantities.

Flexible Armored Conductor.—Double-strip, No. 14, is quoted at $61.70 per 1,000 ft. in coil lots of 250 ft.

Outlet Boxes—Three-inch standard outlet boxes are quoted at $12 per 100 in standard-package quantities of 100. Four-inch boxes are $15 per 100 in similar quantities.

SALT LAKE CITY

Building permits in practically all important cities of the Intermountain region showed a healthy increase for May, 1922, over the corresponding month of last year. Permits were granted for the past month in Salt Lake City alone for 149 new constructions, with a total cost of over $500,000. This represents a decided advance over the record set for April of this year.

The lumber and allied industries are consequently experiencing a decided seasonal boom that is reflecting favorably on business generally. Builders' hardware is in good demand, with prices fairly stable.

A reduced price schedule covering many lines of electrical merchandise will become effective July 1. Jobbers expect a corresponding pick-up in general demand and dealers manifest a better buying tendency. As mining resumes on a better production scale, jobbers of electrical products note an improvement of the market. Copper plants are still going on a partial production schedule, but lead and silver properties are normally active. Lead recently reached the level of $5.65 per 100 lb., showing an advance of 15 cents in one record day.

Wire.—As construction work advances, the wire market shows steady improvement. The improved demand for copper is reflected in a stiffening tendency in wire. Rubber-covered wire made a recent jump of 1½ cents per pound and bare copper wire one of ½ cent per pound. Stocks are in excellent shape.

Conduit.—Stocks are in good condition, with a fairly good demand. No recent price fluctuations are noted.

Transformers.—This is a staple line, the market holding an even tendency. The power companies furnish a good market, with the prospect of steadily increased demand as development proceeds. There is no shortage of stocks.

Dishwashers.—This is another electrical device the sale of which lags.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Anaconda Copper Company Books 1,000,000-Lb. Wire Order

The Anaconda Copper Mining Company reports a good wire business on the Pacific Coast and states that it has booked an order for another 1,000,000 lb. of wire from the Pacific Gas & Electric Company. Two months ago the Anaconda company made a final shipment on a 10,000,000-lb. wire order for this concern. The Great Falls plant, which has a monthly capacity of 8,000,000 lb. of wire and rods, is operating at between 6,000,000 lb. and 7,000,000 lb. at present.

Holslag Wins Arc-Welding Patent Decision

Priority of invention of the alternating-current transformer type of arc-welding equipment has been awarded by the Patent Office to Claude J. Holslag. This equipment is manufactured under license by the Electric Arc Cutting & Welding Company, Newark, N. J.

This case of Waters versus Holslag, wherein Waters declared that he was the original inventor of the welding machine, started in the summer of 1920. The written record of the case is one of the most voluminous ever presented to the Patent Office. A total of forty-five witnesses were examined and testimony was taken in Schenectady, Albany, Peekskill and New York City. The case was decided May 22.

The entire testimony of more than 2,000 pages was gone into at great length by the Patent Office in a forty-page decision, in which it stated:

"Waters relies mainly on exhibits Holslag had written Waters while they were friends, which were satisfactorily explained by Holslag under cross-examination. These exhibits appeared to include Woticky in the alternating-current welding scheme, but inclusion of Woticky is explained in cross-question No. 1170, and both Holslag and Waters deny joint inventorship, and the evidence showed that Holslag is the actual inventor."

The General Electric Company attacked these patents on the grounds that one of Thomson's transformer patents was very similar, but the Patent Office allowed the broad transformer welding claims of Holslag in the following words:

"The gist of the broad invention is this new use for an old apparatus. *Ex post facto*, the applications seem obvious, but the long want for such an apparatus in the welding art, unsatsified, as appears from the record, until the present system for use of this apparatus long known and used in other relations was devised and found favor, indicates a high degree of invention."

Business Growth Forces Boston Distributer to Move

The Beaudette & Graham Company, 130 Federal Street, Boston, will move about July 1 to 915 Boylston Street, Boston, as a result of the rapid development of the company's business. W. H. Dalton, sales manager, informed the ELECTRICAL WORLD recently that the new quarters will not only occupy a larger area than the present space of the company, but will permit a consolidation of warehousing, service and merchandising facilities under a single roof, in place of the present scattered arrangement.

The demand for washing machines and refrigerating apparatus has been improving of late, and the company has recently taken the agency for "Emmonswood" radio apparatus, manufactured by the Boston Scale & Machine Company, Roxbury, Mass.

Travis Company New Representative of Pacific Electric

The Travis Engineering Company, consulting, designing and constructing, Kansas City, has been appointed a sales representative for the Pacific Electric Manufacturing Company in the Kansas City territory, officials of that company have announced.

Wagner Electric Announces Reorganization Plan

Provides for Issuance of $3,000,000 7 per Cent Preferred, $2,500,000 7 per Cent Bonds and 80,000 Shares No-Par Common

The proposed plan for reorganization of the Wagner Electric Company, which provides for the issuance of $3,000,000 in 7 per cent preferred stock, $2,500,000 in 7 per cent bonds and 80,000 shares of no-par common stock, has been announced in a letter of W. A. Layman, president of the company, to the stockholders. The plan is approved by the board of directors and unanimously indorsed by the stockholders' committee. A reorganization of the directorate is also planned.

The proposed financial plan is as follows:

To authorize 7 per cent cumulative preferred stock to the amount of $3,000,000, of which $1,500,000 is now to be sold; to authorize and sell bonds bearing interest at a rate not to exceed 7 per cent to the amount of $2,500,000; to authorize no-par-value common shares to the amount of 80,000 shares, of which approximately 58,270 are to be exchanged, share for share, with the holders of the present common stock; 20,000 shares to be used to accomplish the reorganization and refinancing of the company, and the balance of which is to remain in the treasury for future use.

The $1,500,000 of preferred shares are to be offered to the stockholders at par, or $100 per share, with a bonus of two-thirds of one share of no-par common with each share of preferred stock taken. During the last seven fiscal years, according to the latter, the average annual earnings applicable to dividends have been approximately three times the annual dividend requirements of the proposed preferred stock.

With the placing in effect of the new financing a new board of directors is proposed with the following membership: V. W. Bergenthal, assistant treasurer of the company; James M. Buick, vice-president of American Car & Foundry Company; Guilford Duncan, president of Ludlow-Saylor Wire Company; James H. Grover, vice-president of St. Louis Union Trust Company; John F. Lee, attorney; W. A. Layman, president of the company; Stewart McDonald, president of Moon Motor Car Company; E. J. Miller, president of St. Louis Screw Company; J. Herndon Smith, of Smith-Moore & Company, and Harry J. Steinbreder, president of Fulton Iron Works.

Regarding the operations of the current year, Mr. Layman makes the following statement: "The electrical business of the country as a whole is showing a marked revival. Our production operations at the present time are on a basis of approximately 50 per cent of the capacity of our plant facilities. Incoming business is at the rate of approximately 70 per cent of the capacity of the plant. The number of employees of the company has increased from 1,219 on Jan. 1, 1922, to approximately 1,900 for the week ended May 20. There is every indication from the steady increase of our sales that the operations of the year will show a profit after payment of interest on bonds, dividends on new preferred stock and making adequate provision for physical depreciation of property. If the improvement in business which has been experienced since Jan. 1 continues throughout the year, within six months substantially the entire manufacturing facilities of the company will be occupied."

New Departure Company Adds 800 Men to Payroll

That 800 men have been added to the payroll of the New Departure Company at the Bristol and Elmwood plants in the last two months is announced by officials of that company. The larger part of this increase has occurred in the last month. It is interesting to note, says the announcement, that the present force is nearly three times what it was before the war.

Worthington Pump Announces Purchase of Camden Records

The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, announces that it has purchased all drawings, records and patterns covering centrifugal pumps and pumping engines manufactured by the Camden Iron Works, Camden, N. J., and formerly sold either direct or through R. D. Wood & Company, Philadelphia, and other agents.

Chicago Firm to Represent Many Electrical Lines

The Manufacturers' Electrical Corporation, 123 West Madison Street, Chicago, is one of the latest organizations to enter the field as representatives in the Middle West for manufacturers of electrical equipment ranging from motors to wiring materials. Edgar Switzer, for the past ten years with the Westinghouse Electric & Manufacturing Company, has resigned his position to become vice-president and general manager of the Manufacturers' Electrical Corporation. Mr. Switzer, while outlining the plans of the new company to a representative of the ELECTRICAL WORLD, pointed out the need for a selling company for manufacturers specializing in the production of lines that were somewhat limited. Closer relationships could be established by better and more frequent contacts with the buyers by a company solely devoted to distribution problems than could be obtained by a manufacturer of a single product. The capital stock consisting of $25,000 of preferred stock and 1,000 shares of non-par value has all been sold.

Increased Demand for Domestic Power Apparatus

Since April 1 the demand for motor-driven equipment for various classes of domestic service has increased materially, according to Philip Atwater, manager Boston office, Home Electric Power & Equipment Company, agents for "Delco Light" products. Mr. Atwater informed a representative of the ELECTRICAL WORLD last week that in the past ten weeks about thirty electric refrigerating plants have been sold through this office, including a single order for five equipments from the Rhode Island Hospital at Providence and two equipments for John Hayes Hammond, Gloucester, Mass. This represents a striking increase over the sales rate of the past two years. The demand for lighting equipment is also picking up at present, and increased interest has followed price reductions announced several weeks ago. Farm business is somewhat spotty, depending upon local prosperity, but conditions in both Vermont and New Hampshire are steadily improving. Mr. Atwater also said that the demand for the new duplex type of washing machines recently placed on the market by the company is so marked as to make it impossible to build up local stocks to any extent at present.

The demand for motor-driven pumping plants is very active, following a recent price reduction of $55 on a representative outfit.

Westinghouse Domestic Sales Committee Is Augmented

The activities of the large sales force of the Westinghouse Electric & Manufacturing Company are directed by a committee composed of the heads of various departments of the company. This body is known as the domestic sales committee, and it holds meetings monthly for the discussion of business conditions and sales policies and for the purpose of formulating action to keep the sales of the company on the upward grade.

H. D. Shute, vice-president in charge of sales, is chairman of the domestic sales committee, and Roscoe Seybold, manager of price statistics, is secretary.

The committee was augmented recently when the supply department was reorganized and the new merchandising department of the company was established.

The Pacific States Electric Company, electrical jobber, San Francisco, has recently taken on the line of "Red Spot" lighting specialties, manufactured by the F. W. Wakefield Brass Company, Vermilion, Ohio.

The Elliott Company, manufacturer of power accessories, Jeannette, Pa., announces the following changes in its organization. W. E. Widau, formerly of the Cleveland office, has been made assistant general sales manager; J. R. Lemon and S. B. Overton have been added to the sales force of the Philadelphia office; R. K. Williams has been added to the sales force of the Cleveland office and W. T. Bickel to that of the Pittsburgh office. In addition to Elliott products the latter four men will sell the products of the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield.

The Hygrade Lamp Company, Salem, Mass., has let the contract for the construction of a four-story 50 ft. x 100 ft. brick and steel addition to its factory on Boston Street, that city. The new building will afford the company 20,000 sq.ft. of additional floor space and will cost about $75,000.

The Illinois Electric Company, electrical supply jobber, Chicago, has purchased a block of property at Boyd and San Pedro Streets, Los Angeles, where a modern warehouse and office building will be erected for its Los Angeles branch. This, according to C. B. Hall, manager of the Los Angeles branch, is the first step in a program of expansion in the Southwest territory. The new building will have more than 35,000 sq.ft. of floor space with provisions for future additions.

DOMESTIC SALES COMMITTEE, WHICH WAS ENLARGED RECENTLY, OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Front row, left to right: John J. Gibson, assistant to vice-president in charge of merchandising and supply departments; G. Brewer Griffin, manager of automotive equipment department; W. S. Rugg, assistant to vice-president; H. D. Shute, vice-president in charge of sales; E. H. Sniffin, manager of power department; J. C. McQuiston, manager publicity department.

Back row, left to right: Charles Robbins, assistant to vice-president; Roscoe Seybold, secretary of domestic sales committee; J. S. Tritle, manager of merchandising department; D. D. Ferris, assistant manager of marine department; T. J. Pace, manager of supply department; W. K. Dunlap, acting vice-president; J. M. Curtin, manager of industrial department; M. B. Lambert, manager of railway department; A. A. Brown, manager of syndicate operations.

Foreign Trade Notes

PROPOSED ELECTRIC TRAMWAY IN SEVILLE, SPAIN.—Application has been made by the Compañia Tranvia de Sevilla, the *Electrical Review* states, for a concession to construct an electric tramway in Seville.

LOAN FOR AUSTRALIAN TELEPHONE LINES.—A foreign loan of £2,000,000, according to *Commerce Reports*, has been authorized by the Australian government for the Postmaster-General's Department in connection with the construction of trunk, telegraph lines, telephone lines and other telephone work. In January the post office officials asked for a loan of £8,000,000 for this purpose.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An importing firm in Spain (No. 2,312) wishes to purchase aluminum sheets for automobile bodies and machinery for working same and electric ovens for varnishing and enameling automobiles.

The purchase is desired of electrical supplies, novelties, toys, etc., by a merchant in Spain (No. 2,319).

A firm of commission agents in Italy (No. 2,323) desires to secure an agency for the sale of electrical articles, motorcycles, etc.

A mercantile firm in Belgium (No. 2,340) desires to purchase and secure an agency on consignment for small electrical appliances, including lamps, flatirons, sweepers, etc.

The purchase is desired by a municipality in Canada (No. 2,350) of meters for electric current applied to kitchen ranges, alternating current, 60 cycles, 110 volts.

Dealers in optical goods in Italy (No. 2,353) wish to purchase and secure an agency for electric lamps and electrical goods in general.

The purchase of electrical supplies, novelties, etc., is desired by a merchant in Spain (No. 2,364).

AUTOMATIC SWITCHBOARDS FOR MELBOURNE.—Tenders will be received by the Postmaster-General's Department, Melbourne, Australia, until Oct. 17, according to the *Electrical Review*, for automatic switchboards and accessories for two suburban exchanges at Melbourne.

ELECTRIFICATION OF BOLOGNA-MONFALCONE (ITALY) RAILWAY.—The Director-General of Italian State Railways, according to the *Electrical Review*, announces an extension of date from April 30 to July 31, 1922, for receiving tenders for the electrification of the Bologna-Venice-Monfalcone Railway.

ELECTRICAL APPARATUS FOR NEW ZEALAND.—Tenders are being asked by the Southland Electric Power Board, Wellington, New Zealand, to close in September, the *Electrical Review* states, for electrical apparatus, including transformers, cables, switches, insulators, etc.

New Apparatus and Publications

WATT-HOUR-METER ATTACHMENT.—A demand attachment for use with a standard type "OA" polyphase watt-hour meter for small power installations is being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

LIGHTING CALCULATOR.—"The Westinghouse Pocket Lighting Calculator," designed by the Illuminating Engineering Bureau of the Westinghouse Companies, has been published by the Westinghouse Lamp Company, 165 Broadway, New York City.

METAL STATISTICS.—The fifteenth annual edition of "Metal Statistics," 1922, has been published by the American Metal Market and Daily Iron and Steel Report, 81 Fulton Street, New York City.

RANGES.—The Simplex Electric Heating Company, 15 South Desplaines Street, Chicago, is distributing a folder covering various types of the "Simplex" electric ranges.

PORTABLE INSTRUMENTS.—The Jewell Electrical Instrument Company, 1640 West Walnut Street, Chicago, has issued a bulletin which describes two new garage testing meters.

INSULATOR TEST.—The Lapp Insulator Company, Inc., Le Roy, N. Y., is distributing bulletin No. 88, describing the Lapp "Overpotential" insulator, a new feature in high-voltage insulator production.

RECEPTACLES AND ACCESSORIES.—"Elexits-Places for Lights" is the title of an eight-page pamphlet issued by the Bryant Electric Company, Bridgeport, Conn., covering its various types of standard receptacles and accessories

RHEOSTATIC CONTROL.—A four-page leaflet issued by the Allen-Bradley Company, Milwaukee, describes and illustrates the "Bradleystat" filament control for adjustment of radio vacuum-tube filament current.

REFLECTORS.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is distributing a leaflet calling attention to its "Elliptical Angle" reflectors, designed for sign illumination.

FAN STAND.—A new fan stand has recently been placed on the market by the Crucet Manufacturing Company, 292 Fifth Avenue, New York City.

ELECTRIC LAMPS.—The Duplex Lighting Works of General Electric Company, 6 West Forty-eighth Street, New York City, has recently brought a new development in lighting, known as "Filterlite." The company has also added a new floor lamp and two table lamps to the "Duplex" line of lighting products.

RADIO APPARATUS.—The Beaver Machine & Tool Company, 625-643 North Third Street, Newark, N. J., is distributing a four-page folder covering its new "Beaver Baby Grand" vest-pocket portable radio receiving set.

INDUSTRIAL EQUIPMENT.—Nathan Klein & Company, 208 Centre Street, New York City, dealers in electrical and industrial equipment, has issued catalog R, covering various types of industrial equipment, including electric motors, portable drills, welding apparatus, machine tools, etc.

ELECTRICAL APPARATUS.—The Mutual Electric & Machine Company, Detroit, Mich., has issued its apparatus division catalog for 1922, covering its "Bulldog" line of safety switches, switchboards, panelboards, cabinets, etc.

ELECTRIC NEWS BULLETIN MACHINE.—No. 78, Vol. IV, of the *Cutler-Hammer Bulletin*, issued April 22, describes the new type of electric news bulletin machine recently brought out by the Cutler-Hammer Manufacturing Company, Milwaukee.

TRUCK SKID.—The Cowan Truck Company, 7 Water Street, Holyoke, Mass., is distributing a four-page folder describing the "Cowan" steel frame-lift truck skid, designed for use with hand and electric lift trucks.

OIL COOLER.—Bulletin No. 904 issued by the Griscom-Russell Company, 90 West Street, New York City, describes its "Multiwhirl" cooler for the cooling of oil and water in connection with Diesel engines.

RESISTANCE THERMOMETER.—A new direct-reading resistance thermometer designed for measuring temperature has recently been developed by the Brown Instrument Company, Philadelphia.

ARMATURE COIL TAPING MACHINE.—A self-feeding kickless armature coil-taping machine has recently been brought out by the P. E. Chapman Electrical Works, corner of Tenth and Walnut Streets, St. Louis.

METAL BASE.—A new device has been developed by Pass & Seymour, Inc., Solvay, N. Y., known as the "All Metal" BR base for use for all concealed outlets. A complete series of adapters has been developed to secure this base to all forms of outlets.

New Companies

THE AMERICAN SUPERPOWER CORPORATION, Lewiston, N. Y., has been incorporated with a capital stock of $10,000 to operate an electric light and power system in that section. The incorporators are J. Boardman Scovell, Lewiston; Edward C. Randall and A. M. Layton, Buffalo, and Frederick W. Ballard, Cleveland.

THE PLAINVILLE ELECTRICAL PRODUCTS COMPANY, Plainville, Conn., has been incorporated by F. L. Benzon, H. E. Smith and Donald Benjamin, all of Plainville. The company is capitalized at $50,000 and proposes to manufacture all kinds of electrical parts and supplies.

Record of Electrical Patents

Notes on United States Patents

(Issued May 16, 1922)

1,416,061. Radio-Receiving System Having High Selectivity; Michael I. Pupin, Norfolk, Va. App. filed Dec. 18, 1917.

1,416,077. System for Electrical Signaling; De Witt C. Tanner, Glen Ridge, N. J. App. filed March 8, 1919. Two-element electron tube used as modulator.

1,416,088. Telephone Exchange System; Edward E. Clement, Washington, D. C. App. filed March 14, 1905. Combination of automatic and manual devices.

1,416,089. Electric High-Velocity Classifier; Carl W. J. Hedberg, New Britain, Conn. App. filed Nov. 26, 1919. Separates suspended particles from gases.

1,416,099. Folding Machine; Roy S. Latimer, Troy, N. Y. App. filed April 12, 1917. Heating of machines for folding fabric blanks.

1,416,124. Electric Light Fixture; Paul J. Pfeifer, Cleveland, Ohio. App. filed July 11, 1921. Bracket for side lights.

1,416,181. Car Brake; Robert Z. Farmer and George S. Marsh, Roseburg, Ore. App. filed Nov. 8, 1919. Operated directly by electric motor.

1,416,183. Welding Electrode; Joseph W. Fay, Milwaukee, Wis. App. filed June 24, 1921. Covered with cement and insulated paper.

1,416,192. Conductor Rail; Edwin B. Grace and William Laffey, Memphis, Tenn. App. filed March 18, 1921. Three-conductor collector for cranes.

1,416,195. Electric Storage Battery; Edward Hacking, Central Falls, R. I. App. filed April 30, 1918. Has solid electrolyte.

1,416,197. Manufacture of Incandescent Electric Lamps; Francis Harrison, London, England. App. filed July 8, 1910. Method of renewing lamp filaments.

1,416,214. Storage-Battery Ventilating System; Charles C. King, Bridgeport, Conn. App. filed Sept. 5, 1919. Used in submarine boats.

1,416,225. Electric Heater; Francis M. May, Louisville, Ky. App. filed June 13, 1921. Heater draws air from outside street car.

1,416,226. Telephone Exchange System; Henry L. Meade, New York, N. Y. App. filed July 14, 1920. Common telephone connection for offices.

1,416,236. Electrical System; Franklin Punga, Liège Belgium. App. filed Sept. 25, 1911. Charging of automobile batteries.

1,416,254. Self-Winding Clock Mechanism; Charles E. Boillot, Brooklyn, N. Y. App. filed July 12, 1919.

1,416,256. Dynamo-Electric Machine Armature; Henry E. Borger, Newark, N. J. App. filed Dec. 30, 1916. Design of small motors and generators.

1,416,263. Electric Fireless Cooker; William Campbell, Detroit, Mich. App. filed Dec. 5, 1921.

1,416,265. Inherently Regulated Direct-Current Dynamo; Hans Charlet, Krefeld, Germany. App. filed July 8, 1920. Automobile motor and generator.

1,416,272. Electric Toaster; Edmond C. Floriot, New York, N. Y. App. filed Nov. 5, 1921.

1,416,273. Electric Power Transmission and Control; Ethelbert M. Fraser, Yonkers, N. Y. App. filed March 16, 1916. Gasoline-electric automoboile.

1,416,275. Sanitary Telephone Mouthpiece; Abraham A. Freedman, Chicago, Ill. App. filed May 11, 1921.

1,416,306. Driving Means for Phonographs; Henry K. Sandell, Chicago, Ill. App. filed April 17, 1919. Motor rotor fastened to under side of table.

1,416,320. Heat Exchanger; Hjalmar V. Barclay, New York, N. Y. App. filed Feb. 14, 1919. Closed circulating system.

1,416,326. Electric Starter for Internal-Combustion Engines; Frederic Billion, Solothurn, Switzerland. App. filed Jan. 18, 1922.

1,416,327. Storage-Battery Construction; Robert S. Blair, Sound Beach, Conn. App. filed May 9, 1919. One filling hole for all cells.

1,416,340. Annunciator; William T. Dippel, New York, N. Y. App. filed May 27, 1919.

1,416,359. Method of Side-Welding Wires; Laurence S. Lachman, New York, N. Y. App. filed July 12, 1920. By electric resistance welding.

1,416,360. Electric Welding Device; Laurence S. Lachman, New York, N. Y. App. filed July 12, 1920. For wire mesh or network.

1,416,398. Trolley Guard; George G. Cooper, Hillsboro, Ill. App. filed Oct. 7, 1921. Wire clamp has lateral arms.

1,416,403. Method and Means for Cleaning Silver, Gold, Platinum and Other Articles; Wilbur W. Everts, Rochester, N. Y. App. filed July 6, 1918. Articles immersed in salt solution with a bi-metal.

1,416,436. Electrical Heating Element; Percy A. E. Armstrong, Loudonville, N. Y. App. filed May 1, 1919. Alloy of iron and chromium.

1,416,446. Electrical Controlling Device; Dawson J. Burns, Bronxville, N. Y. App. filed June 14, 1919. Adjustable rheostat.

1,416,449. Electric Arc Welding; Alexander Churchward, New York, N. Y. App. filed Feb. 18, 1920. Current regulated by solenoid-operated carbon pile.

1,416,450. Electric Welding Method and Apparatus; Alexander Churchward, New York, N. Y. App. filed June 26, 1920. Automatic control for several arcs.

1,416,459. Electric Heater; Edward E. Gold, New York, N. Y. App. field Jan. 8, 1920. For passenger vehicles, etc.

1,416,481. Electric Heating Pad; Antonio Longoria, Cleveland, Ohio. App. filed Feb. 18, 1920. With thermostatic control.

1,416,482. Controlling Device for Electric Heaters; Antonio Longoria, Cleveland, Ohio. App. filed June 30, 1920. Condenser prevents arcing on thermostatical breaker.

1,416,485. Electrical Indicating System; William A. Lurie, New Orleans, La. App. filed Nov. 17, 1919. Shows if hotel-room doors are locked.

1,416,513. Generator for Electric Lamps; Sylvain Rosengart, Paris, France. App. filed Oct. 23, 1918. Portable flashlight.

1,416,527. Electric Fireless Cooker; Percival J. Townsend, Redwood City, Cal. App. filed May 25, 1920. Element embedded in soapstone.

1,416,535. Trolley Guard for Tunnels; Cyrus T. Whaley, Norfolk, Va. App. filed Oct. 17, 1921. Conductor fastened to inverted channel.

1,416,536. Trolley Guard for Tunnels; Cyrus T. Whaley, Norfolk, Va. App. filed Oct. 17, 1921. Inverted channel.

1,416,544. Heat-Controlling Device; Richard G. Barzen, Kansas City, Mo. App. filed March 30, 1921. Electric iron with thermostatic cutout.

1,416,572. Fluid Meter; Horace N. Packard, Milwaukee, Wis. App. filed March 27, 1918. Thermal type.

1,416,584. Method of Preserving Electric Furnace Linings; Hugh C. Sicard, Buffalo, N. Y. App. filed Feb. 12, 1920. By smelting titaniferous ore and iron to form lining.

1,416,592. Clock-Circuit Control Device; George A. Albright, Atlanta, Ga. App. filed Feb. 4, 1920. Mercury contact

1,416,601. Combined Heater and Ventilator; Robert G. Boone, Asbury Park, N. J. App. filed Sept. 7, 1920. Electrical element with motor-driven fan.

1,416,607. Lamp Socket; Walter M. Carter, Portsmouth, Va. App. filed Feb. 11, 1919.

1,416,611. Electrical Driving Means; E. L. P. Colardeau. App. filed Oct. 27, 1917. Vehicles with two motors and engine-driven generators.

1,416,612. Electric Motor; E. L. P. Colardeau, Paris, France. App. filed Nov. 13, 1919. Control system for multiple-unit train.

1,416,623. Electric Discharging Tube; Bruno Donath, Friedenau, Germany. App. filed Oct. 1, 1914. Improved covering for cathode.

1,416,631. Process and Apparatus for Concentration and Separation of Diamagnetic Minerals; Willard C. Hall, Butte, Mont. App. filed Aug. 4, 1921. By induction.

1,416,642. Call-Box Contact Mechanism; George W. Janson, Brooklyn, N. Y. App. filed July 2, 1920. Signal transmitter.

1,416,663. Telephone Repeater; Bernard C. Groh, St. Paul, Minn. App. filed March 13, 1916. For automatic or semi-automatic telephone systems.

(Issued May 23, 1922)

15,364 (reissue). Electrical Riveting; Albert B. Rypinski, Brooklyn, N. Y. App. filed Jan. 20, 1921. Rivets metal and non-metallic plates together.

1,416,688. Electric Heater; Samuel M. Carmean and James H. Carmean, Kansas City, Mo. App. filed Sept. 12, 1921. Fan and electric heater combined.

1,416,692. Electrolytic Apparatus and Method; Christian Dantsizen, Schenectady, N. Y. App. filed May 21, 1920. Deposition of iron on tungsten or molybdenum plates.

1,416,704. Electric Battery; Harry F. French, Fremont, Ohio. App. filed April 26, 1920. Dry cells of deferred-action.

1,416,724. Telephone Circuits; George W. Kuhn, Brooklyn, N. Y. App. filed March 16, 1918. Testing circuit.

1,416,738. Battery Construction; Albert L. Muren, Burlington, Iowa. App. filed Jan. 11, 1919. Electrolyte contains alkaline tungstate.

1,416,750. Heater for Waving Hair; Ziva Popin, New York, N. Y. App. filed May 17, 1919. Hair pressed between cylindrical shells.

1,416,751. Electrical Recording Apparatus; R. W. Press and C. W. Schwenzfeier, Glassboro, N. J. App. filed April 19, 1920. To keep performance records of machines.

1,416,761. Storage-Battery Separator; Godfrey Steerup, Chicago, Ill. App. filed Aug. 11, 1919. Diatomaceous earth formed into plate.

1,416,765. Ciphering Device; Gilbert S. Vernam, Brooklyn, N. Y. App. filed July 23, 1920. Enciphers and decipers telegraph messages.

1,416,774. Device for Receiving Radio Signals; Cedare Bardeloni, Rome, Italy. App. filed April 17, 1920. Uses electron tubes.

1,416,787. Method of Preparing Paste; Campbell C. Carpenter, Niagara Falls, N. Y. App. filed April 19, 1920. For storage-battery plates.

1,416,788. Storage-Battery Plate; Campbell C. Carpenter, Niagara Falls, N. Y. App. filed Aug. 3, 1917. Prevents treeing from plate to plate.

1,416,789. Magneto Generator; William H. Chapman, Portland, Me. App. filed May 5, 1919. To neutralize static in paper, wool and other processes.

1,416,802. Ignition System; Henry T. Duket, Toledo, Ohio. App. filed June 15, 1917. Ignition and starting apparatus for automobile.

1,416,804. Control Apparatus; Earl R. Evans, Great Barrington, Mass. App. filed Feb. 5, 1921. Drum-type motor controller.

1,416,824. Galvanometer; Charles F. Hindle, Elmhurst, N. Y. App. filed July 2, 1917. String galvanometer.

1,416,839. Clamp for Welding-Machine Attachments; Harry W. Kranz and John Lukes, Cleveland, Ohio. App. filed May 24, 1920. Welding ends of circular band or rim.

1,416,851. Thermostatic Regulating or Controlling Apparatus; Alfred H. McNeil, Chingford, England. App. filed Jan. 23, 1918. For temperatures to 1,000 deg. Fahr.

1,416,860. Machine for Collecting Waste Metal Articles; William Nelesen, Sheboygan, Wis. App. filed June 15, 1920. Truck equipped with magnets.

1,416,872. Electric Heater; J. R. Quain, London, England. App. filed July 26, 1920. Silica used to inclose element.

1,416,879. Process of Making Composite Metal Articles; J. F. R. Rousseau, Indianapolis, Ind. App. filed April 15, 1920. Making bearings, cam shafts, etc., by welding process.

1,416,883. Method of Spot Welding; Jacob C. Sander, Lynn, Mass. App. filed May 10, 1920.

1,416,897. Electric Heater; Maurice Simon, St. Louis, Mo. App. filed July 12, 1920. Inserted in walls of water tank.

1,416,908. Fluid Rheostat; Benjamin F. Tillson, Franklin, N. J. App. filed Sept. 15, 1920. Automatic control of fluid temperature.

1,416,910. Time-Controlled Reminder Apparatus; Samuel Toy, Boston, Mass. App. filed March 16, 1921. Electrically operated yearly calendar.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME. — The Cumberland Power & Light Company is planning to lay underground conduits on several streets in the city.

BOSTON, MASS.—An appropriation of $25,000 has been made by the board of directors of Wentworth Institute for the purchase of equipment and to complete plans for alterations in the chemical and electrical laboratories.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company has issued $650,000 in bonds, part of the proceeds to be used for extensions and improvements.

QUINCY, MASS.—The Quincy Electric Light & Power Company has been granted permission to issue $250,000 in bonds and $100,000 in capital stock, part of the proceeds to be used for extensions and improvements.

BRIDGEPORT, CONN.—A movement has been started to install an ornamental lighting system on Stratford Avenue from Seaview Avenue to the city line, to cost about $50,000.

DANBURY, CONN.—A one-story power plant will be erected by the Tweedy Silk Mills, Inc., at its local factory.

Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Edison Company contemplates extensions and improvements to its substation at Rodney and Analie Streets, to cost about $50,000.

BUFFALO, N. Y.—A power plant will be installed in the new building to be erected by the Buffalo Athletic Club on Niagara Square, to cost about $2,000,000. Edward B. Green & Son, Buffalo, are architects.

CATSKILL, N. Y.—The United Hudson Electric & Railroad Company has awarded a contract to the Fred T. Ley Company, Springfield, Mass., for the construction of a one-story substation, to cost about $50,000.

DUNKIRK, N. Y.—At a special election held May 24 the proposal to issue $1,400,000 in bonds for a hydro-electric plant was defeated.

MOUNT MORRIS, N. Y.—The Niagara Falls (N. Y.) Power Company is said to be arranging for the purchase of the property of the Mount Morris Illuminating Company and will furnish service to this section and eventually to the Genesco Gas & Light Company, Genesco.

WATERVLIET, N. Y.—The London Turbine Company will build a power house in connection with its proposed local plant for the manufacture of turbine engines, to cost $150,000.

CAMDEN, N. J.—The Board of Freeholders is preparing plans for a central power plant at Asyla for county service, to cost about $90,000.

NEWARK, N. J.—The National Oil & Supply Company, 180 Frelinghuysen Avenue, will build a one-story power house at its plant.

NEWARK, N. J. — The Public Service Electric Company contemplates the construction of two large substations in connection with extensions to its Essex, Marion and Burlington generating plants.

PASSAIC, N. J.—Steps have been taken by the Eastside Business Men's Association for an ornamental lighting system on Second Street.

TRENTON, N. J.—The John A. Roebling's Sons Company will increase the output of the power house at its wire and cable mills from 8,000 hp. to 12,000 hp.

TRENTON, N. J.—Bids will be received by the City Commission, City Hall, Trenton, until June 16 for furnishing and erecting at the Trenton pumping plant, an Ames "Una-flow" engine, one Root rotary pump electric generator, condenser and atmospheric check valve. Plans and specifications may be obtained at the office of superintendent of water works, City Hall.

TRENTON, N. J.—The Trent Tile Company, Klagg Avenue, will build a new one-story power house, 30 x 50 ft., at its plant

CANADENSIS, PA.—George W. Backoff, 40 Park Place, Newark, N. J., will take bids at once for the erection of a power house in connection with a new hotel here.

GREENSBURG, PA.—A central power house will be built in connection with a number of new buildings, to be erected at the Westmoreland Hospital, to cost about $500,000. Edward P. Mellon, 52 Vanderbilt Avenue, New York, is engineer.

HARRISBURG, PA.—Bids will be received by the Board of School Directors of the school district of the city of Harrisburg until June 23 for work in connection with units C-1, C-2 and C-3 of Senior High School, including general construction, electric wiring, boiler-room blowers, coal and ash-handling devices, generators, main switchboard, engines, etc. Plans and specifications may be seen at the office of Charles Howard Lloyd, Suite 701-A, Telegraph Building, Harrisburg.

JOHNSONBURG, PA.—The Council has voted to make improvements and extensions in the lighting system; 400-cp. units will be installed in the business section.

KINGSTON, PA.—The Luzerne County Gas & Electric Company has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEW CASTLE, PA.—The Pennsylvania-Ohio Electric Company has issued $1,950,000 in bonds, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Philadelphia Electric Company will build an addition to its substation at Ontario and J Streets.

RIDGWAY, PA.—The Keystone Power Corporation has issued $1,750,000 in bonds, the proceeds to be used for the purchase of the property of the Keystone Electric Service Corporation in Elk and McKean Counties and for the construction of a new hydro-electric generating plant in the vicinity of Keating.

WESTON, PA.—The Weston Light & Power Company has been organized to install and operate a light and power system in Weston. George Puhak, Hazleton, Pa., is president.

WOMELSDORF, PA.—A company is being organized to purchase the municipal power plant at Charming Forge for $30,000. Extensions and improvements will be made to the system, to cost approximately $25,000.

WILMINGTON, DEL.—The Street and Sewer Department has awarded a contract to the Wilmington & Philadelphia Traction Company for the installation of an ornamental lighting system on King Street, from Front to Tenth Street. An underground conduit system will be installed.

BLUEFIELD, W. VA.—The Appalachian Power Company contemplates extensions and improvements to its system.

DANVILLE, VA.—Bonds to the amount of $100,000 have been voted for extensions and improvements to the municipal electric plant.

FORT MYER, VA.—Bids will be received at the office of the construction quartermaster, Room 2,306 Munitions Building, Washington, D. C., until June 13, for repairs to the local electric lighting system.

HAMPTON ROADS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon call for bids for coal and ash-handling equipment at the local naval base. (Specification 4667.)

SOUTH HILL, VA.—The Council has awarded a contract to A. H. Guion, Gastonia, N. C., for the construction of a municipal electric plant. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer.

WASHINGTON, D. C.—Bids will be received by the Board of Awards Department of Agriculture, until June 27 for the installation of a 300-hp. water-tube boiler and auxiliary equipment at the department power house.

North Central States

SHEBOYGAN, MICH.—The Sheboygan Light & Power Company has been granted permission to issue $45,000 in bonds, the proceeds to be used for extensions and improvements.

SNOVER, MICH.—The Snover Light & Power Company, recently organized, contemplates the installation of a local distributing system. Charles L. Bell heads the company.

CINCINNATI, OHIO.—The Cincinnati Gas & Electric Company has issued $6,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

CLEVELAND, OHIO.—Bids will be received by the clerk of the board of education of the city school district of the city of Cleveland, Room 104, School Headquarters, Rockwell Avenue and East Sixth Street, until June 12 for electric wiring, fixtures and reflectors for the East Technical High School. Frank G. Hogen is director of schools.

NEW PHILADELPHIA, OHIO.—The Ohio Public Service Company is negotiating for the purchase of the plants of the Zoar (Ohio) Electric Company, Zoar and the Sugarcreek (Ohio) Electric Company. The Ohio company contemplates transmission line extensions in these districts and station improvements. J. Hall Truman is superintendent of the local district.

YOUNGSTOWN, OHIO.—The Council has authorized extensions to the ornamental lighting system in the business district.

LOUISVILLE, KY.—Permits have been granted for the construction of a warehouse building with power plant at First and Main Streets by the Belknap Hardware & Manufacturing Company. The cost of the building is estimated at about $1,200,000.

INDIANAPOLIS, IND.—The Dusenberg Auto & Motor Company, West Washington and Harding Streets, contemplates building a one-story power house.

MITCHELL, IND.—The Orange County Public Service Company has contracted with the Interstate Public Service Company for power supply, for distribution at Mitchell, Orleans and Paoli. Service will be rendered from Bedford.

OSGOOD, IND.—The municipal electric light plant was recently destroyed by fire. At present the town is without electrical service.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company is reported to have awarded contract for extensions to its South Bend plants to increase the output by 15,000 hp. The cost is estimated at $1,250,000.

HILLSBORO, ILL.—The Southern Illinois Light & Power Company has issued $1,200,000 in bonds, the proceeds to be used for the purchase of the property of the St. Clair County Gas & Electric Company, Belleville, and for extensions and improvements.

MILWAUKEE, WIS.—Bids will be received by the Sewerage Commission until June 16 for superstructures for main power house and boiler plant, 90 ft. x 225 ft. and 68 ft. x 166 ft. respectively, on Jones Island. T. C. Hatton is engineer of sewerage commission.

ST. LOUIS, MO.—The General Council on Civic Needs has recommended the construction of a new municipal power house and mechanical building to cost $1,000,000. W. Frank Carter is chairman.

CAVOUR, S. D.—The installation of a municipal electric light plant, to cost about $10,000, is under consideration.

ELLINWOOD, KAN.—Work will soon commence on the installation of an ornamental lighting system in the business district. C. E. Stephen is city clerk.

KANSAS CITY, KAN.—An ornamental lighting system will be installed on streets in the district north and west of Eighteenth and State Streets. R. L. McAlpine is engineer.

LAWRENCE, KAN.—The Kansas Electric Power Company has applied to the Public Utilities Commission for permission to issue $4,975,000 in bonds, the proceeds to be used to purchase the property of the Bowersock Mill & Power Company, Lawrence; the Leavenworth (Kan.) Heat, Light & Power Company and the Bonner Electric & Manufacturing Company and for extensions to its plant at Emporia.

Southern States

JACKSONVILLE, FLA.—H. W. Dexter contemplates the purchase of a 650-kw. generator, or two 300 kw. units, and auxiliary equipment for a local power plant.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company, recently organized to take over and consolidate the Chattanooga Railway & Light Company and the Nashville (Tenn.) Railway & Light Company, has issued $12,150,000 in bonds, part of the proceeds to be used for extensions and improvements.

HUNTSVILLE, ALA.—The Alabama Power Company is planning to extend its transmission lines from Huntsville to the Agricultural and Mechanical College for Negroes at Normal. The company will also supply electricity to residents along the line.

MORRILLTON, ARK.—The installation of an ornamental lighting system in the business district is under consideration by the Council.

AMITE, LA.—The Central Light & Power Company has entered into a contract with the Rathborn Lumber Company, Ponchatoula, whereby it will secure electricity from the latter for distribution in the parish of Tangipahoa. The Central company is establishing a branch plant in Ponchatoula to generate electricity for transmission through Hammond, Natalbany and Independence to Amite City.

EL DORADO, OKLA.—Bids will be received by the Council until June 15 for equipment for a 13,200-volt, three-phase transmission line, triangle construction, between Quanah, Tex., and El Dorado, and for a local distributing system. J. P. DeLoach is clerk.

LOCUST GROVE, OKLA.—Bids will soon be asked for the construction of a transmission line and installation of a local distributing system, to cost about $20,000, for which bonds have been voted. V. V. Long & Company, 1,300 Colcord Building, Oklahoma City, are engineers.

THOMAS, OKLA.—Bonds to the amount of $28,000 have been voted for a municipal electric plant. H. G. Olmstead & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

SAN ANTONIO, TEX.—Directors of the Southwestern Insane Asylum have authorized plans prepared for a new power house to cost about $100,000.

Pacific and Mountain States

MUKILTEO, WASH.—The Puget Sound International Railway & Power Company contemplates extending its transmission line from Everett to Mukilteo and installation of a distributing system here.

LOS ANGELES, CAL.—The Lighting and Power Bureau plans the installation of an ornamental lamp system on Melrose Avenue, St. Andrews Place and Gramercy Place.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission, 207 South Broadway, until June 27, for an electric generator, hydraulic machinery, transformers and auxiliary electrical equipment. James P. Vroman is secretary. (Specification P-262.)

PITTSBURG, CAL.—Plans have been approved for an ornamental lighting system on Black Diamond and Railroad Avenues.

SAN FRANCISCO, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is preparing plans for an addition to the power house at the Mare Island Navy Yard. (Specification 4664.)

SAN FRANCISCO, CAL.—The American River Water & Power Company is perfecting plans for the construction of a hydro-electric power plant in Placer County, with total capacity of 200,000 hp., estimated to cost about $15,000,000, including transmission system. Water rights have been secured. Ellery, Frost & Patten, Merchants' National Bank Building, are engineers.

SALT LAKE CITY, UTAH.—The Utah Light & Traction Company has disposed of a bond issue of $12,471,000, a portion of the proceeds to be used for extensions and improvements.

PRESCOTT, ARIZ.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until June 15 for the installation of a light, power and telephone system at the United States Veterans' Hospital, Whipple Barracks, Prescott.

ROOSEVELT, ARIZ.—The Roosevelt Electrical District, Maricopa County, is arranging a bond issue of $75,000 for the construction of new substations and transmission lines.

CHEYENNE, WYO.—The installation of a new ornamental street-lighting system is under consideration. It is proposed to replace the five-lamp clusters with single lamps.

Canada

COBALT, ONT.—Preparations are being made by the Northern Ontario Light & Power Company to construct a dam at Rabbit Lake, near Femagami. The company also contemplates extending its transmission line from Cobalt to Haileyburg, to cost about $30,000.

OTTAWA, ONT.—The City Council has approved a by-law authorizing an appropriation of $280,000 for extensions and improvements to the hydro-electric plant and electric distribution system. N. H. H. Lett is city clerk.

THESSALON, ONT.—The town officials are considering the construction of a hydro-electric plant at Little Rapids on Thessalon River, to cost about $50,000. The project will include power house, dam, transmission lines, etc.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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Volume 79 — *Number* 24

Who Are "the Interests"?

RABID politicians and editors of yellow newspapers used to rave about "the interests" behind utility corporations. There had been plenty of selfish exploitation of public service franchises to provide material for campaign issues and political propaganda in many cities. But the cart-tail spellbinder and the men who plied the poison pens adopted it as universal gospel, good for any town and any time.

Out of the smoke and fire of all this spectacular headline and platform accusation came a general popular belief that utilities were owned by "interests." "Interests" were supposed to be groups of rich, greedy and dishonest men, banded together to rob communities by overcharging them for electric light or gas, or water or street-car rides. These rich men kept hidden out of sight and therefore were despicable.

THE reason sensible grown-up men and women swallowed all of this was because so many people said it so continuously in so many cities and because in some places it was proved to be true. And all the time the utilities in their towns did not prove to them that it was false. So, not knowing who did own their utilities, and not being told, they believed that there *were* hidden owners, that there must be a reason why they hid, and that the reason must be the same as in the other crooked cases.

So the politicians reared and pitched for personal reasons and the sensation editors wrote on and on. And the people kept wondering who it was who did own the utilities. The utility executives for some mysterious reason elected to sit still and suffer silently, when all that they had to do was to publish their stockholders' names to prove that as a matter of fact the people owned the utilities themselves.

If they had done this—if they would do it now—there would never be a word about "interests." For everybody knows that "we, the people"—all of us neighbors—are honest and never steal pennies from any one.

IT IS the duty of every man in any branch of the electrical industry to spread continuously a clear understanding of who it is who actually owns the electric utilities—and as a matter of fact all other large modern business enterprises as well. We own them, of course—we, the people—only we are allowed to forget. But the more electrical men talk about it, the less the politician can hinder and the more people will buy utility securities. And the more there are who are stockholders, the fewer there can be who will misunderstand.

Out of this understanding naturally will come more confidence, interest and enthusiasm for electrical appliances. And that, above all things, will promote the electrical industry.

Irving Edwin Moultrop

An engineer of national reputation in the field of central-station design and construction.

LACK of interest in the welfare of the profession as a whole and indifference to national aspects of engineering are two serious indictments to which many otherwise valuable men associated with technical industries must plead guilty. Conditions are changing for the better, however, and one of the chief causes is the leadership of engineers who have labored unremittingly along nationally constructive lines while carrying heavy individual responsibilities at home. These men speak with authority based upon solid achievement in day-to-day problems and upon their ability to escape the limitations of the local through their vision of what is attainable in the engineering world as a whole by co-ordinated professional activities.

In the person of the assistant superintendent of its construction bureau, the Edison Electric Illuminating Company of Boston has contributed an amazing total of good work on behalf of central-station engineering during the past thirty years. I. E. Moultrop's services to power-plant development, and especially to prime-mover progress, have been of exceptional character. The company's plant development is closely identified with the engineering leadership of the man, and this leadership transferred into national organizations has added to the reputation of both company and engineer. This does not mean that Mr. Moultrop has submerged his individuality for a moment; it does mean that he practices what he preaches and that his devotion to the cause of "reliability first, economy second," is the keynote of his engineering thinking both at home and abroad. He has never been led astray by the spectacular or the bizarre at the expense of service efficiency and has always borne in mind the quasi-public responsibilities of electric utilities in applying new ideas in design and equipment.

Mr. Moultrop was born in 1865 at Melrose, Mass. He served an apprenticeship in the Whittier Machine Company's shop at Roxbury, Mass., from 1883 to 1886, later becoming head draftsman. On Jan. 1, 1892, he was appointed chief draftsman of the Boston Edison company and in 1897 was made mechanical engineer. He was appointed to his present post in 1913. During this time he has had charge of station construction. The generating stations and substations of the system, the General Service Buildings of the company and many other of its engineering works bear his impress.

As former vice-president of the American Society of Mechanical Engineers, former chairman of its committee on increase of membership (which increased the enrollment from 4,000 to more than 8,000), representative of that society of the Engineering Foundation and on the American Engineering Council, member of the A. S. M. E. boiler code committee, of the power stations committee of the A. I. E. E. and of the committee on steam turbines and generators of the Association of Edison Illuminating Companies, past-chairman of the prime-movers committee and Technical Section of the N. E. L. A., representative of the N. E. L. A. on the American Engineering Standards Committee and on the advisory council of the federal government's Board of Surveys and Maps, and as a contributor to engineering publications and lecturer at technical institutions, Mr. Moultrop has served the engineering industry with zeal and ability.

Editorial Comment

Electrical World, June 17, 1922

Volume 79 Number 24

Bigger Men or a Bigger Job?

WE ASKED an official of one of the large operating companies recently what his sales managers were thinking about. He was just leaving for a sales managers' convention. When he came back he said: "They are not thinking. We sprang two or three fundamental propositions upon them without giving them advance notice, questions which they should have been considering for years. They made a sorry showing. There was no initiative, but apparently a complacent willingness to sit back and wait to be told step by step. Very few have the story back of public utility operation. They do not understand the underlying principles which formulate rates. They know too little of state commission supervision and nothing about the reasons why. They do not understand financing, and so on down the list." And this man has set himself to find the way to implant this fundamental knowledge.

It is a common weakness not only in the men who head the sales departments of central-station companies but in high executives themselves. But it is particularly costly in these commercial managers who maintain the contact between the company and the community. And the fault lies largely in the mistaken policy of not giving this function its proper recognition and making it the job of, say, a vice-president who *does* know the fundamentals of the business. Too long the central station has been content to select small-salaried men of small experience to head the commercial staff and conduct the sales, publicity and customer service operations, with all the influence that this work wields on the public and trade relations.

The manufacture and marketing of electric light, heat and power is a business and to be fully successful needs the ablest business man obtainable to head its commercial activities. Among the men now holding these posts are many who with encouragement and practical co-operation can measure up to the full opportunity. Many others have been ill chosen. But it is a policy that is at fault primarily. These men need broader knowledge, yes, but first of all the business management must be made a bigger job.

More Light on the Cost of Distribution

A PAGE of statistics on the electrical supply jobber's cost of doing business appears in this issue. It is a presentation similar to but more complete than that published in the March 25 issue of the ELECTRICAL WORLD as a part of the article entitled "A Study of Jobbers' Sales and Costs." The figures printed this week cover a full year and embrace the operations of five houses; the others were for six months only. The findings as to costs and averages are similar. Throughout the entire year 1921 the jobbers were losing money heavily, and these figures show why.

As one jobber put it, "Why do we do it?" He was discussing the findings of this survey. "I think we jobbers ourselves are largely to blame for our own predicament," he said, "because it is an old saying of the manufacturers that the more profit they give us the more cheaply we sell our goods to our customers. In other words, too many jobbers do not keep the full profit that is allowed them." There is much truth in this. In fact, the thought that bears in heaviest in studying these statistics is amazement that men could be willing to sell so much merchandise at so beggarly a profit and to carry so much slow-moving stock that the average turnover is reduced to 2.49.

Happily times are now better. Most of the jobbers are at last back across the profit line or at least pulling surely out of the red. But the experience of these lean years just gone and the evidence of this study of costs should not be laid aside and forgotten. The distributor must prosper or the distribution cannot maintain good health and therefore good service. Yet full, freely functioning distribution is absolutely vital to all—to the men who sell to and buy from the jobber as much as to the jobber himself. And the work must be put upon a basis that pays adequate returns.

Over-regulation of Radio Installations Undesirable

AN ORDINANCE has recently been passed in Chicago for the control of radio installations which is so drawn that it can give rise to gross abuse. Not only are inspections charged for at prices that local authorities estimate will bring in $100,000 yearly, but reinspections are provided for on a basis subject to the whims of city officials. The way is also left open to impose in the future a requirement that none but licensed electricians shall make installations. In Chicago this means union labor and possible, if not probable, graft.

It is undoubtedly necessary that some sort of control over the installation of radio sets be maintained. Central-station companies are interested in this because of conflicts with distribution lines that create hazards for which they may be held liable in some measure. Some fatal injuries have occurred already, and many conditions can develop which will be undesirable for every one concerned. Ample clearances from the lines of power companies, a few simple wiring requirements and the provision of a simple form of protector to care for possible lightning discharges are all that are necessary for receiving sets. Transmitting sets require more elaborate precautions, since they can produce serious service disturbances to nearby lines or the circuits from which they draw their power supply. However, these precautions are not complicated, and to enforce them it is not necessary to over-regulate the entire industry.

Before any other cities pass ordinances regulating radio installations it would be advisable for them to study the proposed specifications for such work recently prepared by a committee of the Radio Institute.

System Analysis and Adequate Maintenance Essential to Proper Protection

THE value of various schemes and apparatus for protecting equipment and increasing service reliability is just now the subject of considerable controversy. In large measure the failure or success of a protective system or apparatus depends on two things—first, an analysis of the particular system, and, second, operating methods to maintain the protective equipment at its maximum efficiency.

The analysis of the system should be detailed and should be based on operating and service requirements both for the present and for the future. This analysis involves the mechanical strength and insulation of all elements in the system from generator to substation, because questions of factor of safety and permissible time duration of overloads are fundamental. Moreover, the time required for successive operations of protective equipment must be accurately determined. Having the system analysis, an intelligent study of the protective devices and systems now available will indicate the types of installations to be made. In general, the addition of protective equipment is cheaper than adding to the insulation or mechanical strength of major apparatus, so that reliability is the chief consideration.

The second and a badly neglected element in the situation is found in the fact that delicate apparatus is often installed and maintained by incompetent or inadequately instructed men. The relay is as fragile as a switchboard meter, yet often has an accuracy requirement comparable to that of a precision wattmeter. Hence its proper adjustment and maintenance should be placed in the hands of skilled relay men who not only know relays but also know their functions at each location. Hit-or-miss relay test and maintenance methods are worse crimes than poor wattmeter tests because more responsibility rests on the relay. It must maintain service and protect a large capital investment.

If a broader view of the protective situation is taken, there is no doubt that any existing light and power system can increase its service reliability by the intelligent use of existing protective schemes and equipment, provided that it maintains them at maximum service efficiency.

Service-Cost Analysis Must Precede Solution of Power-Factor Metering

THE building of rate schedules and the devising of metering schemes to arrive at a fair charge against a customer for operating his load at less than unity power factor can be done only with due regard to the real economics of the problem. Theoretically, and to some extent actually, there is a loss due to the existence on any circuit of a power factor less than unity; but the determination as to the final form of the rate schedule and metering scheme necessary to permit charging the customer for this loss will be based entirely on the practical balance between the loss stated on a money value basis and the cost of determining and charging for the loss. Unfortunately too much of the discussion that has been indulged in during the past few years has been concentrated on the purely theoretical side of the subject. This has been due somewhat to the fact that metering equipment which will permit of ready determination of the losses has not been available. Although some equipment could be purchased, it has been of a character and price that prohibited its widespread use.

This situation is gradually changing, and while it has been impossible for manufacturers completely to solve the metering equipment problem so that all classes of service can be readily investigated, equipment that can be used for the more important classes of service is becoming available and better means of determining conditions are therefore at the command of the investigator.

In the May 6 issue of the ELECTRICAL WORLD, on page 877, Messrs. Doran, Hodtum and Fryer discussed some of the economic phases of the problem. In this issue they discuss metering schemes and the type of equipment available for the determination of some of the factors on which the economic phases are based. At the present time there seems to be a strong drift in the direction of utilizing the kilovolt-ampere-demand basis as the best method of reaching the desired results. Some authorities, however, are inclined to believe that this tendency is merely a step in the development of a better and more comprehensive basis.

In the heat of discussion and when there is radical disagreement it must be remembered that the type of study at Cincinnati on which the articles mentioned are based is the shortest and best road to the final answer. For that reason the two articles deserve thorough study, and real efforts should be made to extend the field of investigation they open.

Centralized Control Advocated for System Operation and Emergency Maintenance

SHARPLY focused views of staff responsibility for system operation and emergency maintenance are put before the reader in this issue by William H. Atkins. Year by year the conception of what constitutes good and efficient service rises in the minds of progressive central-station men above former levels of reasonable content with operating performance. The amount of hard work constantly being done behind the scenes to supply the great public with electricity at all hours and regardless of weather and other physical conditions is beyond the popular imagination. Lower unit costs may often be the reward of such efforts, but the greatest gain is to the people served by the utilities.

System operation at Boston is undergoing a sort of grooming at present in order that still heavier load responsibilities may be carried with greater co-ordination of responsibility and more effective organization for emergency maintenance and for contacts with the public resulting from changes in operating conditions. It is purposed to centralize both operating and emergency maintenance functions, and how this will be done and how the company's contact with the public should be improved thereby form the burden of Mr. Atkins' story. The problem is not peculiar to Boston, and so its discussion signifies much to other companies of both large and medium size. Very small companies are obliged to place widely diversified responsibilities upon individual executives, but larger organizations will find food for thought in the co-ordination which the author outlines and which has been developed only after earnest study and committee work by experts in the generating, transmitting and distributing forces of the company, including also authorities on engineering, maintenance and public relations.

By putting load-dispatching and system-operation responsibilities upon a single executive of high caliber, with subdivisions of staff to meet the requirements of distribution, service operation and emergency maintenance and inspection, it is believed that much lost motion will be eliminated, that repairs will be more accurately and quickly determined upon, and that the public will be brought much more nearly into phase with the company's efforts to render the best possible service than is feasible under the present organization. The greater use of indicating apparatus in system operation is forecast, with the establishment of an improved operating center, freed as far as may be from local hazards.

No reflection upon present staffs should be read into a "betterment" story of this kind, but we believe the reader will lay down the article with the conviction that preparedness and foresight spell opportunities for utilities run with open minds and with a personnel loyally trying to raise their daily work to higher planes of achievement. Of such are the real joys of service, whatever the size of the company concerned.

Construction Accounting Coming to the Front

CONSTRUCTION accounting as a factor in the support of property accounts is growing in the favor of utility men. For a good many years there has been an undercurrent of feeling that too many detailed property records, such as real construction accounting would provide, might be used as a club by regulatory bodies to keep down the value of investments for rate-making purposes. There has also been the fear that perhaps by setting one job against another without consideration of the circumstances under which each was done, the detailed figures might be used to prove charges of inefficiency in construction methods.

Facts never do so much damage to a fairly and honestly conducted concern as does a lack of them. Public utilities have been involved in rate cases where the actual amount of money invested in the physical property could not be ascertained to a certainty from any available records. Opinions have been taken, and the final decisions of the regulatory bodies in all too many cases have been compromises between opposing opinions that have left every one connected with the cases dissatisfied and have engendered a public suspicion that some one has not played an honest game.

It requires money to build utility properties. The cost of the physical property used in the service of a utility will always be a vital factor in any rate case before a commission. Such bodies have the authority to ascertain all the facts in connection with investments. There is enough legitimate difference of opinion as to the other factors involved in rate making to employ all the energy available without fighting battles over things that ought to be susceptible of proof so definite that it cannot be gainsaid. Construction cost records are needed of such a nature that they tell a convincing story and will stand against the mere expression of opinion.

In this issue W. Paxton Little describes the elements of a system that has been in successful use for accomplishing this result. Though Mr. Little's construction accounting program is of recent date, it is not in an entirely untried field, for the general plan which underlies his method has been in use in a number of forms and on a number of systems for a period of years. Criticism of his system there may be, proceeding largely from a difference of opinion on details, and this is perfectly logical, because no one plan can be devised to fit every utility system. But the vital point is that the fundamental facts be correct and expressed by methods that will fit specific problems. It costs something to carry out such a program, but it also costs money to prove property values when no real original evidence is available.

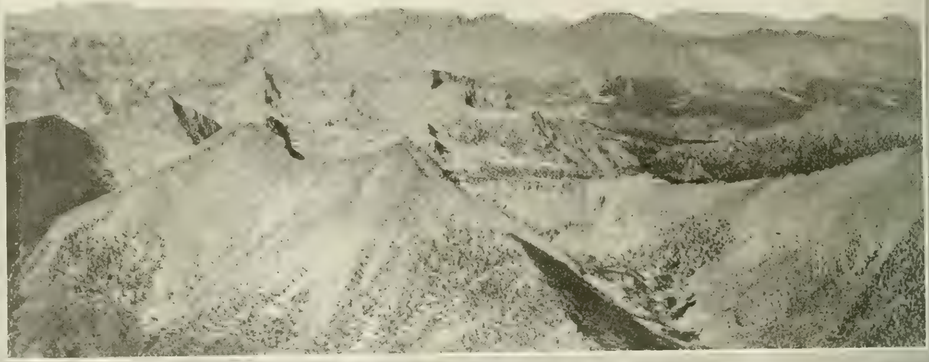
Another Notable Development in Radio

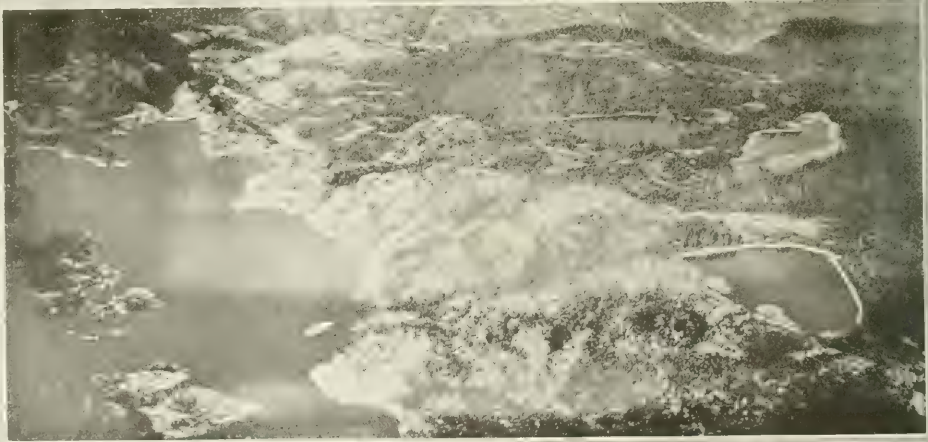
READERS of electrical literature should now be fairly well accustomed to the term "negative resistance." While there can be no such thing as a conductor having negative resistance, certain types of circuits show decreasing resistance with increasing current and may therefore be regarded as having negative resistance added to the initial higher positive value corresponding to a lower current. A most interesting example is the regenerative oscillating circuit of the three-electrode vacuum tube used in radio transmission. In this case the feed-back electromotive force introduced in the oscillating circuit increases the amplitude of oscillation; that is, the result is the same as would be caused by a decrease of resistance or the adding of negative resistance. The system is self-starting owing to filament irregularities or extraneous disturbances, and the amplitude of oscillation increases to a point where the current-carrying capacity of the tube prevents the further insertion of negative resistance. In this condition the regenerative circuit may be said to have zero resistance, the plate circuit of the tube furnishing the increased resistance loss in the oscillating circuit. This has usually been assumed to be the limit of the possibilities of the negative resistance feature of the regenerative circuit.

However, just ten days ago Edwin H. Armstrong demonstrated before a New York meeting of the Institute of Radio Engineers that the resistance of the regenerative circuit may be made to pass through zero value and become negative as a whole by varying the voltage of the plate of the tube by connection to the plate of a second tube whose grid is excited by suitable means. Now, a circuit of resultant negative resistance has the property that when an oscillation is started in it the amplitude tends to build up to infinity. Mr. Armstrong has conceived the idea of using this property as a means of amplifying incoming signals. He has succeeded in doing this by an ingenious method of eliminating the tendency of such a circuit to build itself up to the limit of the tubes, under extraneous disturbance, and in so doing lose its amplifying power. The method is to introduce a relatively low-frequency alternating electromotive force from the grid of the second tube. During one-half cycle the resistance of the amplifying regenerative circuit is negative and during the other positive; the average value is positive and the circuit does not run away with itself. However, during the negative-resistance periods the impressed electromotive forces from the incoming signals set up very large free oscillations, causing amplification in the usual detecting circuits. The auxiliary electromotive force serves as a sort of "tikker" for interrupting the tendency of the regenerative circuit to load itself.

Since amplification up to 300,000 times the impressed emf. is claimed for this super-regenerative circuit, and since it is particularly immune to spark interference, according to Mr. Armstrong, it appears to have great possibilities of extending the range of reception of radio communication. Besides, it is remarkable as embodying a newly discovered property of vacuum tubes which is an example of the surprises in store for the patient researcher in the radio field.

Airplane Has Attractive Advantages in Hydro-Electric Surveys, Construction and Transmission Maintenance





RECONNAISSANCE work for hydro-electric development and transportation of construction personnel and equipment have been successfully undertaken by means of the airplane on at least two occasions by R. C. Starr, chief engineer of the San Joaquin Light & Power Company. The airplane has also been tried for inspecting and repairing long stretches of transmission line. With a certain amount of experimentation and development it appears that the airplane might be used more extensively for like purposes. By means of aerial photography an entire watershed can be explored and mapped in a few days. Besides showing the general lay of the land an immense amount of valuable detail can be obtained as well. Used for transportation of construction personnel and equipment the airplane would make accessible many sites that would otherwise require many miles of expensive, circuitous roadbuilding that would be very time-consuming. For patrolling long lines and enabling prompt repairs the airplane also offers a method of effecting the work in short order. For the foregoing services the chief requirements are that the plane shall be capable of carrying moderate weights and especially of landing easily at moderate speeds.

Accounting for Construction Projects

Commission Regulation Requirements Give Importance to Proper Accounting Actual Unit-Cost Information Needed as Guide to Engineers and Executives Outline of Specific Methods that Have Been Found Successful

By W. PAXTON LITTLE
Treasurer The Niagara Falls Power Company

ACCOUNTING for the cost of construction or investment in property of public utilities, regulated as they are by federal or state commissions and in many cases by both, and required to conform to a uniform classification of accounts, necessarily must be done with great accuracy for the protection of both the investors in the property and the public to whom it renders service. The fixed-capital accounts representing costs of investment are the basis on which are determined fair rate of return to the investor and cost of service to the public.

In the early days of electric public utilities such accounts had not the importance which they have now and usually were so condensed in the corporation's books of account as to furnish little information other than the amount of the investment. The engineering or construction departments kept for their own purposes such record of detailed costs as they deemed requisite and were able to obtain in an unsystematic manner. Today, however, the accounting for fixed capital is of such importance that the methods and systems used must furnish, in addition to the information required for the owners of the property and the regulatory governmental bodies, such data in such detail as will permit the preparation at regular periods of reports showing comparison of actual unit costs with estimated costs

These reports to be of value to the executives and engineers in charge of construction must be "up to the minute" so that the expenditures may be compared with the estimates and the reason for any discrepancy immediately determined. Such reports will also show the rate at which expenditures are progressing and will thus act as a guide to the financial executive. It is obvious that a system of accounts for fixed-capital costs kept to furnish the information referred to will constitute a permanent record of the utmost value. The system and methods described below provide satisfactorily for the fixed-capital accounting of a large hydro-electric utility. It is the system now in active use by The Niagara Falls Power Company in accounting for construction projects.

A SUGGESTED SYSTEM

When a new development or extension to an existing plant is contemplated, the engineering department prepares plans and studies thereof and submits them with detailed estimates to the board of directors for its consideration, accompanied by a request for a project order or authorization (Fig. 1). If the board decides that the work is to be undertaken, a project order or authorization (Fig. 2) is issued by the executive.

Each major division of the construction has assigned to it a project order or authorization bearing a number. Subdivisions thereof also have their project orders or authorizations bearing sequential numbers. For example, the project order covering power-house buildings may be designated as Project 4400. This project would be further subdivided in accordance with a standard classification: "Project 4401—Clearing site for power house;" "Project 4402—Excavation for power house;" "Project 4403—Foundation for power house," etc.

A brief title of the specific work appears on the project order, followed by more detailed description and a classified estimate of costs, and the various departments of the company interested are furnished with copies. When the accounting department receives its copy of the project order, a project ledger sheet (Fig. 3) is prepared. Upon this sheet are entered the project number and description, and in addition to the columns provided for charges for materials, miscellaneous items and labor, five blank columns are provided to facilitate accounting for costs peculiar to that particular project. For example, on a project covering the construction of foundations of power house the blank columns may be used for costs of cement, reinforcing steel, etc.

METHOD OF ACCOUNTING

To illustrate the method used in accounting for the cost of construction, the elements have been classified:

1. Labor: (a) Salaries; (b) wages.
2. Materials and supplies: (a) Materials charged from stores on requisitions; (b) materials charged direct from invoices.
3. Materials transferred or retired.
4. Trucking.
5. Construction equipment.
6. Interest, taxes, etc., during construction.

Each salaried employee is required to file monthly with the accounting department on a form (Fig. 4) the distribution of his salary according to the accounts indicated. These reports are summarized on the monthly pay rolls, and the items chargeable to construction or projects are posted in total direct to the project ledger. The aggregate of the charges so posted is posted to the control account "fixed capital" in the general ledger.

Employees appearing on the weekly pay roll are under the supervision of foremen. Each foreman in charge of a gang is required to furnish the general superintendent each morning with a time or gang card, signed by him, entitled "Foreman's Labor Record" (Fig. 5). This card shows for the previous day the name or number of each employee coming under the foreman's personal supervision, the total number of hours worked, together with a description of the work performed by the gang, under which the foreman indicates the number of hours each employee was engaged on the work described. After approval by the general superintendent the project numbers assignable are affixed by the proper department in accordance with the classified description appearing on the upper part of the card. After verification of the distribution by project numbers is made by the accounting department the cards are forwarded to the pay-roll department, where the total hours appearing opposite the name of the employees are entered on the weekly pay roll (Fig. 6) and at the same time the rate per hour of each employee is entered on the card (Fig. 5).

When all the time cards (Fig. 5) of the previous day have been received by the pay-roll department, a consecutive number is given to each card. This numbering begins with the numeral 1 applied to the first card received the first day of the month. The pay-roll department computes on each card the amount payable to each employee, and at the same time the total amount of pay earned for the day is computed from

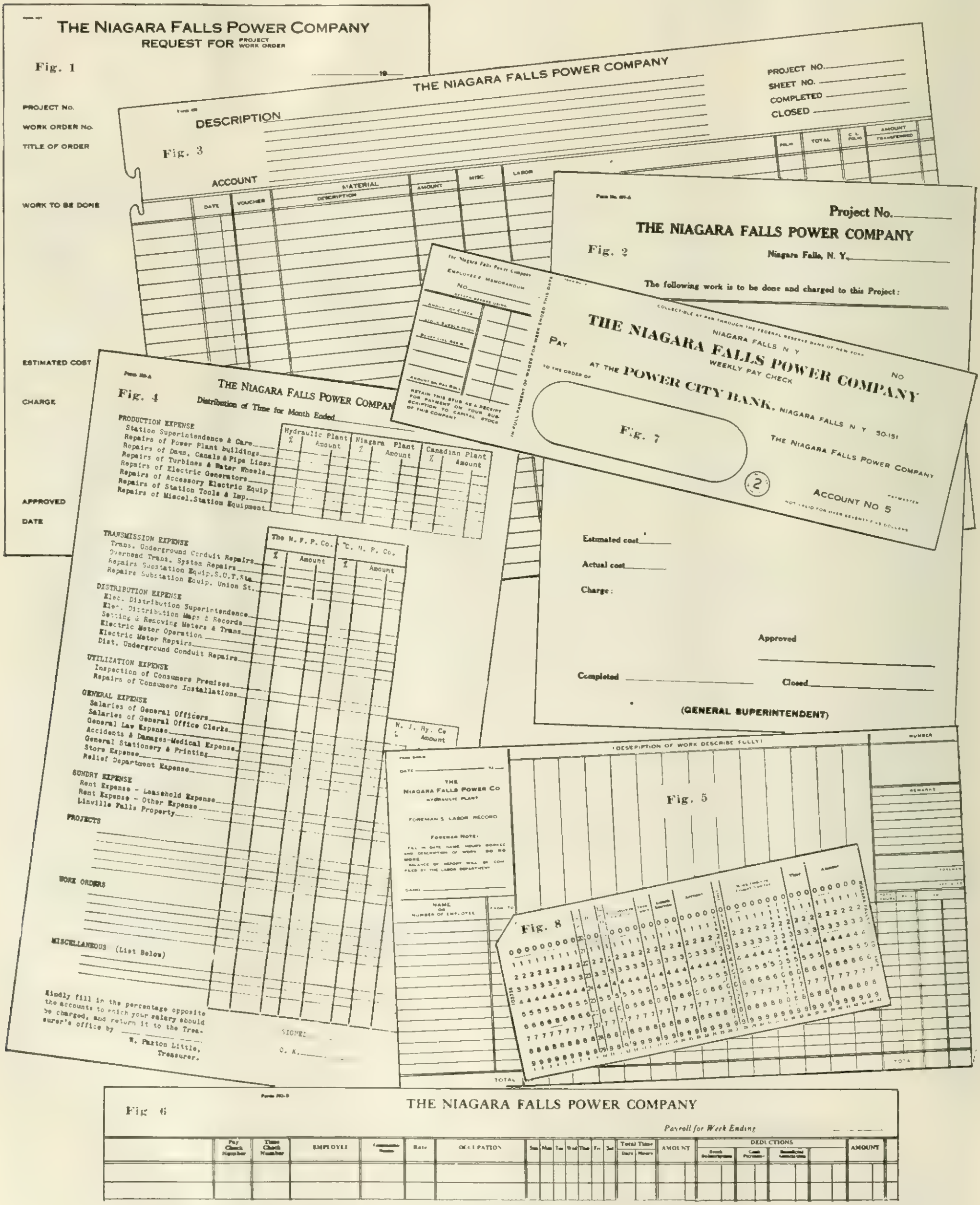


Fig. 1

THE NIAGARA FALLS POWER COMPANY
REQUEST FOR PROJECT WORK ORDER
19
PROJECT No.
WORK ORDER No.
TITLE OF ORDER
WORK TO BE DONE
ESTIMATED COST
CHARGE
APPROVED
DATE

Fig. 3

THE NIAGARA FALLS POWER COMPANY
DESCRIPTION
ACCOUNT
PROJECT NO.
SHEET NO.
COMPLETED
CLOSED

DATE	VOUCHER	MATERIAL DESCRIPTION	AMOUNT	MISC.	LABOR	FOLIO	TOTAL	C. L. FOLIO	AMOUNT TRANSFERRED

Fig. 2

Project No.
THE NIAGARA FALLS POWER COMPANY
Niagara Falls, N. Y.
The following work is to be done and charged to this Project:
Estimated cost
Actual cost
Charge:
Approved
Completed
Closed
(GENERAL SUPERINTENDENT)

Fig. 4

THE NIAGARA FALLS POWER COMPAN
Distribution of Time for Month Ended

PRODUCTION EXPENSE

	Hydraulic Plant %	Hydraulic Plant Amount	Niagara Plant %	Niagara Plant Amount	Canadian Plant %	Canadian Plant Amount
Station Superintendence & Care						
Repairs of Power Plant buildings						
Repairs of Dams, Canals & Pipe Lines						
Repairs of Turbines & Water Wheels						
Repairs of Electric Generators						
Repairs of Accessory Electric Equip						
Repairs of Station Tools & Imp.						
Repairs of Miscel. Station Equipment						

	The N. F. P. Co. %	The N. F. P. Co. Amount	C. N. P. Co. %	C. N. P. Co. Amount
TRANSMISSION EXPENSE				
Trans. Underground Conduit Repairs				
Overhead Trans. System Repairs				
Repairs Substation Equip. S.U.T. Sta				
Repairs Substation Equip. Union St.				
DISTRIBUTION EXPENSE				
Elec. Distribution Superintendence				
Elec. Distribution Maps & Records				
Setting & Removing Meters & Trans.				
Electric Meter Operation				
Electric Meter Repairs				
Dist. Underground Conduit Repairs				
UTILIZATION EXPENSE				
Inspection of Consumers Premises				
Repairs of Consumers Installations				
GENERAL EXPENSE				
Salaries of General Officers				
Salaries of General Office Clerks				
General Law Expense				
Accidents & Damages-Medical Expense				
General Stationery & Printing				
Store Expense				
Relief Department Expense				
SUNDRY EXPENSE				
Rent Expense - Leasehold Expense				
Rent Expense - Other Expense				
Linville Falls Property				

N. J. Ry. Co
% Amount

PROJECTS
WORK ORDERS
MISCELLANEOUS (List Below)

Kindly fill in the percentage opposite the accounts to which your salary should be charged, and return it to the Treasurer's office by

SIGNED
O. K.

W. Paxton Little,
Treasurer.

Fig. 7

The Niagara Falls Power Company
EMPLOYEE'S MEMORANDUM
NO.
DETACH BEFORE USING
AMOUNT OF CHECK
STOCK SUBSCRIPTION
BENEFICIAL ASSN.
AMOUNT ON PAY ROLL
RETAIN THIS STUB AS A RECEIPT FOR PAYMENT ON YOUR SUBSCRIPTION TO CAPITAL STOCK OF THIS COMPANY
IN FULL PAYMENT OF WAGES FOR WEEK ENDED THIS DATE

COLLECTIBLE AT PAR THROUGH THE FEDERAL RESERVE BANK OF NEW YORK
THE NIAGARA FALLS POWER COMPANY
NIAGARA FALLS N Y
WEEKLY PAY CHECK
NO
PAY
TO THE ORDER OF
AT THE POWER CITY BANK, NIAGARA FALLS N Y 50-151
THE NIAGARA FALLS POWER COMPANY
②
ACCOUNT NO 5
PAYMASTER
NOT VALID FOR OVER SEVENTY-FIVE DOLLARS

Fig. 5

DATE 19
THE
NIAGARA FALLS POWER CO
HYDRAULIC PLANT
FOREMAN'S LABOR RECORD
FOREMAN NOTE:
FILL IN DATE NAME HOURS WORKED AND DESCRIPTION OF WORK. DO NO MORE.
BALANCE OF REPORT WILL BE COMPILED BY THE LABOR DEPARTMENT
GANG
NAME OR NUMBER OF EMPLOYEE
FROM TO
(DESCRIPTION OF WORK DESCRIBE FULLY)
NUMBER
REMARKS
FOREMAN
TOTAL HOURS
TOTAL

Fig. 8

NIAGARA FALLS

Fig. 6

THE NIAGARA FALLS POWER COMPANY
Payroll for Week Ending

Pay Check Number	Time Check Number	EMPLOYEE	Commission Number	Rate	OCCUPATION	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total Time Days	Total Time Hours	AMOUNT	DEDUCTIONS Stock Subscription	DEDUCTIONS Cash Payment	DEDUCTIONS Beneficial Association dues		AMOUNT

FIGS. 1 TO 8—LEDGER SHEETS AND FORMS USED IN CONSTRUCTION ACCOUNTING. DETAILED DESCRIPTION ON PAGE 1214

the weekly pay roll and must balance with the total of a similar computation from the daily time cards. At the end of the week each employee's earned wages are computed and the pay roll is balanced with the aggregate of the daily totals referred to above. Pay checks (Fig. 7) are then prepared by the paymaster.

In the preparation of the pay rolls and pay checks an addressograph and an "F. & E." motor-driven check writer and protector are used to the fullest extent. The pay-roll department forwards the day's time or gang cards (Fig. 5) to the tabulating department, where the data on them are transferred to Hollerith cards (Fig. 8). The Hollerith cards are automatically totaled, and this total must agree with the total of the weekly pay roll as well as with the total of the gang cards. After this verification the gang cards are placed in chronological order and filed. By the use of the Hollerith cards and tabulating and sorting machines, daily reports (Fig. 9) are then prepared showing a classified distribution of the wages of the previous day for both day and night shifts and total to date, as well as the number of men engaged on each class of the work. Unit costs are computed and stated where applicable, and for comparative purposes standard unit costs are also stated.

At the end of each week there is prepared a cost report for that week (Fig. 10). Labor and material are summarized and the costs shown separately against the several projects with the total for the week and the total to date. In the next columns appear respectively the amounts of the original estimate and the amounts of increases or decreases in the original estimate due to alterations of plans, etc. The percentage of construction completed is calculated and an amount equal to that percentage of the revised estimate is compared with actual cost to date. The amount of percentages by which the actual costs to date differ from the estimated costs to date are then determined and shown on the report. The form may be further elaborated to show credits to any of the several projects during a given period and the estimated distribution of balances to be expended weekly, monthly or annually as the case may be. The value of this report is obvious.

At the close of the month the Hollerith cards above referred to are automatically summarized and the results obtained are entered on a summary sheet (Fig. 11) showing project numbers and the amounts chargeable to each. The items appearing on this summary are then posted to the project ledger (Fig. 3), and corresponding entry of the total is made in the general-ledger controlling account, after which the sheets are filed chronologically in a binder.

Materials passed through stores are issued on requisitions, Hollerith cards (Fig. 12). On the requisition are stated the quantity ordered and quantity and description of material issued, unit price, place delivered, construction on which used, and account or accounts to be charged. It is forwarded by the stores department to the accounting department, where the distribution of account is verified. From that point the requisition (Fig. 12) is handled in the same manner as the Hollerith labor card (Fig. 8).

Invoices bearing items chargeable to construction which are not passed through stores account, after passing through the usual routine of the accounting department, are sorted by projects, and by the use of an Elliott-Fisher bookkeeping machine are recorded on an individual project sheet (Fig. 14) simultaneously with their entry on the invoice register (Fig. 13).

At the close of the month the total on an individual project sheet (Fig. 14) is posted to the corresponding account in the project ledger (Fig. 3), and the total of invoices charged to projects in the invoice register (Fig. 13) is posted to the control account in the general-ledger fixed-capital accounts.

Materials transferred from one project to another, or an account other than construction or retired from service, are recorded on a material transfer and retirement report (Fig. 15). These reports contain a full description of the material, the original cost, estimated if not known, account to which originally charged, and amount of depreciation, if any, and are approved by the officer of the department under whose supervision the material is transferred or retired from service. After verification of the distribution by the accounting department, these reports are summarized in a material transfer and retirement report register (Fig. 16). Debits or credits to the individual projects are posted from the material and retirement reports (Fig. 15), and aggregate totals appearing on the material-transfer and retirement report register (Fig. 16) are posted to the control account in the general ledger.

Trucking

Where a company carrying on its own construction employs a large number of trucks for disposing of excavated material, etc., an individual work order is issued to cover furnishing of supplies to and maintenance of each truck. These work orders are closed monthly into a clearing account entitled "Trucking." A daily record of the use of the trucks is kept and used at the close of the month as a basis for distributing the aggregate of the total charged to trucking among the proper project accounts.

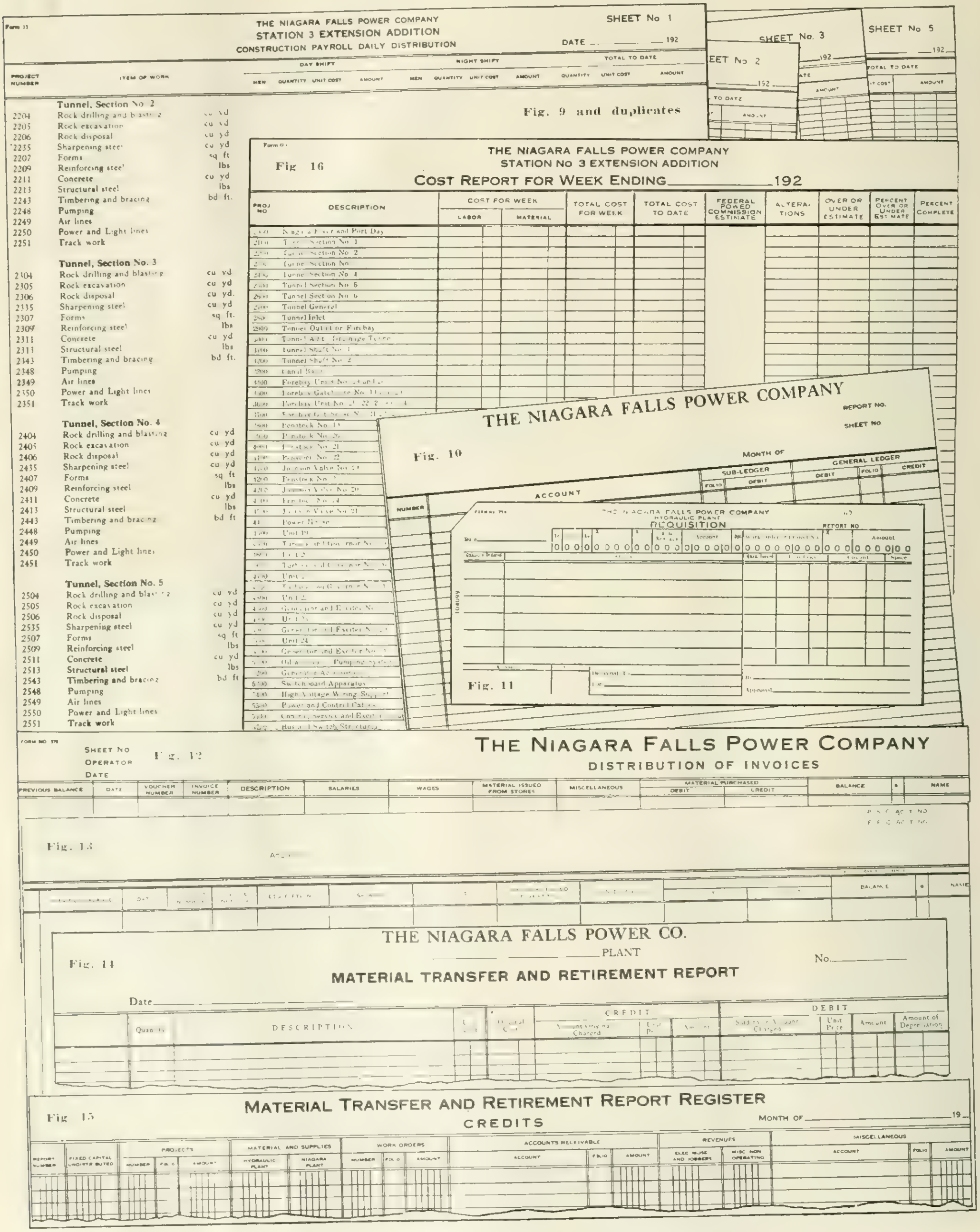
Construction Equipment

Where a company carries on its own construction work, if the work is of any magnitude, a large investment will be made in construction equipment, such as steam shovels, locomotive cranes, steam locomotives, drilling tools, dump cars, etc. The use of this equipment is recorded daily, and upon its retirement from service its cost, less salvage, is apportioned among the projects in which it has been used. Small tools for which it would not be practicable to account in this manner and whose cost is negligible are charged directly to the project for which they are requisitioned.

At the close of the month the total net debits to each project for that month are posted from the project ledger (Fig. 3) to their appropriate classified construction accounts in the construction ledger (Fig. 17) such as "power-house buildings," "dams," "canals," "pipe lines," etc. The aggregate of the construction ledger balances is then reconciled with the control fixed-capital account in the general ledger. A schedule (Fig. 18) is then prepared showing in detail additions to and withdrawals from the fixed-capital account for the month and period of the current year.

Interest and Taxes During Construction

Interest during construction is a well-recognized element of cost and should consist of the interest on funds provided for and used in the acquisition or construction of fixed capital after such funds become available for use and before the receipt or completion or coming into service of the property so acquired. It should also include such proportion of discount and expense on



Form 11

THE NIAGARA FALLS POWER COMPANY
STATION 3 EXTENSION ADDITION
CONSTRUCTION PAYROLL DAILY DISTRIBUTION

SHEET No 1
DATE ______ 192

Fig. 9 and duplicates

Project Number	Item of Work	
	Tunnel, Section No 2	
2204	Rock drilling and blasting	cu yd
2205	Rock excavation	cu yd
2206	Rock disposal	cu yd
2235	Sharpening steel	cu yd
2207	Forms	sq ft
2209	Reinforcing steel	lbs
2211	Concrete	cu yd
2213	Structural steel	lbs
2243	Timbering and bracing	bd ft.
2248	Pumping	
2249	Air lines	
2250	Power and Light lines	
2251	Track work	
	Tunnel, Section No. 3	
2304	Rock drilling and blasting	cu yd
2305	Rock excavation	cu yd
2306	Rock disposal	cu yd.
2335	Sharpening steel	cu yd
2307	Forms	sq ft.
2309	Reinforcing steel	lbs
2311	Concrete	cu yd
2313	Structural steel	lbs
2343	Timbering and bracing	bd ft.
2348	Pumping	
2349	Air lines	
2350	Power and Light lines	
2351	Track work	
	Tunnel, Section No. 4	
2404	Rock drilling and blasting	cu yd
2405	Rock excavation	cu yd
2406	Rock disposal	cu yd
2435	Sharpening steel	cu yd
2407	Forms	sq ft
2409	Reinforcing steel	lbs
2411	Concrete	cu yd
2413	Structural steel	lbs
2443	Timbering and bracing	bd ft
2448	Pumping	
2449	Air lines	
2450	Power and Light lines	
2451	Track work	
	Tunnel, Section No. 5	
2504	Rock drilling and blasting	cu yd
2505	Rock excavation	cu yd
2506	Rock disposal	cu yd
2535	Sharpening steel	cu yd
2507	Forms	sq ft
2509	Reinforcing steel	lbs
2511	Concrete	cu yd
2513	Structural steel	lbs
2543	Timbering and bracing	bd ft
2548	Pumping	
2549	Air lines	
2550	Power and Light lines	
2551	Track work	

Day Shift: Men, Quantity, Unit Cost, Amount — Night Shift: Men, Quantity, Unit Cost, Amount — Total to Date: Quantity, Unit Cost, Amount

SHEET No. 2 ______ 192 — SHEET No. 3 ______ 192 — SHEET No 5 ______ 192

Fig 16

THE NIAGARA FALLS POWER COMPANY
STATION No 3 EXTENSION ADDITION
COST REPORT FOR WEEK ENDING ______ 192

Proj No	Description	Cost for Week		Total Cost for Week	Total Cost to Date	Federal Power Commission Estimate	Alterations	Over or Under Estimate	Percent Over or Under Estimate	Percent Complete
		Labor	Material							

Fig. 10

THE NIAGARA FALLS POWER COMPANY
REPORT NO.
SHEET NO
MONTH OF
Number — Account — Sub-Ledger: Folio, Debit — General Ledger: Debit, Folio, Credit

Fig. 11

THE NIAGARA FALLS POWER COMPANY
HYDRAULIC PLANT
REQUISITION
REPORT NO

Fig. 12

FORM NO. 371
SHEET NO
OPERATOR
DATE

THE NIAGARA FALLS POWER COMPANY
DISTRIBUTION OF INVOICES

Previous Balance	Date	Voucher Number	Invoice Number	Description	Salaries	Wages	Material Issued from Stores	Miscellaneous	Material Purchased		Balance		Name
									Debit	Credit			

Fig. 13

Fig. 14

THE NIAGARA FALLS POWER CO.
______ PLANT
No. ______
MATERIAL TRANSFER AND RETIREMENT REPORT
Date ______

Quantity	Description			Credit			Debit			
				Account to be Charged	Unit Price	Amount	Account to be Charged	Unit Price	Amount	Amount of Depreciation

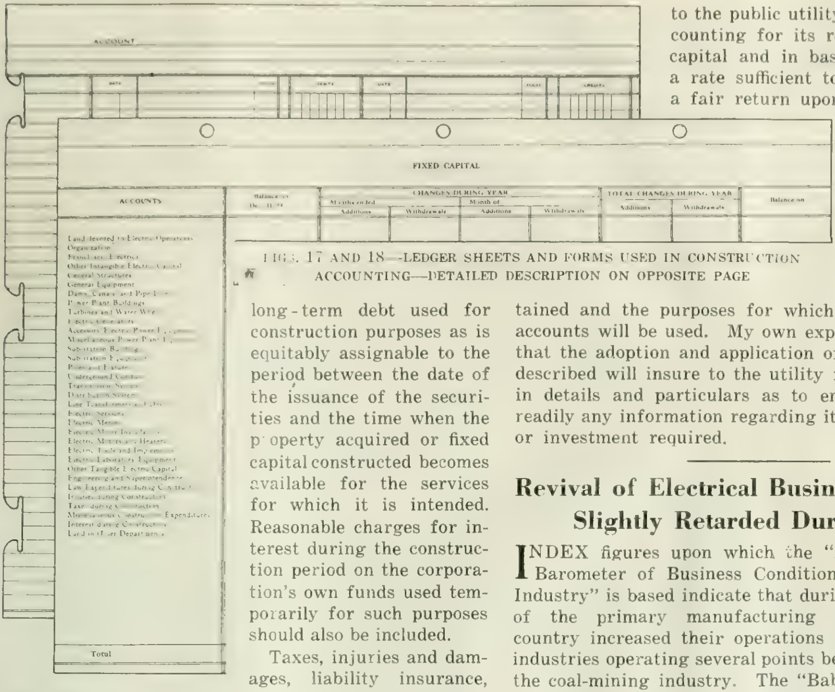
Fig 15

MATERIAL TRANSFER AND RETIREMENT REPORT REGISTER
CREDITS
MONTH OF ______ 19__

Report Number	Fixed Capital Undistributed	Projects			Material and Supplies		Work Orders			Accounts Receivable			Revenues		Miscellaneous		
		Number	Folio	Amount	Hydraulic Plant	Niagara Plant	Number	Folio	Amount	Account	Folio	Amount	Elec. Misc. and Jobbers	Misc. Non Operating	Account	Folio	Amount

FIGS. 9 TO 16—LEDGER SHEETS AND FORMS USED IN CONSTRUCTION ACCOUNTING

The complete equipment of ledger sheets and record forms used in The Niagara Falls Power Company's system of accounting for construction projects reproduced in the three group cuts with this article. The use of these forms is as follows: Fig. 1, request for project authorization; Fig. 2, project for authorization; Fig. 3, project record sheet; Fig. 4, salary distribution sheet; Fig. 5, foreman's labor record; Fig. 6, weekly pay sheet; Fig. 7, pay check; Fig. 8, Hollerith cards used by payroll department; Fig. 9, payroll daily distribution sheet; Fig. 10, weekly cost report; Fig. 11, monthly summary of charges to project; Fig. 12, Hollerith cards recording stores issued; Fig. 13, register of invoices charged to project; Fig. 14, classified register of invoices; Fig. 15, material transfer and retirement report; Fig. 16, register summarizing material transfers and retirements; Fig. 17, construction record sheet; Fig. 18, schedule of additions to and withdrawals from fixed capital account.



ACCOUNT

FIXED CAPITAL

ACCOUNTS	Balance on Dec. 31 19	CHANGES DURING YEAR				TOTAL CHANGES DURING YEAR		Balance on
		Months ended		Month of				
		Additions	Withdrawals	Additions	Withdrawals	Additions	Withdrawals	
Land devoted to Electric Operations								
Organization								
Franchises, Electric								
Other Intangible Electric Capital								
General Structures								
General Equipment								
Dams, Canals and Pipe Lines								
Power Plant Buildings								
Turbines and Water Wheels								
Electric Generators								
Accessory Electric Power Equipment								
Miscellaneous Power Plant Equipment								
Substation Buildings								
Substation Equipment								
Poles and Fixtures								
Underground Conduits								
Transmission System								
Distribution System								
Line Transformers and Devices								
Electric Services								
Electric Meters								
Electric Meter Installations								
Electric Motors and Heaters								
Electric Tools and Implements								
Electric Laboratory Equipment								
Other Tangible Electric Capital								
Engineering and Superintendence								
Law Expenditures during Construction								
Injuries during Construction								
Taxes during Construction								
Miscellaneous Construction Expenditures								
Interest during Construction								
Land in Other Departments								
Total								

FIGS. 17 AND 18—LEDGER SHEETS AND FORMS USED IN CONSTRUCTION ACCOUNTING—DETAILED DESCRIPTION ON OPPOSITE PAGE

long-term debt used for construction purposes as is equitably assignable to the period between the date of the issuance of the securities and the time when the property acquired or fixed capital constructed becomes available for the services for which it is intended. Reasonable charges for interest during the construction period on the corporation's own funds used temporarily for such purposes should also be included.

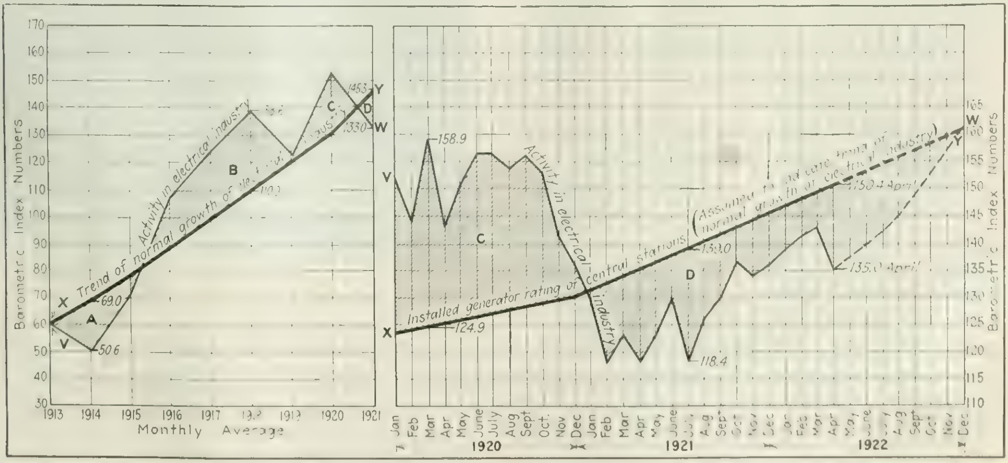
Taxes, injuries and damages, liability insurance, legal expenses and such "overheads" pass through the accounting department practically in the form of invoices and are treated substantially the same as invoices included under item 2 (b) above. The treatment of general office salaries and expenses and engineering and superintendence has been dealt with under item 1 (a).

In pursuing the method of accounting for construction costs as described above the accounts may be kept with such particularity as to details as is required and desired and so that such accounts will constitute a complete up-to-date inventory of the fixed-capital investment at cost. This record, of course, is of great value to the public utility corporation in accounting for its retirements of fixed capital and in basing its claims for a rate sufficient to enable it to earn a fair return upon its investment.

Accounting for the cost of construction or investment in property of public utilities requires an intimate knowledge of the results to be obtained and the purposes for which statements of the accounts will be used. My own experience satisfies me that the adoption and application of the method above described will insure to the utility records so complete in details and particulars as to enable it to furnish readily any information regarding its fixed-capital costs or investment required.

Revival of Electrical Business Conditions Slightly Retarded During April

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that during April only three of the primary manufacturing industries of the country increased their operations above March, some industries operating several points below March, notably the coal-mining industry. The "Babsonchart of American Business Conditions" shows a drop of 17 points from March 21 to April 18 and a slight upward turn during the last part of April. The "ELECTRICAL WORLD Barometer" indicates that during April business conditions in the electrical industry took a drop of 9.3 points on the barometer scale. The electrical industry as a whole during April was operating at 15.4 points below the point of normal demand if growth in the industry had been normal. In March it was operating at 6.1 points below the point of normal demand. Indications are that an increase of several points was made on the barometer scale during May.



"ELECTRICAL WORLD BAROMETER" OF ELECTRICAL BUSINESS CONDITIONS

Comparison of Power Factor Metering Favors Kva. Demand

Cost of Equipment and Results Secured by Five Methods —Comparison on Basis of Steinmetz Method—Tests Showing the Effect of Magnetizing Current on Power Factor

By J. E. DORAN, J. B. HODTUM and R. C. FRYER
Engineers Union Gas & Electric Company, Cincinnati, Ohio

AS WAS pointed out in a previous article,* a power-factor clause fails to define correctly the demand, and the method of obtaining the correction factors is more complicated than if the contract had been based upon the kilovolt-ampere demand. In this connection it may be interesting to compare the accuracy, the instruments, the cost of instruments and the handling of billing in several methods of metering power factor. Five methods are considered, involving the measurement of (1) kilowatt-hour energy and kilowatt demand; (2) kilowatt-hour energy and determination of average monthly power factor by measurement of total reactive kilovolt-ampere-hours (applied to the kilowatt demand); (3) kilowatt-hour energy charge and power factor of the demand interval by measurement of the reactive kilovolt-ampere demand and the kilowatt-demand simultaneously; (4) the French method, involving energy charge in kilowatt-hours plus reactive kilovolt-ampere-hours multiplied by a certain factor (which is understood to be one-third) and the demand in kilovolt-amperes; (5) kilowatt-hour energy and kilovolt-ampere demand. In making the comparisons it will be assumed that metering is required for a 1,000-kw. load on a 13,000-volt, three-phase, 60-cycle circuit.

Using method No. 1, the following instruments are required: One polyphase watt-hour meter with kilowatt-demand attachment, two current transformers, two potential transformers and one meter test block. The total cost would be $537 list. For one customer no chart is necessary. The demand attachments may be integral with the watt-hour meter. Reading and billing costs upon this basis are a minimum, but the method is entirely inequitable for the distribution of demand charges between customers with varying power factors.

Using method No. 2, the following instruments are needed: One kilowatt-hour meter connected to register reactive kilovolt-ampere-hours, one auto-transformer, one kilowatt-hour meter with demand attachments, two current transformers, two potential transformers and two meter-test blocks. The total list cost would be $580. This equipment will give the so-called "average monthly power factor" as a corrective factor against the kilowatt demand. Usually the average monthly power factor will be less than the power factor of the load at the time of the kilowatt demand; therefore in using it a greater so-called correction factor will be applied to the customer's kilowatt demand than should be applied. This method is believed to be discriminatory. Average monthly power factor applied to kilowatt demand will not give kilovolt-ampere demand, the factor most nearly proportional to demand cost, as shown in Figs. 4, 5, 6 and 7. In addition method No. 2 will complicate billing since the total hours and the total reactive kilovolt-ampere-hours must be read and the average monthly power factor computed, after which the correction must be computed. Nine customers out of ten will not understand the method as two meters are required.

With method No. 3 the following instruments are required: One recording kilowatt-hour-demand meter to read kilowatt-hours and kilowatt demand, one recording kilowatt-hour meter connected to record reactive demand during the same interval that the kilowatt demand is recorded, one auto-transformer, two current transformers, three potential transformers and two test blocks. The total cost of this equipment will be $765 list. This method would more nearly approach an equitable basis if it were possible to obtain an equitable power-factor correction. Its cost, including maintenance of two graphic meters, is high. The two charts used must be kept in synchronism. This means careful inspection, and if clocks are used, synchronous charts are well-nigh impossible. The power factor must be calculated from the reading and the corrective factor applied to the kilowatt demand, which means increased cost and likelihood of mistakes in billing. This method does not give the factor that applies most nearly to the cost of supplying this demand, and even if all metering difficulties are overcome, an economic loss still exists.

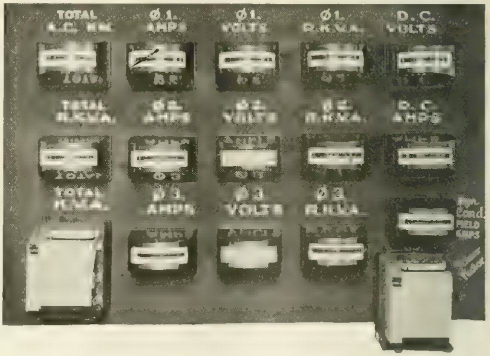


FIG. 1—METER ARRANGEMENT USED IN DETERMINING THE EFFECT OF MAGNETIZING CURRENT ON POWER FACTOR

Using method No. 4, the following complement of instruments is required: One polyphase watt-hour meter registering kilowatt-hours, one kilowatt-hour meter to register reactive kilovolt-ampere-hours, one auto-transformer, one kilovolt-ampere-demand meter, two current transformers, two potential transformers and two meter-test blocks. This apparatus would cost $824 list. This price may be higher than necessary because it involves a graphic meter. An indicating meter might be used. It is possible to buy combined instruments that might cost less than the instruments listed. It is understood that this method was legalized by the French government and that the product of the total reactive kilovolt-ampere-hours multiplied by one-third the value of the total kilowatt-hours was added to the energy charge. This method was later declared discriminatory, it is reported, and billing is now on a basis of kilowatt-hours and kilovolt-ampere demand. The original method, at best, would complicate the calculation of bills in a way that would not be thought permissible in this country.

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*Electrical World, May 6, 1922, page 877

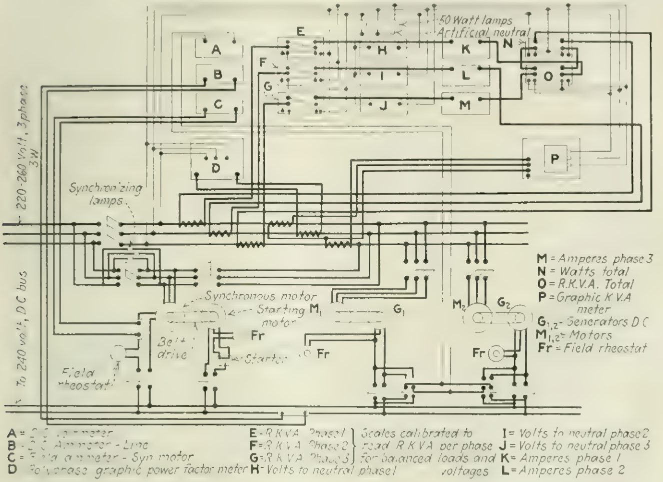


FIG. 2—DETAIL WIRING USED WITH METER ARRANGEMENT SHOWN IN FIG. 1

Method No. 5, which most nearly approaches the cost of supplying a demand, involves the following instruments: One polyphase watt-hour meter, one kilovolt-ampere-demand meter, two current transformers, two potential transformers and one test block. This apparatus would cost $779 list. The price given is based on using a graphic kilovolt-ampere meter. For billing a single customer the indicating type might be used. These meters are not yet in regular production and the price is for a die-cast job.

The foregoing method, while attractive in many ways, does not compensate for energy losses at low power factor. However, it makes billing very simple and is equitable in the distribution of demand charges. Demand cost is probably affected by low power factor to a far greater extent than is energy cost. With the actual operating conditions outlined in the previous article, the energy loss due to low power factor is considered less than 5 per cent at 61 per cent power factor during the demand peak. This energy loss should be recovered, but at present no method of accurately metering it is known. The loss is that at the coal pile (in the case of steam plants) and represents the magnetizing-current copper losses applying to lagging or leading magnetizing currents.

Under present conditions the effective idle I^2R losses due to lagging power factor are considered as more important than effective idle I^2R losses due to an equal power factor leading, because of the corrective effect exerted on the system by leading power factor. Consider a possible system operating at unity with two customers going on the line with an equal load and equal power factor, one lagging, the other leading. Under ideal unity power factor conditions, one would be almost as undesirable as the other. The measurement of energy loss due to lagging or leading power factors should be independent of any clause limiting measurement to a point different from unity, be it leading or lagging. This may be more thoroughly understood by considering the equation of the producer's energy loss at leading and lagging power factors, which may be represented as follows: Total current squared minus inphase current squared times effective ohmic resistance of the circuit, including generator and transmission plant plus transformer equipment and auxiliary losses plus additional generator field losses. These quantities are variable in different circuits of the same station. With any factor of resistance determined, the energy loss due to idle current is not due to the idle current squared times the determined resistance factor, but is a value determined by the square of the total current minus the square of the inphase current times the determined resistance, or is proportional to the effective idle current squared times the resistance.

Further comparisons of the suggested methods of measuring energy loss, using Dr. Steinmetz's method as a basis, are shown by the accompanying curves. Dr. Steinmetz's suggestion to correct billing energy for power factor is interpreted by using 16 per cent of the reactive kilovolt-amperes measured as an additive energy correction. All values are computed from an assumed load of 1,000 kw. at 10,000 volts to neutral. As indicated in Fig. 8, Curve A is the billing energy for various power factors using the Steinmetz method; Curve B is the energy which should rightfully be charged if Dr. Steinmetz's method is correct for 90 per cent power factor; Curve C is the energy which should rightfully be charged if Dr. Steinmetz's method is correct for 60 per cent power factor, Curve D that of an overlagged meter and Curve E, an overlagged meter compensated to register correctly at unity power factor.

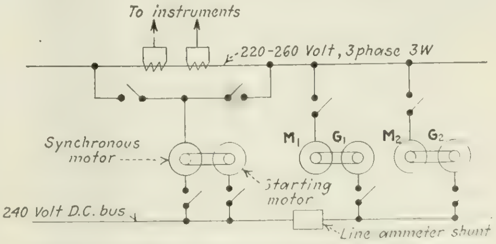
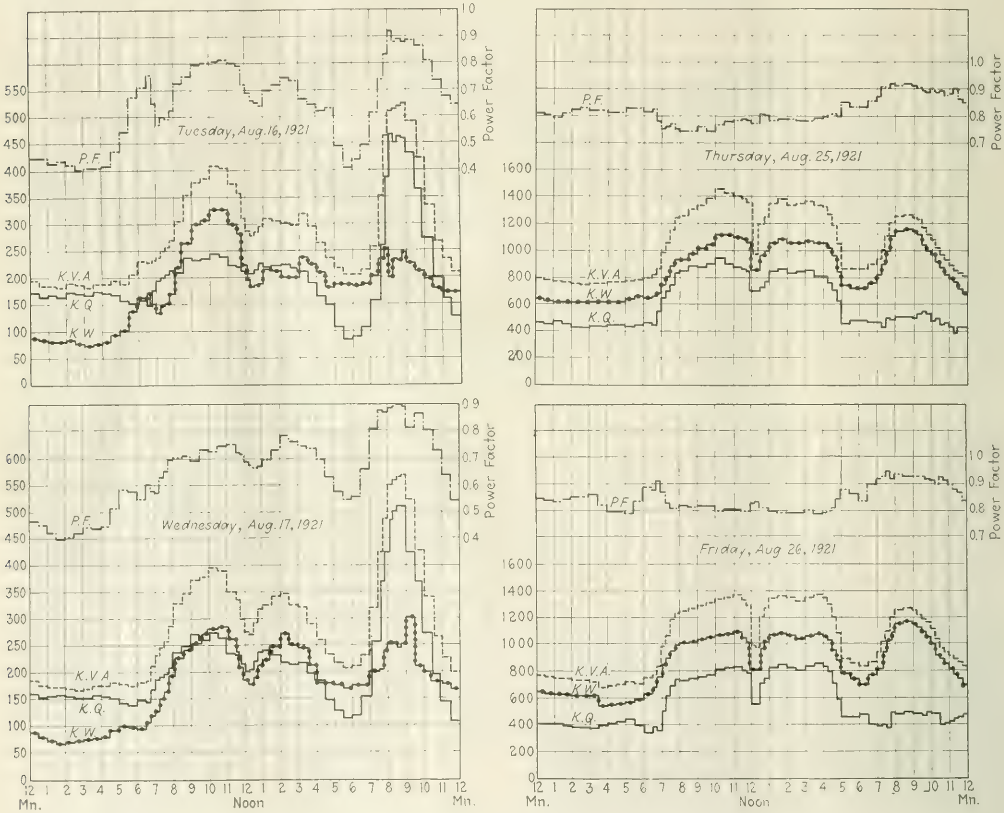


FIG. 3—SIMPLIFIED DIAGRAM OF LOWER PART OF FIG. 2

The calculations for the curves are as follows: Assuming Dr. Steinmetz's method correct at 90 per cent power factor, and using the assumed load conditions, we get: 16.1 effective idle amperes per phase $3 \times (16.1)^2 = 779$. The reactive kilovolt-amperes at 90 per cent power factor are 483×16 per cent $= 77$, which should be the energy loss due to power factor. The loss equation is, $779R \div 1{,}000 = 77$, where R is the effective resistance of the system per phase for the assumed three-wire, three-phase system. Solving this equation for R we get $R = 99$ ohms. Squaring the current per phase at various power factors and multiplying by three times the resistance factor, the result will give the true energy loss if the method is correct at 90 per cent power factor.



FIGS. 4, 5, 6 AND 7—POWER FACTOR, KILOVOLT-AMPERES, REACTIVE KILOVOLT-AMPERES AND KILOWATTS MEASURED ON VARIOUS FEEDERS OVER TWENTY-FOUR-HOUR PERIODS

These values are plotted in Curve B, Fig. 8. Curve C was obtained in a similar manner, assuming the method correct at 60 per cent power factor. The curves at 60 per cent and 90 per cent are of the same general form but neither corresponds exactly to Curve A. The intersections of the 60 per cent and 90 per cent curves with Curve A show that in the former case the method would charge the customer too much above 60 per cent, while below this value the curve falls below the actual loss. Again assuming the method right at 90 per cent power factor, the customer is charged too much above 90 per cent, while below this value the curves are so far apart that little over one-half the loss value is recovered. The method represented by Curve A more nearly approaches the loss curve in form than any other suggested method. The method seems to be almost the same as that used in France and reported abandoned. Two suggested curves which one manufacturer finds it possible to obtain with the use of only one energy meter and without the use of auxiliary transformers or other auxiliary equipment are plotted as Curves D and E. While these have the same general slope, their general form does not correspond to the general form of these loss curves, and unless they can be made to correspond they should not be used.

At present the conclusion is that no accurate method of measuring energy losses due to low power factor is available, but methods are available for proper measurement of demand charges in units of kilovolt-amperes. The diversity factor should be considered, but this should be done equally in the billing of demand by any other units. The instruments to measure kilovolt-amperes may be constructed to measure in accord with either the first or the second definition under consideration by the standards committee of the American Institute of Electrical Engineers. Definition No. 1 gives power factor in a polyphase circuit as the ratio of the total watts to the arithmetical sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point. Definition No. 2 gives power factor in a polyphase circuit as the ratio of the total watts to the vector sum of the volt-amperes in the several phases. To demonstrate and illustrate the various methods of determining the effect of magnetizing current on the power factor, and to show the variation of magnetizing current in different types of machines under identical conditions, metering equipment was installed as shown in Fig. 1. The indicating meters and the graphic kilovolt-ampere meter were checked against laboratory standards. Two 2-hp., 220-volt, three-phase induction motors were belted to direct-current generators with loading back connections to the direct-current lines. A 5-hp. synchronous motor was connected to float on the line for power-factor correction. Bucking and boosting transformers were connected to give balanced three-phase voltage higher and lower than the voltages stamped on the name plate of the machines. The connections of the apparatus are shown in Fig. 2. Special attention was given to demonstrating the properties of synchronous machinery as used for power-factor correction. With this apparatus the following readings were taken simultaneously: Volts per phase, amperes per phase, reactive kilovolt-amperes per phase, total reactive kilovolt-amperes, total kilowatts, total kilovolt-amperes, power factor, amperes in field of synchronous motors, direct-current volts and direct-current amperes. Each of these readings was shown by an instrument either indicating or graphic. At no time during the entire test, which ranged from 18 per cent lagging power factor to 50 per cent leading power factor, was there a discrepancy of more than 2 per cent in checking the readings of reactive kilovolt-amperes, kilowatts and kilovolt-amperes. The load being balanced, the power-factor meter also checked.

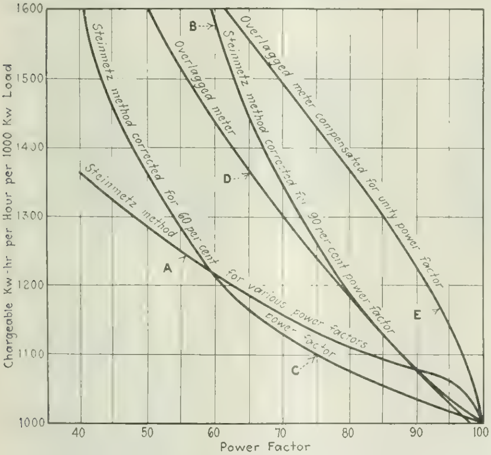


FIG. 8—COMPARISON OF METHODS OF MEASURING ENERGY LOSSES DUE TO POWER FACTOR

Two conclusions are drawn from the test: (1) The kilovolt-ampere meter is the best method of obtaining kilovolt-ampere demand for billing demand purposes. (2) In selecting synchronous motors or converters care must be taken to have the normal voltage of the machines as high as the voltage of the system on which they are to be used. The synchronous motor used in the test was a 220-volt machine. When the machine was operated on a 245-volt line the power factor was lagging for all values of field excitation.

Putting System Operation on a Higher Plane

Advocacy of Placing System Operation, Restoration of Service and Emergency Repair Under Control of a Central Authority

BY WILLIAM H. ATKINS
General Superintendent
Edison Electric Illuminating Company of Boston, Mass.

SUBDIVIDED responsibility for system operation in the modern central station involves losses in time and money which careful study indicates can be cut down considerably by organizing a centralized "load and trouble dispatching division" headed by an operating superintendent who is a high-grade engineer, well balanced, level headed and experienced in the handling of station apparatus, transmission and distribution systems. The Edison Electric Illuminating Company of Boston is keenly interested in this problem, and certain aspects of it may not be without interest to operating organizations of other central-station companies.

The prompt handling of service troubles of whatever nature and wherever occurring is so important today that constant observation and critical analysis of system handling is necessary in progressive companies. I am convinced that a centralization of load-dispatching, distribution and service operation functions may profitably be effected in many cases where the authority of different branches of the central-station organization has either been too limited to span the gap between them or so extensive as to overlap. This overlapping or insularity causes confusion and lost motion in remedying system troubles, whether in plant or on lines or in substations. Time is lost through failure to notify the proper people immediately in case of system trouble and to concentrate upon the job only those most needed to restore normal conditions. The presence of groups of official automobiles where the job is overmanned through uncertainty as to what members of the staff should respond in particular cases also gives undesirable publicity.

BROADENING THE CONTACTS

In the past there has been in not a few companies too little co-ordination between switchboard operators and men working on lines or on customers' premises. The general public has been obliged to call the main office of a company in case of trouble, with resulting delays on large systems in transferring such calls to the proper parties. We are of the opinion in Boston that all the work of system operation and emergency repairs may wisely be placed under a central authority.

It is proposed that the operating superintendent or chief load dispatcher shall head four sections:

1. System operators, directing the operation of the generating stations and substations and transmission.
2. Distribution operators, directing the operation of distributing circuits and feeders, including location of faults and making repairs for restoring service.
3. Service operators, answering customers' complaints and directing the restoration of service when due to minor service failures and interior troubles.
4. Outside forces—call men under direction of distribution operators and call men and inspectors under the service operators.

The chief load dispatcher, according to the foregoing plan, will direct through his subordinates the operation of the generating, transmission and distribution systems

Boston Plans to Centralize System Operation, Restoration of Service and Public Contact

THE functions of the various branches of the Boston Edison organization illustrated in views A to D inclusive are to be centralized in the new operating arrangement outlined by W. H. Atkins. Under a chief load dispatcher or operating superintendent are to be performed the duties of load dispatchers, distribution operators, service operators, and such call men and inspectors as are available for emergency maintenance. The handling of plant, lines, public contact and emergency repairs will thus be more effectively co-ordinated. Among the activities which will be placed under a central authority are the following:

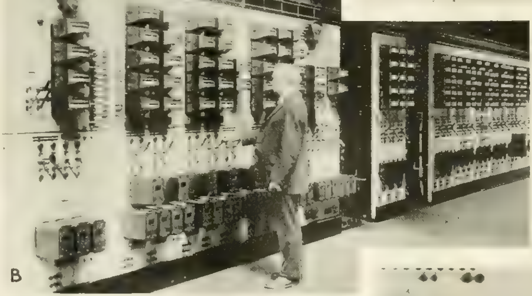
A — Private branch exchange of Boston Edison Company, which handles public inquiries, transferring calls as necessary.

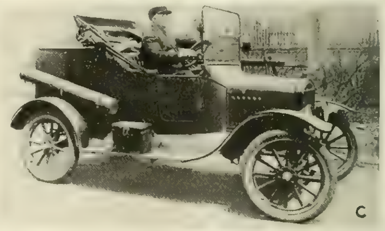
B—Switchboard at L Street station.

C—Call man, maintenance of lines department, equipped with automobile to scene of service trouble.

D—Load dispatchers' headquarters.

A


B


C

D

and through his subordinates will direct such emergency or temporary repairs on apparatus and lines as may be necessary for the restoration and maintenance of continuous service. At all times he will maintain the fullest possible information for his operators regarding emergency methods of operation for all branches or parts of the system. A part of his work will include the devising and supervision of trials of emergency methods of operation to train operators or others in the duties they may be called upon to perform. The starting of new station equipment may be supervised by him, if necessary or desirable, together with the approval of arrangements for tests on new or existing equipment or lines as made from time to time. Full information, plans, maps, etc., will of course form a part of his equipment, and to him will be assigned the problem of devising methods of transmitting all necessary information to interested departments or individuals regarding system troubles. This official will be authorized to call for assistance from any and all departments, but his work will be so planned as largely to do away with the need of calling upon other officials at all hours of the day or night to keep the system in full operation.

System operators will direct the operating of generating plants and substations, controlling generating station operation and loading, transmission-line operation, substation operation and high-tension switching operations up to high-tension buses at all points including substations. These men will also control switching operations on apparatus in substations, although substation operators will generally perform switching operations on substation equipment as required for loading conditions in accordance with an approved plan of operation for each substation. The restoration of high-tension service to any and all stations, the restoration of service up to substation buses after the failure of substation equipment, and the distribution of load between direct-current substations, will also fall upon the system operators. It may be desirable to arrange that these men shall have no dealings with the outside public.

Distribution operators will direct the operation of distribution circuits and feeders, switching operations on circuits and feeders outside of stations to redistribute load when necessary in emergencies, and the location of faults and repair and restoration to service of all transmission lines, distribution circuits and feeders. Repairs to be made will be only such temporary or emergency repairs as can be made by the "call men" available and as are necessary to restore service. Permanent or extensive repairs will be carried out by the maintenance department as at present. The foregoing work will involve direct control of "call men," the obtaining of progress reports during repair operations, and reports of these to the chief load dispatcher for transmission to interested departments as he may direct or as may be necessary. Distribution operators will co-operate with service operators regarding troubles, so the latter may properly answer inquiries.

BRINGING COMPANY AND PUBLIC CLOSER

Customers' complaints now handled by inspectors will be turned over to the service operators, who in future, according to the plan above outlined, will direct the movements of inspectors and call men as required to deal with inside troubles and to patrol street-lamp routes where such work is now being done by call men. Customers' complaints of service troubles will be received by the service operators over telephone exchange lines, and it is probable that a special "trouble number" will be established by the telephone company to facilitate the transmission of this information. Service interruptions affecting single consumers will be assigned to inspectors or call men as convenient. If trouble is general, the service operators will be informed as to its nature and extent and thereby be able to handle inquiries efficiently and to avoid the dispatch of inspectors and call men on unnecessary trips, thus reserving their services for important work. Service operations will at all times be in touch with the public by means of the "trouble number."

The location of the headquarters will be governed by many factors, but wherever it is situated full use will be made of the latest developments in signaling systems for indicating the opening and closing of switches of major importance, often remote from the operating center. The problem of telephone facilities will be taken up with the local telephone company and the convenience and economy of various arrangements discussed, with provision for the growth of the system. Desirable features include the provision of separate boards for the three classes of system operators, presumably separated by glass partitions in a single room to insure noninterference and at the same time wired for "listening in" and so arranged as to permit each division to observe the work of the others.

It is hoped that in due course radio-telephone equipment will be available which will greatly facilitate the control by distribution operators of call men on inspection or repair work.

SOURCES OF PERSONNEL SUPPLY

On any system taking up improved load dispatching the existing system operating organization should form the nucleus of the future group responsible for service. An efficient system operating force would logically be transferred to the new co-ordinated staff and be expected to continue along the specialized lines hitherto followed by these men. Distribution and service operators would presumably be selected from a group of men specially trained for these positions, preference being given to young men of good habits, intelligent, alert and well educated, but not necessarily conversant with outside construction. A suggested course of training would acquaint such men with the practical use and operation of all the equipment in service on the system, the arrangement of all equipment in stations, the routing and connections of overhead and underground lines, the methods to be employed in fault location, use of emergency connections, use of record data in formulating operating methods, and finally, the relations which the company desires to maintain with its customers.

Fundamentally an organization such as is here contemplated should be able to do more than merely meet the conditions developed by the failure of individual lines or converting units. In fact, it should be able to meet any contingency, even the destruction of a complete substation. At first glance this may seem a far cry, but with a definite scheme laid out in advance and with the company's facilities and reserves carefully marshaled and arranged in advance, the impossible may be accomplished in a short time.

Acknowledgment is hereby given to L. L. Elden, chairman; R. E. Dillion, J. W. Cowles and J. E. Larrett of the Boston company for their comprehensive study of the load-dispatching and system-operating problem.

Consolidated Summary of Sales, Operating Expenses and Statistical Data by Commodities for Five Houses

TWELVE MONTHS ENDED DEC. 31, 1921

Developed by the Electrical Supply Jobbers' Association

Commodity		Net Sales						Operating Expenses				Operating Expense to Sales												
												Percentage, Direct Sales			Percentage, Warehouse Sales									
Commodity No	Description	Warehouse	Per Cent to Total Sales Ea. Commodity	Direct	Per Cent to Total Sales Ea. Commodity	Total	Per Cent to Total Sales All Commodities	Financial and Accounting	Selling	Warehousing	Total	Financial and Accounting	Selling	Total	Warehousing	Total	Bills and Credit Memoranda Issued	Items on Bills and Credit Memoranda Issued	Average Amount of Items on Bills and Cr Memoranda Issued	Units Received	Units Shipped	Average Selling Price of Units Shipped	Number of Packages Shipped	Times Turnover of Merchandise Owned
1	Wiring devices	$538,517	82.21	$116,553	17.79	$655,070	6.42	$35,096	$57,183	$36,808	$129,087	5.36	8.73	14.09	6.84	20.93	38,537	91,036	$7.20	21,837	361,323	$1.49	64,446	2.34
2	Rubber-covered wire and lamp cord	468,791	60.56	305,269	39.44	774,060	7.59	19,039	41,759	22,297	83,095	2.46	5.39	7.85	4.76	12.61	16,263	31,673	24.44	9,744	64,319	7.29	22,401	2.65
3	Weatherproof wire	162,013	39.41	249,065	60.59	411,078	4.03	6,994	15,383	5,975	28,352	1.70	3.74	5.44	3.69	9.13	3,074	5,173	79.47	4,294	10,062	16.10	5,772	4.93
4	Bare copper wire	20,175	17.50	95,114	82.50	115,289	1.13	1,545	7,443	812	9,800	1.34	6.46	7.80	4.02	11.82	532	660	174.68	62	933	21.62	497	1.21
5	Rigid conduit	238,639	80.89	56,374	19.11	295,013	2.89	6,322	16,157	18,311	40,790	2.14	5.48	7.62	7.67	15.29	4,892	12,524	23.56	24,296	75,115	3.18	36,377	2.80
6	Condulet type fittings	131,250	86.88	19,822	13.12	151,072	1.48	11,415	17,169	13,885	42,469	7.56	11.36	18.92	10.58	29.50	11,631	38,066	3.97	10,325	124,875	1.05	22,506	2.02
7	Outlet boxes and other conduit fittings	84,164	85.78	13,950	14.22	98,114	0.96	8,872	16,081	14,157	39,110	9.04	16.39	25.43	16.82	42.25	9,787	29,306	3.35	8,135	168,712	.50	25,465	1.40
8	Metallic flexible conduit	94,236	86.62	14,558	13.38	108,794	1.07	2,937	6,140	4,566	13,643	2.70	5.64	8.34	4.85	13.19	2,653	5,107	21.30	5,806	16,323	5.77	6,499	3.29
9	Non-metallic flexible conduit	98,395	95.13	5,016	4.87	103,411	1.01	2,597	8,848	5,120	16,565	2.51	8.56	11.07	5.20	16.27	2,406	4,646	22.26	10,000	15,620	6.30	9,643	5.00
10	Metal molding and fittings	16,542	77.70	4,747	22.30	21,289	0.21	1,537	4,615	2,217	8,369	7.22	21.68	28.90	13.40	42.30	1,632	5,384	3.95	2,403	15,939	1.04	2,925	1.83
11	Porcelain knobs, tubes and cleats	80,821	89.60	9,384	10.40	90,205	0.88	3,534	12,643	11,662	27,839	3.92	14.02	17.94	14.43	32.37	3,647	8,751	10.31	2,678	235,008	.34	17,618	1.67
12	House goods	46,924	73.58	16,851	26.42	63,775	0.62	4,473	7,223	3,961	15,657	7.01	11.33	18.34	8.44	26.78	5,772	10,673	5.98	3,026	39,250	1.20	6,466	1.95
13	Tape—rubber and friction	51,653	74.30	17,864	25.70	69,517	0.68	3,565	7,647	4,320	15,532	5.13	11.00	16.13	8.36	24.49	4,355	8,667	8.02	1,590	72,260	.71	8,141	6.48
14	Tools—lineman's and electrician's	21,799	65.33	11,564	34.67	33,363	0.33	2,901	4,844	2,596	10,341	8.70	14.52	23.22	11.91	35.13	2,963	5,423	6.15	1,370	7,990	2.73	2,435	1.30
15	Lamps—large mazda	1,322,174	96.03	55,037	3.97	1,387,211	13.60	31,617	75,717	39,086	146,420 *156,531	2.28	5.46	7.74	2.93	10.67	27,743	57,507	24.12	54,198	147,760	9.02	51,684	†
16	Lamps—miniature	123,360	97.02	3,799	2.98	127,159	1.25	5,477	13,865	4,807	24,149	4.31	10.90	15.21	3.90	19.11	5,947	12,970	9.80	1,528	28,043	4.40	6,296	†
17	Lamps—carbon	13,448	60.90	8,635	39.10	22,083	0.22	1,035	2,238	2,179	5,452	4.69	10.14	14.83	16.20	31.03	1,424	1,860	11.87	375	15,062	.89	2,524	1.85
18	Flashlamps, batteries and cases	60,649	79.72	15,433	20.28	76,082	0.75	6,276	9,247	5,082	20,605	8.25	12.15	20.40	8.38	28.78	8,012	16,511	4.61	2,866	59,042	1.03	8,948	5.85
19	Dry batteries	98,245	82.31	21,116	17.69	119,361	1.17	3,629	8,011	4,190	15,830	3.04	6.71	9.75	4.27	14.02	4,149	5,281	22.60	3,229	32,168	3.05	6,212	8.18
20	Fan motors	175,097	89.71	20,080	10.29	195,177	1.91	4,697	14,699	7,078	26,474	2.41	7.53	9.94	4.04	13.98	4,832	6,170	31.63	5,637	10,547	16.60	6,065	1.93
21	Heating devices	409,291	84.67	74,088	15.33	483,379	4.74	22,149	50,874	22,411	95,434	4.58	10.52	15.10	5.48	20.58	26,558	41,988	11.51	19,534	111,421	3.67	28,007	2.62
22	Washing machines and parts	537,494	95.34	26,251	4.66	563,745	5.52	11,382	70,412	19,099	100,893	2.02	12.49	14.51	3.55	18.06	8,917	13,188	42.75	8,614	18,734	28.69	8,192	6.85
23	Ironing machines and parts	90,683	82.20	19,632	17.80	110,315	1.08	2,205	41,314	7,771	51,290	2.00	37.45	39.45	8.57	48.02	1,400	1,629	67.72	1,058	1,351	67.12	1,029	1.28
24	Vacuum cleaners and parts	201,861	97.05	6,139	2.95	208,000	2.04	3,793	29,167	5,887	38,847	1.82	14.02	15.84	2.92	18.76	3,619	5,063	41.08	5,679	10,641	18.97	4,783	4.20
25	Other socket appliances	49,889	80.41	12,154	19.59	62,043	0.61	2,499	13,325	2,458	18,282	4.03	21.47	25.50	4.93	30.43	2,769	3,740	16.59	1,103	5,778	8.63	2,494	1.53
26	Electric ranges and ovens	111,130	61.43	69,762	38.57	180,892	1.77	4,496	27,974	8,269	40,739	2.49	15.46	17.95	7.44	25.39	3,896	5,538	32.66	2,459	5,611	19.81	2,930	1.29
27	Ornamental street lighting equipment and supplies	16,700	13.82	104,105	86.18	120,805	1.18	2,349	11,561	902	14,812	1.94	9.57	11.51	5.40	16.91	1,452	2,058	58.70	365	6,947	2.40	1,054	2.15
28	Pole-line hardware	87,647	50.41	86,221	49.59	173,868	1.70	6,021	22,281	13,068	41,370	3.46	12.82	16.28	14.91	31.19	5,173	10,541	16.49	9,110	176,765	.50	13,042	2.67
29	Wood cross-arms	58,726	51.69	54,893	48.31	113,619	1.11	2,370	9,575	11,649	23,594	2.09	8.43	10.52	19.84	30.36	1,577	2,751	41.30	39,904	54,102	1.08	32,592	1.91
30	High-tension insulators	42,351	50.35	41,755	49.65	84,106	0.82	2,081	8,138	4,434	14,653	2.47	9.68	12.15	10.47	22.62	1,618	2,529	33.26	2,793	46,040	.92	3,082	3.17
31	Strand, bare iron and steel wire	28,869	72.97	10,694	27.03	39,563	0.39	1,168	5,281	2,785	9,234	2.95	13.35	16.30	9.65	25.95	1,177	1,808	21.88	2,472	4,850	5.95	3,426	2.45
32	Watt-hour meters	18,020	30.13	41,796	69.87	59,816	0.59	1,311	4,882	887	7,080	2.19	8.16	10.35	4.93	15.28	924	1,249	47.89	1,029	1,545	11.66	908	4.28
33	Inclosed fuses	35,949	79.61	9,211	20.39	45,160	0.44	2,920	5,980	2,522	11,422	6.47	13.24	19.71	7.02	26.73	3,473	6,737	6.70	1,327	26,882	1.34	4,798	1.62
34	Renewable inclosed fuses	56,983	93.13	4,206	6.87	61,189	0.59	3,067	6,199	3,741	13,007	5.01	10.13	15.14	6.57	21.71	3,233	7,650	8.00	2,244	32,792	1.74	3,830	1.33
35	Safety switches	53,690	57.61	39,501	42.39	93,191	0.91	3,652	10,699	3,528	17,879	3.92	11.48	15.40	6.57	21.97	3,977	6,817	13.67	2,465	16,030	3.35	4,005	2.25
36	Lighting fixtures	808,570	93.15	59,452	6.85	868,022	8.51	33,120	133,088	73,884	240,092	3.82	15.33	19.15	9.14	28.29	29,675	53,719	16.16	26,765	85,581	9.45	29,876	1.87
37	Automobile accessories	533,990	91.14	51,923	8.86	585,913	5.74	16,363	96,865	29,231	142,459	2.79	16.53	19.32	5.47	24.79	16,795	30,006	19.53	7,362	34,860	15.32	7,233	3.45
38	Apparatus sales	233,322	40.41	344,108	59.59	577,430	5.66	11,461	54,417	19,347	85,225	1.98	9.42	11.40	8.29	19.69	8,212	12,662	45.60	7,654	20,832	11.20	8,019	2.18
39	Sundry commodities	294,199	49.07	305,299	50.93	599,498	5.88	16,233	74,703	30,019	120,955	2.72	12.45	15.17	10.20	25.37	15,516	34,118	17.57	5,603	77,340	3.80	13,838	1.09
40	Miscellaneous	132,401	51.39	125,248	48.61	257,649	2.52	15,330	25,803	15,084	56,217	5.95	10.01	15.96	11.39	27.35	16,145	30,568	8.43	9,250	109,152	1.21	15,439	2.04
	Total	$7,658,657	75.05	$2,546,669	24.95	$10,205,326	100.00	$327,528	$1,049,450	$486,085	$1,863,063	3.21	10.28	13.49	6.35	19.84	316,357	631,747	$16.15	330,189	2,347,605	$3.26	501,497	2.49

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* This amount includes $10,111 outgoing transportation, which generally is not considered operating expense, but should be added to these expenses to obtain total cost of handling this commodity.

† All merchandise consigned.

The table covers twelve months and embodies the six months study published in ELECTRICAL WORLD March 25, 1922.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Compensated Impulse Gap Subjected to Severe Test

To the Editors of the ELECTRICAL WORLD:

In the editorial in the June 3 issue of the ELECTRICAL WORLD, under the caption of "Compensated Spark Gap an Important Improvement," you inquire what would happen to the gap in the case of a drenching rain. I beg to say that these gaps were given a wet test with five 0.2-in. precipitation nozzles in the laboratory of the Ohio Brass Company. In other words, they were completely flooded by a very finely divided water supply, and this was even more severe than a drenching rain.

Electro Service Company, CHARLES E. BENNETT,
Atlanta, Ga. Chief Engineer.

Electrical Development in Sweden

To the Editors of the ELECTRICAL WORLD:

In a little item which appeared in the ELECTRICAL WORLD on March 18 last what should be prophecy takes the form of fact. Of course there is no such thing in existence as an all-Swedish high-tension line system reaching "from the far north down to Skane in the south." There are indications, however, that such a system will exist some twenty or thirty years hence. It is, indeed, hoped that the future trunk lines will link not only Sweden but all three Scandinavian countries. Unfortunately, however, the recently completed Trollhättan-Västeras line is only the first humble beginning. Moreover, this line is operated at 132,000 volts, although it is so constructed as to permit the voltage to be raised to 220,000, after reinsulation, when conditions warrant. EDY VELANDER.

Stockholm, Sweden.

The Right Measure of "Going Value"

To the Editors of the ELECTRICAL WORLD:

Referring to the editorial in your May 6 issue in regard to the Supreme Court's decision in the Galveston case concerning "going value," it seems to me that it was perfectly reasonable to reject the early losses as the yardstick of this value in view of the fact that what was to be arrived at was the value at the present time.

Consider the case of two public utilities constructed in similar towns at the same time and costing about the same. Plant A ungraciously accepts such business as is brought to it, while plant B makes an honest effort to get all the business and give good service. The result is that plant A never earns a fair return, while plant B is without such a return for only a few years. Under the early losses measure, plant A has a larger going value than plant B, though its business is certainly not worth so much.

To my mind going value is the value of the business as distinct from the plant and is measured by what an ordinary good business man would pay *today* for that business. What that business has cost is no more a measure of its value than what the plant has cost. They are both indications of what it would cost today, and as such they are factors to be weighed in determining the value, but neither is a measure.

The best measure of the going value, in my view, is the judgment (or guess, if you please) of an experienced man as to what it would cost to attach that business today under conditions as they exist at present, modified by any prospective change of pronounced character during the time necessary to attach it.

F. V. GALLAUGHER.

Lake Charles Railway, Light & Water Works Company,
Lake Charles, La.

Production of Cold-Light Sources Not Over Yet

To the Editors of the ELECTRICAL WORLD:

In your editorial of May 6 concerning cold light you seem to refer to a type of cold-electrode negative-glow corona lamp that has recently been worked upon in Europe. I made this form of lamp in 1894, patented it and described it in a paper presented before the American Institute of Electrical Engineers in 1896, and I also made an improved form suitable for lower voltages in 1913, patented it and described it in a paper presented before the A. I. E. E. March 26, 1920, and also before the Illuminating Engineering Society convention at Rochester last October. You may also be interested in the article entitled "Gaseous Conduction Light from Low-Voltage Circuits" in the *General Electric Review* of July, 1920.

I also imported from Cuba about 1900 several dozen fireflies and reached the conclusion that the color of their light was not desirable and that a drop of water added to their dried luminous organs reproduced the glow, indicating that the light was due to chemical reaction and that the oxygen of the moisture was essential.

It seems to me that it would be appropriate for various writers on cold light to remember that in New York it was a common thing a dozen years ago to see some of the four miles of the long Moore light tubes with icicles pendent from them. It is true that the mechanical limitations of these tubes were emphasized by the advent of the improved incandescent lamp. However, the invention and production of new light sources can be likened to a game that is not over yet, and I am still very much alive. D. MCFARLAN MOORE.

Edison Lamp Works of General Electric Company,
Harrison, N. J.

Cost of Operating Diesel Engines

To the Editors of the ELECTRICAL WORLD:

It has been called to our attention that there is an error in one of the tables of our prime movers committee report, advance copy, for 1922. This table is quoted on page 1034 of the May 20 issue of the ELECTRICAL WORLD, and I am therefore advising you as to the nature of the error.

In item J of the table of "Cost of Operation of Ten Diesel Engine Plants, 1921," the figures in column headed "Repairs," etc., should be $18,773.81 instead of $118,773,81, and the figures in column headed "Total Cost" should be $53,814.99 instead of $253,814.99.

National Electric Light Association, W. J. CANADA,
New York, N. Y. Engineer.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

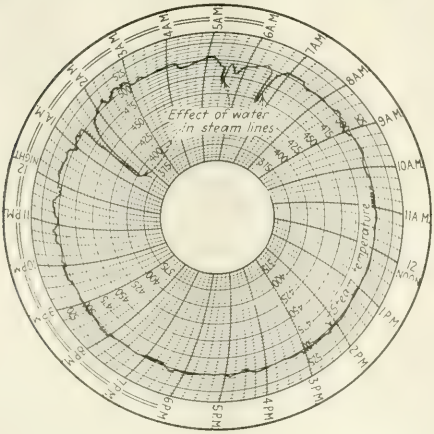
Proper Care of Boilers Prevents Water Going Into Steam Lines

IN MANY steam stations considerable trouble is experienced from water going over into the steam header, especially in those stations that are operated only a part of the day or where the load varies within wide limits, thus necessitating frequent cutting in and out of boilers. This water may cause serious damage to turbine blading, reciprocating engines, pumps and fittings. With proper care most of this trouble may be prevented. There are four principal reasons for this water going over into the main steam line:

1. When a boiler is on standby the steam condenses and water collects in the superheater, and this water will be sent over into the main steam line, unless care is taken to drain the superheater each time a boiler is started up.

2. If the water is being carried high in the boiler at light load and a sudden demand comes for more steam, water is apt to go over.

3. When the salt concentration in a boiler is allowed to become excessive the boiler will prime, especially if the water is high in the glass and the boiler is steaming at a high rate. It has been found that priming happens quite frequently if the salt concentration is allowed to get much over 200 grains per gallon, and whenever it is over this amount the boiler should be blown down. This blowing down must be watched closely if the efficiency is not to be affected. Too much blowing down—that is, keeping the salt concentrate too low—means a loss of heat in the water blown out, while not enough blowing will cause a loss from water going over into the steam lines.



WATER GOING TO THROTTLE THROUGH STEAM LINES IS INDICATED BY LOWERED TEMPERATURES

4. Filling a boiler with water until it overflows into the steam line. It sometimes happens that when a boiler is being worked hard and the feed valve is well open the load drops and the fires are readjusted so that the boiler produces very little steam without the feed valve being properly closed to correspond to the boiler load, thus causing overflowing. Again, this may happen when a boiler is on standby. If the feed valve leaks and the blow-off valves are tight, the boiler will gradually fill up and the water go over into the steam lines unless close watch is kept.

Water going over into the steam line constitutes a serious condition, even though it is only of short duration. If severe enough, it will cause reciprocating engines and pumps to blow out heads or be otherwise wrecked. In the case of turbines the blades will be eroded and scale will be deposited on them, causing a permanent drop in the efficiency until such a time as the machine can be taken down for a general overhauling. If severe enough, the turbine blades will be distorted, if not torn out, and the machine thrown out of balance.

Another result is the "salting up" of valves, valve stems, burner lines, etc. While it is often impossible to estimate just what these losses amount to in dollars and cents, it is a fact that every time water enters the steam line there is a chance that some piece of the equipment will be damaged, if not wrecked, and that where turbines are used their economy will be lowered, if nothing more serious happens to them, and the loss will continue until there is an opportunity to take them out for overhauling and cleaning.

The accompanying illustration give some examples of water going over as shown on the recording steam temperature chart. In this particular station the load is usually off about 10 p.m. and the boilers kept on standby until about 5 a.m., when the load gradually comes on until about 8 o'clock.

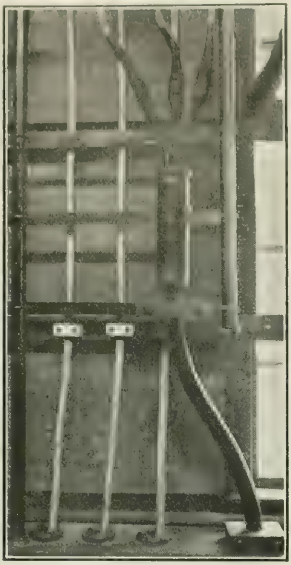
W. E. THOMSON,
Steam Plant Engineer.

Southern California Edison Company,
Los Angeles, Cal.

Three-Conductor Cables Save Space in Substation

WHEN duct capacity is limited it may be advisable to install three-conductor cable instead of separate single conductors. This plan was followed recently in the Sewall Street substation of the Cumberland County Power & Light Company, Portland, Me. It had become necessary to increase the output of the station by running additional cables from the switchboard to the outgoing cable rack. The new 4/0 2,300-volt cables were installed as shown in the illustration. The old and new methods are shown side by side, and the compactness of the three-conductor cable, which saves two ducts per circuit, is apparent. Leads from the station buses are brought overhead to a pothead at the top of the lead-covered cable, and a common frame of ¼-in. x 1½-in. strap-iron, fastened at the ends to vertical pipe framing, is used conveniently for the old and new lines. To take the weight of the lead-covered cable, it is clamped at the concrete sill as shown at the bottom of the photograph by a 6-in. x 5-in. x 1¾-in. split wooden block secured by ½-in. horizontal bolts, and a second clamp just below the pothead further adds to the mechanical strength of the installation. In place of porcelain cleats, the company uses in the new work 2,300-volt insulators which are clamped to the pine framing. FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.



DUCT SPACE SAVED BY REPLACING SINGLE CONDUCTORS BY THREE-CONDUCTOR CABLES

Comparison of Five Diesel-Engine Generating Plants

SOME interesting data on operating costs, with particular attention to maintenance expense for five Diesel-engine generating stations, are given in the accompanying table. The figures are for the year ended Dec. 31, 1921, and were incorporated in the prime movers report of the recent N. E. L. A. convention at Atlantic City.

A study of the table discloses the fact that fuel oils of different specific gravity are used in these plants. The reason for this is that the plants having old-type units cannot use low-gravity fuel oils satisfactorily, while those with more modern Diesel engines are able to do so.

All of these plants received a much-needed overhauling during the past year. As a result the maintenance expenses are higher than they normally would be.

A number of statements were received from operators of Diesel-engine stations. After studying these statements, it is possible to emphasize the following points regarding this type of prime mover:

Reliability. — All operators agree that Diesel engines are entirely reliable for either continuous or intermittent service.

Efficiency.—The thermal efficiency of these engines is high; 34 per cent has been obtained.

Picking Up Load.—One operator calls attention to the time required from starting cold to synchronizing on the board. This is only from five to eight minutes, although he states that fifteen to twenty minutes should ordinarily be taken.

Maintenance.—Depending upon the continuity of operation, attention is called to the increase in cost of maintenance and replacement after several years of operation.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

COMPARISON OF OPERATING COSTS OF DIESEL PLANTS WITH PARTICULAR REFERENCE TO MAINTENANCE

Item No.	Data	Station A	Station B	Station C	Station D	Station E
1	Number, size and kind of Diesel units	Three 500-hp. M. & S. Diesels Three 350-kw. or 437-kva G. E. generators	Four 225-hp. B-S Diesels One 250-hp primary semi-Diesel Two 300-kw. or 375 kva. G. E. (F. W.) generators One 125-kw. or 150-kva. generator	One 500-hp. M. & S. Diesel One 500-hp. B-S Diesel Three 225-hp. B-S Diesel One 350-kw. or 437-kva. G. E. generator One 380-kw. or 475-kva G. E. generator Three 150-kw or 187-kva. generators	One 500-hp. M. & S. Diesel Two 225-hp. B-S Diesels One 170-hp. B-S Diesel One 380-kw. or 475 kva G. E. generator Two 150-kw or 187-kva. generators One 125-kw. or 150-kva. generator	One 500-hp M & S Diesel One 350-kw. or 437-kva. generator
2	Total Diesel plant capacity, kw	1,050	725	1 180	805	350
3	Gravity of fuel oil, degrees Baumé	22-26	28-36	22-36	22-36	22-26
4	B.t.u. per lb. oil (average)	19,200	19,200	19,200	19,200	19,200
5	Annual station output, kw-hr	5,833,260	2,214,876	891,710	2,075,980	1,516,680
6	Maximum hours generation, kw-hr	950	530	880	480	330
7	Peak load, kw	980	620	920	585	350
8	Ratio average hour to maximum hour, per cent	70	47½	11½	49	52½
9	Ratio average hour to plant capacity, per cent	63½	35	9	29	49½
10	Ratio maximum kw. to plant capacity, per cent	93⅓	85½	78	73	100
11	Fuel used, total lb	4,021,300	1,798,100	698,300	1,659,900	1,123,300
12	Average pounds of fuel per kw.-hr. output	0.689	0.812	0.783	0.800	0.740
13	Average B.t.u. per kw.-hr output	13,230	15,600	15,030	15,360	14,210
14	Cost of lubricants per kw.-hr output, mills	0.35	2.07	1.36	1.28	0.66
15	Maintenance of Diesels per kw.-hr. output, mills	4.45	10.39	9.67	10.15	9.77
16	Maintenance of electric equipment per kw.-hr. output, mills	0.05	0.15	0.54	0.15	0.15
17	Maintenance of auxiliaries per kw.-hr. output, mills	0.01	0.27	0.17	0.40	0.16
18	Maintenance station buildings per kw.-hr. output, mills	0.10	0.00	0.43	0.16	0.24
19	Total maintenance per kw.-hr. output, mills	4.61	10.81	10.81	10.86	10.32
20	Miscellaneous supplies per kw.-hr. output, mills	0.54	1.03	1.18	0.68	0.92

Motor-Driven Oil Well Reduces Monthly Power Cost from $1,800 to $253

ELECTRIC power for rotary drilling of oil wells has recently demonstrated its superiority over steam power as successfully as electric drive replaced steam some time ago in drilling with cable tools. In working up rotary-drive apparatus several trials were necessary to determine the best type of mechanical drive from the motor to the draw works. With a belted motor mounted on concrete foundations, not only did the belt give considerable trouble, but the concrete was shattered by sudden shocks such as were produced by the whipping action of the bit slipping past a boulder. Standard rotary chain was substituted for the belt, but the speed was too high for it. High-speed silent chain working on long centers had too much inertia for quick reversals. The outfit finally selected consists of a slip-ring motor of the induction type, with control, driving the line-shaft of the draw works through a gear and sprocket arrangement that constitutes a double speed reduction (Fig. 1). The rotary table is driven in the usual manner from the draw works, while the slush pumps are driven by a separate motor.

The electrical equipment used on the main drive of rotary rigs is the same as that used for standard cable tool drilling, with the exception that the sliding base and pulley of the motor are omitted. The motor is an adjustable varying-speed type with a wound rotor, the required speed range being obtained by the insertion of resistance in the rotor circuit. It has been found that the most desirable motor to use is one rated at 75 hp., 440 volts, three-phase, with a synchronous speed of 720 r.p.m. on 60 cycles, or 600 r.p.m. on 50 cycles. This horsepower has been found sufficient for all purposes in drilling under the usual conditions. With the type of motor described, gear and sprocket ratios are used that will limit the speed of the rotary table to about 85 r.p.m. It has been proved by experience that the fishtail drilling bit will "make hole" in any kind of formation at this speed and that a 75-hp. motor is powerful enough to carry the load. Furthermore, the slow speeds necessary when using a rock bit of the cone or roller type cause a higher-powered motor to be operated so far down on the load curve that it has been found impossible to control the speed with any degree of accuracy.

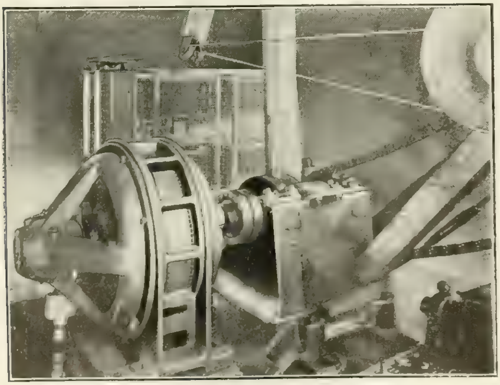


FIG. 1—75-HP. INDUCTION MOTOR WITH REDUCTION GEAR UNIT OPERATING STANDARD ROTARY DRILLING RIG

The main-drive motor is handled by a main and an auxiliary controller, the former having eleven points for coarse speed gradations and the latter thirteen additional ones between any two adjacent points on the main controller, for fine adjustments. The two in combination give a total of 143 points. In rotary drilling with the fishtail bit the auxiliary controller is not employed, but it is necessary with the cone or roller bit in order to get the speed reduction wanted. When finishing the well with cable tools the large number of control points available is enough to obtain the exact speed desired at any time without danger of deadening the movement of the bit or overstraining the rig. The two controllers are placed where the driller can operate them easily by means of rope wheels close to him.

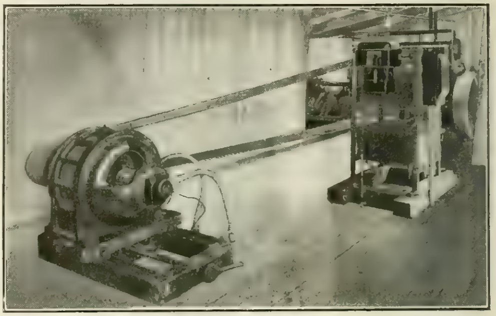


FIG. 2—INDUCTION MOTOR AND CONTROL FOR DRIVING TWO SLUSH PUMPS

As for the mechanical drive of the rig, it consists of the usual draw works, with the line, or main shaft, driven by the motor through a set of cut-steel spur reduction gears, and a sprocket and chain on a short countershaft. The motor pinion is mounted on a short shaft which is connected to that of the motor by a flexible coupling and is carried in heavy bearings. The gear and driving sprocket are keyed to the countershaft, which also has heavy bearings. In addition the countershaft has an extension for a pulley that can be belted to the band wheel if it is necessary to use the outfit for cable tool work. The motor, gear train and countershaft are all mounted on a heavy cast-steel base which keeps them in proper alignment and is strong enough to withstand the severe shocks.

A gear ratio of about twelve to one is used. In order to limit the rotary table to the maximum speed of 85 r.p.m., it is customary to select a countershaft sprocket of suitable size to use with the minimum standard diameter of the line-shaft sprocket on the draw works. This prevents the table from being speeded up by the operator by substituting a smaller line-shaft sprocket.

This type of gear reduction on an electrically driven rig has a comparatively low inertia on the driving end, so that full advantage can be taken of the accurate speed control of the electric motor and of its ability to reverse rapidly. The latter is of particular importance in rotary drilling in case the bit strikes an obstruction, as quick reversing may save a twist-off with all the ensuing difficulties.

The slush pumps used with this type of rig are driven by a separate 50-hp. induction motor, running at 720 r.p.m. on 60 cycles or 750 r.p.m. on 50 cycles. In practice the two pumps are placed with their pulleys adjacent, so that the belt will slip readily from one to the other. The motor is mounted on a sub-base that is adjustable parallel to its shaft, as shown in Fig. 2.

The pump motor has sufficient overload capacity for short periods to develop the power required for pump pressures of 900 lb. to 1,200 lb., which are required for such operations as forcing a plug out of the bottom. Its continuous capacity is ample for the lower pressures required for ordinary drilling operations and for cementing, without its being so underloaded as to sacrifice the accuracy of the speed control.

Regarding the comparative economy of steam and electric drilling, the general statement has already been made that the electric equipment is the most economical. To quote an "isolated case," which is nevertheless typical, a well in southern California was drilled by a standard rotary rig, driven by a 75-hp. induction motor, to a depth of 1,850 ft. in five weeks at a total cost for power and lights of $306.60, or an average cost of $245 per month. The well was finished to 4,300 ft. with standard cable tools, electrically driven, at an average cost of $253 per month, inclusive of lights, for the entire period of drilling operations. It happened that other wells in the vicinity were being drilled with steam, which furnished a fair basis for comparison. The average cost for fuel oil for the engines was $60 per day (40 barrels at $1.50 per barrel), giving an average cost of $1,800 per month, not including the cost of boiler feed water, as compared with considerably less than $300 for electric power. It is evident that the advantage is so greatly in favor of electric power that it would not be materially affected even by any variation in power rates existing in the different oil fields.

W. G. TAYLOR,
Power and Mining Engineering Department.
General Electric Company,
Schenectady, N. Y.

Central-Station Equipment Costs

VARIOUS central-station equipment and installation cost data based on construction and purchasing done within the last two or three years in a number of Eastern properties are presented below. Although prices have decreased somewhat within the past two years in many lines of electrical material, these actual costs from practice are representative and are all based upon carefully recorded work sheets:

MISCELLANEOUS EQUIPMENT COSTS

One CO_2 recorder installed (factory cost $1,163)	$1,339 37
One 40-hp. constant-speed, 1,800-r.p.m., 550-volt, three-phase, 60-cycle induction motor, installed	475 46
Three 3,000-lb. side-dumping industrial coal cars with door control, delivered at plant	1,463 91

TRANSFORMER PRICES

Power Transformers, 2,200 to 575 Volts		Lighting Transformers, 2,200 to 220 Volts	
Seven 15-kw	$1,362	Four 5-kw	$341
Six 25-kw	1,702	Nine 7.5-kw	930
Two 37.5-kw	646	Two 15-kw	330
Three 50-kw	1,206	One 25-kw	328
Three 75-kw	1,487	One 37.5-kw	322
Three 15-kw	494		

Battery Room and Equipment.—The following costs (omitting cents) cover expenses of building a battery room on the foundations of a 600-kw. turbo-generator and the installation of a 60-cell E-7 lead battery for remote-control operation:

Battery room	$1,714	Wiring and installation	209
Battery	1,196	Field engineering	403
Electrolyte, 1,380 lb	37		
Battery control panel	264	Total	$3,935

Construction of Steam Plant Drain.—Installing main drain from station, 16-in. cast-iron pipe, 68 ft. long: Pipe, $98.74; labor, $122.64; liability insurance and miscellaneous, $1.05; total, $222.43.

Disconnection, Etc.—Disconnection and removal from service of one 275-hp. water-tube boiler, superheater and stoker; Labor, $494.14; total, $622.67.

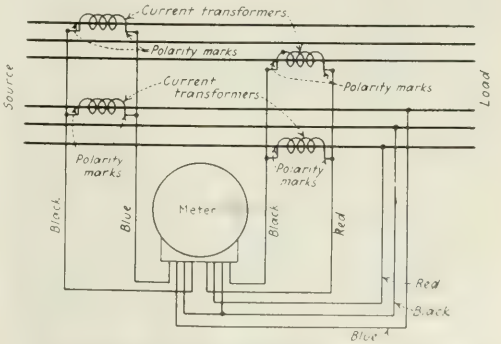
Boston, Mass. FIELD EDITOR ELECTRICAL WORLD.

Paralleling Current Transformer Leads Facilitates Demand Metering

THE adoption of a maximum-demand schedule frequently makes it necessary to consolidate the metering of circuits which otherwise it is much more convenient to meter separately. Such was the case with a large industrial plant in Southern California which was supplied with power from two 60,000-volt lines. The 440-volt secondary circuits were tapped from two buses operated in parallel and fed from one or both of the main banks of transformers. Two meters were used, each with its current transformers connected in the 440-volt side of one of the transformer banks. The change in rate schedule made it desirable to replace these two meters with one which would indicate the combined demand.

The two sets of current transformers were left in place, and the secondaries of corresponding phases were paralleled through the new watt-hour demand meter. As the latter was of the usual 5-amp. rating, it was necessary to replace its series coils with a new set of 10-amp. capacity, thus doubling the meter constant. The diagram herewith shows the connections used.

In series with the primary of each current transformer is a testing link consisting of a bypass shunted around a joint in the busbar. This bypass may be opened up and a "through-type" standard current transformer slipped over the bar. By closing the bypass and opening the joint in the main circuit the standard meters are placed in series for an "over-all" test without interrupting the service. To test the single meter now installed it is necessary to cut in four standard current transformers, using either four single-phase or two polyphase rotating standard meters.



THIS SCHEME PROVED SATISFACTORY IN OBTAINING THE COINCIDENT MAXIMUM DEMAND ON TWO BUSES

Southern California Edison Co.,
Los Angeles, Cal.

H. R. THOMAS,
Meter Department.

Management and Policy

Embracing Central Station Commercial Organization and Management,
Customer and Trade Relationships, Public and Financial Policies, Advertising,
Selling and Service Methods

Broadening the Appeal of the Electric Home

By C. E. Greenwood
Superintendent Appliance Department,
Edison Electric Illuminating Company of Boston

To carry the influence of the electric home continuously into the lives of the people in a territory served by a central station, something more is needed than a short-time exhibition of appliances in a specially prepared house. We should broaden the appeal by making it virtually permanent, constantly interesting and up to date.

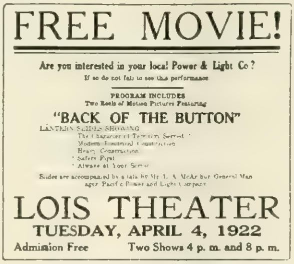
From observation of the effect of many exhibits of appliances upon the general public, I am of the opinion that much would be gained through the establishment of a continuous electric home, underwritten by an organization of, say, a hundred concerns furnishing material and products entering into the modern high-grade house, located on an attractive and accessible site and maintained as a center of semi-social and semi-educational interest. Through a progressive real-estate house, such an organization might well lease a suitable residence and equip it with the latest and best-appointed fittings. It would not seem desirable or necessary to build a house for this purpose in view of the lower cost of leasing. Doubtless real-estate men would quite generally welcome an opportunity to increase interest in a particular neighborhood through the establishment in such a locality of a model home, and appropriations of, say, $100 per year per underwriter would accomplish a good deal in the way of specially directed advertising demonstrations.

If such an electric home, or, rather, model home (which would mean full electric equipment), were on a main thoroughfare traversed by great numbers of motor cars, trolley cars and other vehicles, to say nothing of pedestrians, it might be an excellent plan to maintain a tea room as a part of the establishment, turning the profits into general advertising. Many more visitors would certainly be attracted to the house, and the opportunities to show people about and call attention to its features and fittings would be increased. In some New England tea rooms old houses of the Colonial style have been put to use most attractively, and displays of antique furniture for sale on the premises have found many patrons. So in our model home, always kept up to date by the exhibitors, used by them as a sort of field demonstration station for their products, and provided with as many appliances of electrical nature as good taste and convenience allow, we could tie in the appeal to bodily refreshment with the fascination of more enduring comforts and combine the artistic and the commercial in displays.

In time such a home might easily become a center of interest from the standpoint of dietetics, household economics, interior decoration and so forth. It could be used as a sort of laboratory for demonstrating problems in electric cooking to students, housewives and others, or as a lecture center for a neighborhood. An incidental and valuable public relations result of such a co-operative display would be the closer understanding sure to develop between the central-station representative on the organization slate and the representatives of other industries and trades. Preliminary work on a plan along these general lines in Boston promises success when the time comes to give the scheme a comprehensive try-out.

Pacific Power & Light Builds Good Will with Educational Film

The Pacific Power & Light Company of Portland, Ore., has recently completed a series of moving-picture shows which have been put on with great success. Two performances were given in four cities, The Dalles and Hood River, Ore., and White Salmon and Toppenish, Wash., and 2,810 people attended these eight performances. The show consisted of a series of colored lantern slides showing views of the power company's property and hydro-electric plants. The slides were accompanied by a lecture by Lewis A. McArthur, general manager of the company. In each of the cities Mr. McArthur was introduced by the local manager for the power company. Following the slides and the lecture, the motion picture film "Back of the Button" was shown.



FREE MOVIE!

Are you interested in your local Power & Light Co?
If so do not fail to see this performance

PROGRAM INCLUDES
Two Reels of Motion Pictures Featuring
"BACK OF THE BUTTON"
LANTERN SLIDES SHOWING
The Character of Territory Served
Modern Electrical Construction
Heavy Construction
Safety First
Always at Your Service

LOIS THEATER
TUESDAY, APRIL 4, 1922
Admission Free Two Shows 4 p. m. and 8 p. m.

NEWSPAPER ADVERTISEMENT ANNOUNCING FREE "MOVIE" SHOW

All of the performances were free and each was extensively advertised, not only in the newspapers of each district but also with handbills distributed before the show reached each city. Officials of the company state that the good will accruing has already made itself felt.

Central-Station Company Installs Wireless Aërials for Radio Fans

The Dayton Power & Light Company has adopted a definite policy in dealing with the installation of amateur wireless apparatus by establishing a radio service department. This department will put up the aërial required for service and thus avoid the liability of injury incurred by inexperienced persons attempting to erect wires in dangerous locations.

The company charges for the material used in the service but makes no charge for the labor used in erecting the aerial. It also maintains an office in the company's headquarters to advise people regarding any phase of the radio work. The establishment of a new department of this kind commends itself to the public as it not only stands for safety but assures the public that the utility is always ready to meet its demand.

Frank Kendig, formerly a radio officer in the Sixty-second Field Artillery Brigade, is in charge of the Dayton company's radio service department.

The Opportunity for Electrical Dealers

THE vast field for the sale and installation of better lighting equipment that lies at the very doors of the electrical contractor-dealers is graphically depicted in the accompanying diagrams of typical business blocks in and about New York City. To obtain these statistics showing the existing conditions, surveys were made by the Lighting Sales Bureau of the N. E. L. A. in New York, Brooklyn and various cities in New Jersey to determine how effectively the electrical contractor is selling to the merchants in the immediate vicinity of his store.

These charts show the results of some of these surveys and represent not uncommon examples where prospective business is literally next door or around the corner from the dealer. In many cases it would appear that the "electragist" is sitting at his desk, like Micawber, "waiting for something to turn up." In several instances it will be seen that the dealer himself either does not appreciate the value of or does not know how to obtain proper illumination and thereby sets a bad example to his customers.

Today is a most opportune time to talk better lighting to the store proprietor. Business depression has, of course, hit retail stores, but they are not in a position to close up and wait for better times. Any reasonable plan to increase sales is therefore welcome to the store manager. Here is a field where the central-station company can build up its commercial lighting load and also do a real service for its customers.

What Other Companies Are Doing

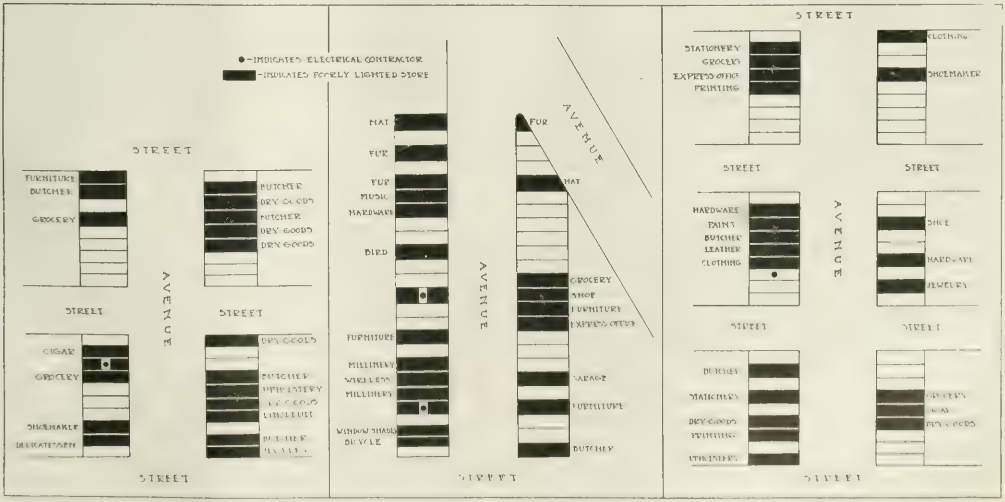
Pawtucket, R. I.—A good example of what the light and power company can do toward educating the public in details of its business is shown in the recent action of E. L. Milliken, assistant manager of the Blackstone Valley Gas & Electric Company, who has contributed gas and electric meters to the laboratories of the Pawtucket high school to be used for instruction and experimental purposes by the physics classes.

Milwaukee, Wis.—The "home electric" which was conducted in this city under the auspices of the Electrical Development Association of Wisconsin was closed on May 21, after being open to the public for twenty-two days. In that time a total of 15,577 persons visited the home and the average daily attendance was 708. Attendance was well sustained throughout the entire period, as 5,070 people visited the home the first week, 4,871 the second week and during the last eight days there were 5,636 visitors. Sundays proved to be the heaviest days, the attendance being two to three times that of the daily average.

Mattoon, Ill.—The Central Illinois Public Service Company sold this week 151 irons, eleven vacuum cleaners, fifteen washing machines, seven electric ranges, two lighting fixtures, one motor, one gas range and miscellaneous other merchandise for a total of $6,074.37.

Grand Island, Neb.—Appliances sold by the Central Power Company during the second week in May were six irons, two curling irons, one electric hotplate, two ceiling fans, one desk fan, three vacuum sweepers, one electric range, one percolator, one washing machine, one mangle, one tank heater, one gas range, one 7½-hp. motor and one 2-hp. motor. Five wiring contracts were secured. Merchandise sales for the week totaled $2,772.

Illinois.—During one week in May 538 new electric customers were connected to the lines of the subsidiary companies of the Middle West Utilities Company. The additional load connected amounted to 343 kw. for light and 336 kw. for power. New power contracts closed but not yet connected total 357 kw.



DIAGRAMS OF BUSINESS SECTIONS IN NEW YORK, BROOKLYN AND NEWARK, N. J., TYPICAL EXAMPLES OF OPPORTUNITIES WHICH SURROUND EVERY CONTRACTOR FOR BUSINESS IN BETTER STORE LIGHTING

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

The Only Way to Sell Appliances

By R. J. Strittmatter
Sales Manager Apex Electrical Distributing Company

DOWN at the bottom of the whole problem of appliance selling lies a fact that in the general discussion is often overlooked. It is this—that with the finest store location on Main Street, the best window display and the best possible advertising campaign, you cannot sell the larger appliances in sufficient volume out of a store to pay a profit on the cost of getting the customer into the store. On the other hand, one commission salesman properly organized and directed, working from house to house, demonstrating and creating demand, will bring in more actual business than all other influences combined, and at less expense because he is paid only for sales. But 95 per cent of the electrical dealers in the country are not in a position to obtain and operate retail salesmen. The dealer himself has never sold appliances from house to house and does not know what the commission man is up against.

R. J. STRITTMATTER

Moreover, the dealer, operating as he does in a small way, has nothing to hold out to the retail salesman in the way of promotion and future opportunity. But the young man entering the selling profession today is looking for opportunity ahead of his immediate remuneration. A man who does not enter with this thought in mind is not a man who will develop any big success.

In the matter of financing, too, the general run of contractor-dealer is not a business man. He knows little of merchandising principles and on top of this has not the finances necessary to do a big volume of business. Yet the dealer must have a good financial responsibility in order to carry on this business.

Our experience is that 80 per cent of the major appliance business is purchased on a time-payment basis. The dealer who sells for cash only, therefore, is securing only 20 per cent of the possible business. He cannot get a commission salesman to work for him on this basis, since he would starve to death, and he cannot get enough orders out of his territory to satisfy an aggressive manufacturer who is pushing for business. It is true that there are time-payment plans offered to the dealer for financing his retail paper, but these plans are only available to the dealer who has sufficient financial responsibility to pass the scrutinizing eye of these financing companies.

So we come to the jobber to see what he can do. The answer, as we see it, and as we have definitely proved to the satisfaction of many of our jobbers, is retail operation of house-to-house men working for the jobber and operating throughout the entire territory that he controls, co-operating with the dealers in that territory. The jobber must absolutely divorce his major appliance business — cleaners, washers, and ironers — from his supply business, and set this up on an independent footing, just as a distributor would who was organized merely to secure appliance business and had no other interest at stake.

Best Possible Co-operation

Our plan is for the jobber to set up such an independent department with a man at the head who absolutely knows the house-to-house selling profession, having himself grown up in this business from a retail salesman. This man then employs commission salesmen, educates them in the mechanical points of our appliances and sends them out into the territory to sell at retail in the various cities, selling on the jobber's paper. The jobber carries the account and finances this business, and the dealer secures a percentage on this business for the use of his store, his name and his good will.

Under this plan when the jobber goes out and sells at retail he does not eliminate the dealer. He gives the dealer the finest sort of co-operation he could possibly afford. He goes into the store of a dealer who has not been doing any business whatever in appliances, engages trained salesmen to operate out of the dealer's store and canvass every home in the city, acquainting the housewife with the fact that the John Jones Electric Company is the livest electrical dealer in the city and incidentally endeavoring to get a demonstration on the particular product that he is selling. He brings in a volume of business that is very profitable to the dealer, being on a percentage basis only with no expense attached to it.

This means that the jobber builds up a big organization of retail salesmen that are in his employ and not in the dealer's employ. They can be moved about from town to town as circumstances warrant in order to keep the men satisfied to go out and build up a volume of business for the distributor and manufacturer at a profit to dealers who previously were making no profit out of the appliance business.

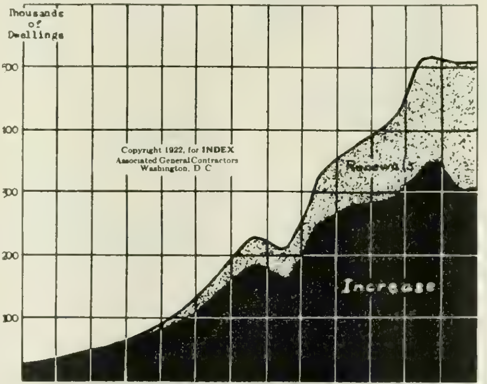
The jobber is able to hold these men because he does a large volume of business and can apply methods of organization and education and provide an opportunity impossible in the case of the dealer. It entails, of course, a big stock of consigned appliances spread over the territory for the salesmen to work with, but this combination provides a volume of business that enables the jobber to succeed in a big way.

Overhead as a Test of Management

By H. F. Stratton*

A LABORER can do about one-third of a kilowatt-hour of work per day; his mechanical output is worth one to two cents per day measured by current prices charged for electric power. It is quite evident that intelligence is the only human quality worth employment. Industry must inevitably develop toward the use of power for work and the use of persons for direction. This spells the concurrent decrease of direct or productive labor and increase of supervisory labor or overhead. Broadly stated, the manufacturer spends at least one-fourth of his entire revenue for overhead; profit, material and productive labor make up the balance.

Society, then, in developing from the state of peasant labor to the state of machine production, has reached a condition of spending about one-tenth of the entire national income for overhead. To a startling and unsuspected degree the test of management is now the management of overhead.



Normal Demand for New Buildings

AFTER all, the demand for new buildings is dependent upon the natural influences of increase in population plus the requirements for replacement of demolished structures. This diagram shows what this amounts to in the United States.

In manufacturing, overhead may roughly be defined as the sum of all expenditures not chargeable to assets, material or productive labor. It is, however, illuminating to reflect that one portion of overhead is definitely and proportionately associated with production, is absolutely needed for production, and will fluctuate at nearly the same rate as production. It is in reality almost a production expense. Illustrations are boxing, painting, testing, inspecting, freight and express, power, tool breakage, trucking. There are many others, but these are sufficient to bring out the point. They present no particular problem. They are not fixed expenses. A second type of overhead is represented by such items as insurance, bond interest and taxes on real estate. These belong more in the domain of finance than manufacturing. They are true fixed charges.

To make a superior product and convince the public of its superiority costs a lot of money. The position of ~~admitted~~ superiority moves from one competitor to another. Constant changes in product and price ensue. They are expensive in the factory and expensive to sell. Because of these expenses and because of competition, the pressure is strong and constant to reduce material and productive labor. Now material and productive labor is the very article itself. It is all that is left to the user after the sale is made. He has no equity in the sums spent for advertising and selling. These expenses were largely competitive, partly masquerading under the name of service. Competition has undoubtedly tremendously advanced the art and has reduced the cost of material and productive labor, but it has probably increased the cost to the consumer. Manufacturing has approached, if it has not already reached, the condition where the cost of competition exceeds the economy of competition.

The Normal Overhead Burden

As a result of these conditions, emphasized by the depression of 1921, accountants have discussed and some have approved the use of a so-called "normal overhead burden."

There are different formulas for its determination, although all appear to have the same philosophical picture of the conditions.

Normal production does not mean possible production. In many cases it does not even mean possible production less proper allowances for repairs and other ordinary hindrances to continuous operation.

Lacking scientific methods for determining the possible output from which to deduct allowances for all possible interruptions, the average business can at least establish its normal as the average of a certain number of years which the management considers representative of its business. If the several years preceding the war brought a volume of business to your plant that kept it as busy as you could ordinarily expect it to be, and there had been no material changes in the plant or methods, there appears to be no good reason why an average of these years should not be used to obtain the basis of a "normal" output. If a corporation in calculating overhead adopt a normal overhead based on some average degree of business activity, it will have a surplus or over-absorbed burden during prosperous years and a deficit or under-absorbed burden during depressions. If the present were an era of marked prosperity, it could conservatively be urged that the over-absorbed burden be transferred to a reserve account to meet the deficit later to be caused by an under-absorbed burden in the next depression. This not being such an era, accountants unanimously feel that any under-absorbed burden should not be carried as an asset, but should be carried to profit and loss at the end of the year.

In short, the overhead burden has now become the most elusive and probably the most expensive factor in manufacturing.

Its distribution in alternate good and bad years is arbitrary and does not square with the fundamental facts.

Therefore, it will be retrogressive and harmful if the manufacturers become vendors of competitive overhead expense at the sacrifice of inherent merit in their product.

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*Chairman cost accounting committee. Abstract of a report presented before the Electric Power Club at its Hot Springs (Va.) meeting, June 5-9, 1922. Embraced in the expanded report were quotations from the *American Machinist* and a bulletin of the Chamber of Commerce of the United States discussing this subject.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

The Design of Fractional-Horsepower Motors.—W. J. John.—Various motor designs are treated theoretically, the article dealing with commutator losses, length of air gap, magnetic circuits and design of field coils and concluding with the complete design of a ⅛-hp. shunt motor.—*Beama,* March, 1922.

Regulating Voltages on a Three-Wire Direct-Current System.—R. D. Archibald.—A method is described for regulating and equalizing the voltages on the two sides of a three-wire direct-current system by static balancers. The merits of this balancer are compared with those of rotary balancers, the chief disadvantage of the former being that the voltage on the two sides of the three-wire system cannot be regulated without the aid of a mid-wire booster. In the static balancer system this disadvantage can be overcome by the use of taps other than the central point of the winding of the balancer.—*Journal of (British) Institution of Electrical Engineers,* March, 1922.

Static Condensers for Power-Factor Improvement.—M. Misserey.—The author describes the benefits derived from the extensive use of static condensers in several industrial plants in France. It is claimed to be more advantageous with small and medium-size motors to use a small condenser directly at the terminals of each motor than one large battery of condensers at the high-voltage side of the supply transformer. A short theoretical explanation is given of the possibility of over-voltage. Several charts are shown, indicating the conditions of different plants before and after the introduction of condensers.—*Revue Générale de l'Electricité,* April 8, 1922.

Lamps and Lighting

The Use of Light as an Aid to Aërial Navigation.—L. F. Blandy.—The high speed attainable by aërial traffic may be lessened or even neutralized if the aircraft has to lie idle at night. Consequently the use of artificial light in connection with aërial navigation is a very important problem—one on whose solution the future of the craft largely depends. The paper treats of the use of light on airships and in aërodromes and of the construction of aërial lighthouses. In view of the high speed at which airships now travel the lights attached to them need very careful design. The problem of sufficient intensity with absence of glare is not easy to meet. The lighting of the quarters for passengers and crew on board aircraft is also a vital matter. Aërodrome lighting presents a variety of aspects, including the use of light to indicate the presence of obstructions and the lighting of the actual ground of the aërodrome. One of the most interesting sections of the paper is that dealing with aërial lighthouses and local pilotage lights. The former indicate the route to distant travelers, while the latter act as a guide to aviators approching their destination. Both classes of lighting have been studied with great care, and the collected data indicate that considerable progress has been made.—*Illuminating Engineering (London),* Vol. 15, No. 2.

Traction

Suppression of the Inverse Current in Mercury Rectifiers.—C. Jotte.—The frequently occurring short circuits between the two anodes of mercury rectifiers threatened for a long time to limit their use to a maximum of 500 volts direct current. A process is being used by one company for preventing short circuits by employing an external direct-current magnetic flux, entering through the vessel at the mercury cathode, which causes a constant rotation of the arc and thus prevents overheating of the electrode. Another company builds its vessels so as to form separating walls around the cathode and conical screens inclosing the anodes. As gases favor the establishment of a short circuit between the anodes, the author suggests building the vessel so that it will taper toward the top and making the connection between the vessel and a vacuum pump at the apex of this conical vessel, so that all foreign gases will accumulate at a point where they can be readily removed by the pump. In addition, a water-cooling chamber is used around the upper part of the vessel and a metallic cylinder surrounds the cathode spot. Results with such a rectifier were very satisfactory.—*Revue Générale de l'Electricité,* March 4, 1922.

Installations, Systems and Appliances

A New Electric Furnace for the Manufacture of Steel.—Alfredi Stromboli.—One-sixth of the steel-making industry in Italy is dependent on electric furnaces, and their product has grown from 20,000 tons in 1915 to more than 130,000 tons in 1921. With a new Fiat furnace which has given excellent results the electrode consumption, reckoning from the cold charge, has been reduced to 3 kg. per ton of steel and the consumption of energy to less than 650 kw.-hr. per ton. Simultaneously a saving in labor and in refractory materials has been effected. In a furnace rated at 5 tons or 6 tons, in service five years, the total time necessary for fusion has been reduced to two hours. These results have been obtained principally by means of the Fiat economizer, which permits the hermetic sealing of the roof of the furnace and hence prevents the escape of gases. Nine charges can be made by hand in twenty-four hours in a 6-ton furnace so equipped. Energy is fed to the furnace three-phase, the hearth acting as a conductor. The connections of the transformer secondary are made in star, each of the three points corresponding to an electrode. From the center of the star connection is made with the hearth and with earth. A copper plate increases the conductivity of the hearth. Numerous installations of this system have been made in Italy, especially notable among them being one at Turin which contains six furnaces rated at 20 tons. This plant is able under normal conditions to produce 1,000 tons of metal a month, the pieces varying in weight from 1 kg. to 30 tons. Almost all the product is reheated at 900 deg. C., there being four furnaces used for this purpose, each capable of reheating 20 tons of castings.—*Le Génie Civil*, April 15, 1922.

The Electric Furnace in the Iron Foundry.—L. C. Judson and H. P. Martin.—A bibliography of practically all the articles appearing on this subject during the past five years. The list is confined to articles concerning the production of iron for the foundry, and all articles relating to the separate field of iron smelting have been excluded.—*Paper presented before American Electrochemical Society at Baltimore,* April 27, 1922.

Electrophysics and Magnetism

X-Ray Studies on the Crystal Structure of Steel.—Arne Westgren and Gosta Phragmen.—Elaborate investigations for determining the crystalline structure of iron and steel have been carried out by the authors under improved experimental conditions, with which they obtained photograms clear enough for reproduction. The results are given with several tables and photographs. The X-rays were produced in a tube of the Siegbahn type with the anti-cathode cut off perpendicularly to its axis and an iron plate soldered to it. Around this anti-cathode five windows were made, which gave beams for making five exposures simultaneously. Through a regulating arrangement the pressure in the X-ray tubes could easily be kept constant at any state and the tube operated at any voltage desired. It was usually charged with 45,000 volts to 50,000 volts and run with 10 milliamperes to 12 milliamperes.—*Engineering,* May 19, 1922.

Electrochemistry and Batteries

Manufacture of Pig Iron Electrically from Iron Ore.—R. C. Gosbrow.—A comparison is made between shaft and open-top furnaces used in this industry. The electric smelting of iron ore brings into consideration certain features of furnace design which are particularly applicable to this art. The author describes the development of the various types of furnaces, concluding with production cost data.—*Paper presented before American Electrochemical Society at Baltimore,* April 27, 1922.

Electrochemical Plant at Lannemezan.—I. Waternaux.—For the production of calcium carbide, cyanamide and nitric acid for war purposes, a large electrochemical plant was erected by the French War Department at Lannemezan at the beginning of the war. A combined daily output of 200 tons was provided for. The plant buys all its power from a number of generating stations, which feed into a 63,000-volt, three-phase trunk line. In three substations within the chemical establishment a total transformer capacity of 130,000 kva. is installed and is in operation. A double transformation is used, the first step being from the trunk-line voltage to 12,500 volts, and the second step, in the furnace transformers, to 100 volts. All transformers use single-phase water-cooled units of from 2,500-kva. to 6,700-kva. rating. The entire electrical switching transforming and distributing system is installed within buildings and is remotely controlled from a centralized bench-type switchboard. A permanently installed transformer-drying and oil-filtering apparatus helps materially to prevent failures of the transformers and oil switches. Detailed transformer data are given. —*Revue Générale de l'Electricité,* April 22, 1922.

Units, Measurements and Instruments

The Effect of High Currents on Disconnecting Switches.—H. C. Louis and C. T. Sinclair.—A number of tests have been made by the authors on disconnecting switches with the object of studying the effects of high currents on this class of apparatus. The principal points observed were (a) the lowest value of current at which a switch blows open, (b) time required for the switch to open, and (c) cause of the failure of the lock on the switch, if one is provided, and the remedy. Switches of different manufacture and of various designs were tested. The investigations clearly demonstrate that some form of lock should be provided. It was noted from a study of the oscillograms that a switch seldom required more than one cycle to open, one-half cycle usually being enough.—*Journal of the A. I. E. E.,* April, 1922.

Researches on Impulse Voltage.—S. Bekku and O. Tanno.—The authors carried out a series of experiments on the needle and sphere-gap discharges. Studies were also made on insulation breakdown of several fibrous insulating materials where there was induced impulse voltage in the secondary caused by sudden connection of the primary of a transformer to a direct-current source.—*Journal of Institute of Electrical Engineers of Japan,* April, 1922.

Telegraphy, Telephony and Signals

Proposed Revision of National Electrical Code Rules on Radio Equipment.—The proposed changes refer to the antenna, lead-in wires, protective device, protective ground wire, wires inside buildings, and receiving-equipment ground wire for receiving stations. The changes for transmitting stations apply to the antenna, lead-in wires, protective grounding switch and ground wire, operating ground wire and protection from surges. Receiving lead-in wires are to be of copper or approved copper-clad steel and shall in no case be smaller than No. 14 B. & S. gage, except that approved copper-clad steel not less than No. 17 B. & S. gage may be used. While the use of an antenna grounding switch is desirable a 500-volt lightning arrester is satisfactory. The size of protective ground wire is the same as stated under lead-in wire.—*Letter Circular No. 62, Bureau of Standards, Washington, D. C.*

Definition of the Output of a Vacuum Tube.—G. Beauvais.—The author mentions the great variance in the customary ratings of vacuum tubes. An example will illustrate his point. Assuming a tube with a plate output of 250 watts, this means that 250 watts is transformed into heat on its plate. To this can be added 30 watts to 50 watts absorbed in the filament to give a total heat output of 280 watts to 300 watts. This tube may be used on a set with 600 watts additional output, so that 300 watts may flow directly to the antenna at constantly depressed key. In telegraph service this tube may easily carry double this energy. It is therefore possible to call this particular tube a 250-watt, a 600-watt or even a 1,200-watt bulb. The author suggests standardizing the tube ratings by calling the above bulb a 250-watt plate and 40-watt filament-output tube.—*Radioélectricité,* March, 1922.

Miscellaneous

The Theory of Water Hammer.—Carlo Fossa Mancini.—A mathematical treatment, with tables and diagrams, outlining a method of calculating the maximum force of water hammer in a given installation.—*L'Elettrotecnica,* April 15, 1922.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by **PROF. VLADIMIR KARAPETOFF**
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ALTERNATORS, HIGH-SPEED, WINDAGE AND LOAD LOSSES IN.

Research work is being done by a radically different method of heat removal from that used at present, in order to eliminate a large part of the windage losses. At the same time we are making a more determined effort than ever before to discover the exact location of the losses that constitute load losses and to find out, if possible, how to build machines so as greatly to reduce these losses. It has been generally supposed that load losses are almost entirely located in the windings and are due to eddy currents in the conductors. Such is not the case, and we hope by certain investigations that we have undertaken to learn exactly where these losses occur.—*W. J. Foster, Schenectady, N. Y.*

RHEOSTAT, INCREASING THE CARRYING CAPACITY OF.

In a rheostat used for controlling a current it often happens that only a small part of the resistance is in the circuit when the current is the largest. A scheme has been devised whereby both ends of a rheostat can be used in parallel with larger current, thus doubling its carrying capacity and making regulation easier and more accurate.—*W. E. Forsythe, Nela Research Laboratories, Cleveland, Ohio.*

TRANSFORMERS, HOT-SPOT INDICATORS FOR.

A current transformer is mounted inside the case of the power transformer. The primary is connected to one of the main windings, and the secondary is closed through a heating coil. This coil is so proportioned and insulated that its temperature above the oil in which it is immersed is the same as that of the main coils. The temperature is measured by a thermometer of the thermocouple or Wheatstone-bridge type. A 10 deg. C. hot-spot allowance, required by the A. I. E. E. Standards, may be made on the thermometer dial.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

INDUCTION GENERATORS, SHORT-CIRCUIT CONDITIONS IN.

An investigation is being made and oscillograms are being taken of the transients obtained upon short-circuiting a three-phase induction generator. There seems to have been some question as to what actually occurs under these conditions, and the work has for its object the clearing up of the doubtful points and of the mathematical solution of the problem, including as far as possible all details of the machine construction which might affect the results.—*Massachusetts Institute of Technology, Cambridge, Mass.*

ELEVATOR MOTORS.

The elevator motor manufacturers report considerable development. One manufacturer mentions a pole-changing motor with a speed ratio of eight to one which is being developed for commercial installation. Other manufacturers report modification of direct-current elevators, such as conversion to multi-voltage direct current or available direct-current voltage, in order to accomplish speed changes economically on direct-current elevator equipment. With the exception of multi-voltage direct current, these methods are as satisfactory for alternating current as for direct-current supply.—*Electrical Apparatus Committee of the N. E. L. A.*

CORONA DISCHARGE, PRESSURE INCREASE DUE TO.

Large ions, electrified aggregations of gas molecules, are formed by the corona which is produced by excessively high potentials on power-transmission lines. These ions, driven away from a conductor by the electrical field, produce an appreciable wind when the conductor is in the open air, and when it is inclosed in a cylinder there is a measurable rise of gas pressure. This pressure, not due to the temperature rise on account of the heating of the wire by the current, amounted in some tests to 3 cm. of water. Theoretical computations were made with the results of measurements obtained using direct current only, but there is qualitative confirmation with the use of alternating current, showing that the pressure rise is due to exceedingly large ions having small mobility.—*Jacob Kunz, University of Illinois, Urbana, Ill.*

IRON LOSSES, DETERMINATION OF, ON SMALL SAMPLES.

The standard apparatus (Epstein) for the determination of core loss of a sample of steel laminations, by the wattmeter method, requires 10 kg. of iron. There are special cases of expensive or rare steels when such a large quantity cannot be had. A method has been recently proposed (*Elettrotecnica*. Vol. 8, 1921, page 519) which requires only 350 grams of sheet steel, and with which the losses in the unknown sample are determined by comparison with a known sample. A further study and adaptation of this method to industrial conditions is desired.

INDUCTANCE COILS, CAPACITY EFFECTS OF.

On account of the importance in radio communication of capacity effects in inductance coils, careful studies of these effects, both theoretical and experimental, have been made at the bureau. An interesting result is as follows: Let two condensers in series be connected across the terminals of an inductance coil and let the common terminal of the two condensers be grounded. If the inductance coil possesses capacity to ground, the familiar criterion for resonance in the system, computed from the known value of the capacities of the two condensers, will not apply. These and other results will be found in Scientific Paper No. 427 of the Bureau of Standards, Washington, D. C.

WIND PRESSURE ON OVERHEAD LINES.

The pressure of the wind upon cylindrical conductors, when blowing at an angle to the line other than 0 deg. or 90 deg., is being investigated. This research is being carried out in a wind tunnel where wind velocities can be controlled and measured. —*H. L. Dryden, Bureau of Standards, Washington, D. C.*

REFLECTION FACTOR OF MAGNESIUM CARBONATE.

Careful tests indicate that the reflection factor of magnesium carbonate in blocks, such as are frequently used in photometry, is as high as 98.7 per cent, corroborating some recent determinations by others. The value for magnesium carbonate has until recently been assumed to be 88 per cent. All blocks of magnesium carbonate, as ordinarily purchasable, have not so high a reflection factor. They may vary by several per cent.—*Enoch Karrer, Bureau of Standards, Washington, D. C.*

CONDUCTIVITY DETERMINATIONS, BY A VISUAL METHOD.

The balance point of an alternating-current bridge is indicated by a direct-current galvanometer in an audion circuit. The method is independent of the frequency impressed on the bridge, thus extending the usable frequencies above the present upper limit of 3,000 cycles per second. When an electrolytic cell was used as one arm of the bridge no difficulty was experienced in balancing with frequencies up to 15,000 cycles per second. The frequency applied to the bridge is not limited by the characteristics of the human ear. The strain on the observer incidental to all telephone methods is eliminated. Readings could be repeated to one part in 50,000 with a galvanometer of only 1 megohm sensibility.—*F. M. Kannenstine and E. E. Rosaire, University of Chicago.*

Apparatus Available

HIGH-TENSION LABORATORY.

A 1,000,000-volt laboratory has been recently completed which consists of a building specially designed for the purpose with adjacent yardage for outdoor tests. The equipment consists of a 1,000,000-volt transformer with all the necessary equipment for control of voltage and equipment for testing transformers, switches, line insulators, model structures, materials, etc. The testing transformer is rated at 1,000 kva. from one terminal to ground, although it will give much more than this for a short period of time. The laboratory is on the lines of the Duquesne Power Company sufficiently near the new Colfax Station to permit power testing to any desired amount. —*Westinghouse Electric & Manufacturing Company.*

Suggestions for Research

ANTENNA, MULTIPLE.

In an antenna consisting of several conductors the individual capacitance, and consequently the charging currents, of the various wires are different from each other. The corona loss may also be quite different. It is desired to devise an arrangement of the wires with which the charging current per wire will be as nearly as possible the same for all the conductors.

OVERHEAD LINES, RULES FOR CONSTRUCTION OF.

There is great need of data with reference to lines which have failed and those which have not failed in severe weather. Several states have already adopted rules for overhead-line construction, while others contemplate such action soon. The requirements of the National Electrical Safety Code are those generally adhered to.—*Bureau of Standards, Washington, D. C.*

TURBO-ALTERNATORS, STRAY LOSSES IN.

High-speed machines show a relatively high stray loss on test, sometimes running as high as four or five times the stator copper loss. Some of it is, of course, represented by eddy-current loss in the stator conductors, but this is a relatively small part of the total. A considerable part is in the frame and end bells. There is room for investigation as to the location of these losses and the best means to be taken to reduce them.—*R. B. Williamson, Milwaukee, Wis.*

INDUCTION MOTOR, SEPARATION OF PRIMARY FROM SECONDARY LEAKAGE INDUCTANCE.

In the exact equivalent performance circuit of the induction motor the exciting admittance is placed between the primary and the secondary leakage impedance. Therefore it is necessary to be able to separate experimentally the primary from the secondary leakage reactance. The same is true when an exact circle diagram is used, the so-called Ossonna circle. A short-circuit test and an open-circuit test alone are not sufficient to separate the two reactances, and it is desired to develop an additional simple test for this purpose.

ALLOYS, TEMPERATURE COEFFICIENT OF.

We can make alloys with virtually a zero temperature coefficient, but the reasons for this have not been made clear. If we knew more about this subject, it would probably be possible to use cheaper materials for many applications, such as the ordinary cast-iron resistor grid, of which millions are used every year. This is an entirely unsatisfactory article from a mechanical standpoint and would be replaced by something else of a stronger nature if a cheaper material were available. —*Wilfred Sykes, Steel & Tube Company of America, Chicago.*

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Supreme Court Defines Congressional Powers in Regulating Coal Mining

IN THE unanimous opinion of the United States Supreme Court, delivered by Chief Justice Taft last week, that labor unions may be sued in federal courts for violation of laws, the court took occasion to define the extent to which Congress may legislate in the matter of coal mining. The court said on this point:

"Coal mining is not interstate commerce, and the power of Congress does not extend to its regulation as such. The mining of coal is not interstate commerce, nor does the fact that it is to be afterward shipped or used in interstate commerce make its production a part thereof. Obstruction to coal mining is not a direct obstruction to interstate commerce in coal, although it, of course, may affect it by reducing the amount of coal to be carried in that commerce. If Congress deems certain recurring practices, though not really part of interstate commerce, likely to obstruct, restrain or burden it, it has the power to subject them to national supervision and restraint. It has the power to punish conspiracies in which such practices are part of the plan to hinder, restrain or monopolize interstate commerce. The intent to injure, obstruct or restrain interstate commerce must appear as an obvious consequence of what is to be done or be shown by direct evidence or other circumstances."

Radio Bill Introduced in House

A BILL to regulate radio operation has been introduced in the House of Representatives by Representative White of Maine. This bill, which is indorsed in its substance by the recent radio conference called by Secretary Hoover at the instance of the President, leaves the act to regulate radio communication approved Aug. 13, 1912, as the basic law upon this subject, amending it only so far as is deemed necessary to carry out the recommendations of the conference designed to meet the situation caused by the enormous expansion of the wireless art. The bill grants enlarged powers of regulation, clarifies ambiguities in the present law and adds a number of sections of minor consequence.

It asserts federal control over radio communication between the states and with foreign countries and requires that no such communication shall be carried on without a license from the Secretary of Commerce. It establishes twenty different classes of transmitting stations with appropriate wave allocations to each and specifies the nature of the service to which each class of station shall be limited. This classification does not, however, exclude the establishment of still other classes of stations. Undue interference by the military and naval stations of the government with private senders is provided against. The Secretary is authorized to refuse a license to any person or corporation seeking, in his judgment, to monopolize radio communication. Licenses are to be for ten years or less, with privilege of renewal, but there shall be no vested property in them or in the wave lengths authorized. A 200-meter wave length is set aside for amateur operators.

Public Service Commissioners of Oregon Recalled

FRED A. WILLIAMS and Fred G. Buchtel, two of the three Public Service Commissioners of the State of Oregon, were recalled by a majority of about three to two at a special recall election held May 19. T. M. Kerrigan and Newton McCoy of Portland were the successful recall candidates against Messrs. Williams and Buchtel.

The recall was invoked against these commissioners because of dissatisfaction arising out of a decision handed down by the commission granting substantial increases in telephone rates throughout the state to the Pacific Telephone & Telegraph Company. It is reported that the new commissioners have declared their intention to reduce telephone, gas and street-car rates immediately. If drastic action is taken along these lines, it is almost certain that an appeal to the Supreme Court of the state will follow. A peculiar phase of the election was that although Buchtel was recalled by a substantial majority, Williams was defeated by a small plurality only, indicating that the voters did not thoroughly understand what they were voting on. Oregon is one of the few states in the Union which have a recall law, and this is the first time the recall has been invoked against a public official.

California State Ownership Amendment Condemned by Bankers

A RESOLUTION was passed by the board of governors of the Investment Bankers of America at a recent meeting strongly condemning the project for state ownership of water powers which is to be submitted to the voters of California next fall. After reciting the provisions of the proposed act, the resolution declared that the board of governors "looks with consternation upon the proposed amendment as threatening, not only the destruction of the credit of existing privately owned hydro-electric, power and light utilities built up within the State of California by the combined capital of a multitude of investors residing throughout the United States who have been induced by the wise laws and sane regulation heretofore existing to intrust their savings to the development of California's natural resources, but even the destruction of the credit of the State of California itself."

Illuminating Engineering Society Elects Ward Harrison President

FROM the general offices of the Illuminating Engineering Society comes the information that the following will be the officers of the organization for the fiscal year beginning Oct. 1, 1922:

President—Ward Harrison.

Junior past-presidents—George H. Harries and George S. Crampton.

Vice-presidents—F. M. Feiker, William J. Drisko, Otto L. Johnson and G. Bertram Regar.

General secretary—Samuel G. Hibben.

Treasurer—Louis B. Marks.

Directors—F. C. Caldwell, A. D. Curtis, P. S. Millar, Adolph Hertz, Walton Forstall, Frank S. Price, F. R. Barnitz, Clarence L. Law and A. L. Powell.

Section chairmen—New York, A. L. Powell; New England, Roy R. Burnham; Philadelphia, Howard Lyon; Chicago, A. L. Anenberg.

Section secretaries—New York, James E. Buckley; New England, C. A. Strong; Philadelphia, H. Calvert; Chicago, F. A. Rogers.

The president of the society, the last three vice-presidents named, the general secretary, the last three directors and all the section chairmen and secretaries except Mr. Calvert are newly elected.

R. J. Russell Elected President of Electric Power Club

AT THE final session of the Electric Power Club's meeting at Hot Springs, Va., last week A. H. Timmerman of the Wagner Electric Manufacturing Company of St. Louis was elected to the board of governors of the club, succeeding A. L. Doremus of the Crocker-Wheeler Company. James Burke, E. R. Harding and H. F. Stratton were re-elected to the board. The terms of the other members of last year's board will not expire until 1923 and 1924. The board at its meeting re-elected R. J. Russell of the Century Electric Company, St. Louis, as president, J. K. Bass as treasurer, C. H. Roth as secretary and S. N. Clarkson as executive secretary, and elected T. E. Barnum of the Cutler-Hammer Manufacturing Company as vice-president.

The Power Club passed a resolution favoring the "American valuation" plan as a basis of assessing duty on imports. The board decided to hold the fall meeting at Asheville, N. C., and set a tentaive date late in October or early in November.

New York State Committee on Public Utility Information Formed

ANNOUNCEMENT is made by M. S. Sloan, president of the Brooklyn Edison Company, that the New York State Committee on Public Utility Information has been formed by the electric and gas companies of the state and has opened offices in the Grand Central Terminal, New York City. Mr. Sloan is its chairman; H. L. Mann, treasurer of the Buffalo General Electric Company, its vice-chairman; W. J. Welsh, president of the New York & Richmond Gas Company, its treasurer, and C. H. B. Chapin, secretary of the Empire State Gas and Electric Association, its secretary. The director of the committee will be Frederick W. Crone, who was for many years a news and editorial writer on the New York *Tribune* and who has had experience in publicity work. The organization of this committee raises the number of states having such bodies to twenty-five, or fifteen more than a year ago.

"It is the purpose of this committee," says Mr. Sloan, "to foster and increase existing good will between gas and electric companies and their customers. If, as may be in some instances, good will does not now exist, it is the purpose of this committee to endeavor to create it. The plan is to obtain the widest possible publicity for all facts concerning the gas and electric industries, both through newspapers and pamphlets and through speakers at meetings. We shall soon begin publication of a weekly bulletin for distribution to newspapers, commercial and civic clubs, company executives, and other individuals and institutions capable of being interested."

Electric Power Club Preferred Standards of Transformer Ratings

AS MENTIONED in these columns last week, the Electric Power Club at its meeting in Hot Springs, Va., approved the recommendations of the Transformer Section that certain of the standard transformer ratings be called "preferred standards" and that these preferred standards be adopted as "recommended practice to take effect Jan. 1, 1923."

The accompanying tables show the present standards of single-phase distribution transformers and single-phase power transformers, and those marked with an asterisk in these tables are the preferred standards.

TABLE I—PREFERRED STANDARDS, SINGLE-PHASE DISTRIBUTION TRANSFORMERS

[The Preferred Standards—both voltages and kva. sizes—are designated by an asterisk (*).]

	Standard Circuit Voltages								
	440*	550	2,300*	4,600	6,600*	11,000	13,200*	22,000	33,000*
Standard Kva. Sizes in Each Voltage Class	1½	1½	1½	1½	1½				
						2½	2½		
	3*	3*	3*	3*	3*				
	5*	5*	5*	5*	5*	5*	5*	5	
	7½	7½	7½	7½	7½				
	10*	10*	10*	10*	10*	10*	10*	10	10
	15*	15*	15*	15*	15*	15*	15*	15*	15
	25*	25*	25*	25*	25*	25*	25*	25*	25*
	37½	37½	37½*	37½	37½*	37½	37½	37½	37½
	50*	50*	50*	50*	50*	50*	50*	50*	50*
	75	75	75*	75	75	75	75	75	75
	100*	100*	100*	100*	100*	100*	100*	100*	100*
			150*	150	150	150	150	150	150
			200*	200*	200*	200*	200*	200*	200*

Note.—In selecting standard transformer voltage ratings for operating from standard circuits, refer to Table I, Reference Number 9,015, "Electric Power Club Handbook."

TABLE II—PREFERRED STANDARDS, SINGLE-PHASE POWER TRANSFORMERS

[The Preferred Standards—both voltages and kva. sizes—are designated by an asterisk (*).]

	Standard Circuit Voltages						
	2,300*	4,600	6,600*	11,000	13,200*	22,000	33,000*
Standard Kva. Sizes in Each Voltage Class	250	250	250	250	250	250	250
	333*	333*	333*	333*	333*	333*	333*
	400	400	400	400	400	400	400
	500*	500*	500*	500*	500*	500*	500*
			667*	667*	667*	667*	667*
			883*	833*	883*	833*	833*
			1,000*	1,000	1,000*	1,000*	1,000*
			1,250	1,250	1,250	1,250	1,250
			1,667	1,667	1,667	1,667	1,667
			2,000*	2,000*	2,000*	2,000*	2,000
			2,500	2,500	2,500	2,500	2,500
				3,333*	3,333*	3,333*	3,333*
				5,000*	5,000*	5,000*	5,000*

Note.—In selecting standard transformer voltage ratings for operating from standard circuits, refer to Table IV. Reference Number 9,215, "Electric Power Club Handbook."

Supreme Court, Wiping Out State Lines in Water-Power Claims, Sets Up Priority

A DECISION of paramount importance to the electrical industry has been rendered by the Supreme Court of the United States in the suit of the State of Wyoming against the State of Colorado, the Greeley-Poudre Irrigation District and the Laramie-Poudre Reservoir & Irrigation Company to prevent the diversion of the waters of the Laramie River. There is some question as to the exact purport of the decision due to the fact that Justice Van Devanter delivered the opinion without having reduced it all to writing. As a result the text of the opinion is not available as this is written. However, the finding allows Colorado to divert not more than 15,500 acre-feet of water, but preserves the prior rights of those who had diverted water for mining and other purposes. It is pointed out in the opinion that waters of the river have always been diverted for mining and other purposes and that these prior rights for mining and other beneficial uses of the water have been recognized by the courts and by Congress, having grown up as a matter of custom and right. These mining diversions have been in both states, and priority of appropriation gives superiority of right to the water.

The opinion has the effect of obliterating state boundaries in the matter of the use of water. States as such have no ground on which to base an appearance in court. This privilege is enjoyed, however, by any citizen of any state who considers himself aggrieved. Under the Supreme Court's verdict, it is a matter of first come first served. Any citizen, regardless of the state in which he resides, may put the water to use. Those putting the water to use first have a prior claim against any subsequent appropriator.

The decision is a complete reversal of the Colorado theory. The position of Colorado, deduced from the decision in the case of Kansas vs. Colorado, was that it was the keystone of the arch. Since most of the water in the Colorado River falls on watersheds within the State of Colorado, it had attempted to establish a prior claim on water originating in Colorado whether or not it was put to use in that state. The waters of the Colorado will be appropriated and put to use faster in the lower basin of the river than will be the case in the upper basin, and the decision means that Colorado must do nothing which interferes with those entitled to priority in the use of the river's water.

In view of the Supreme Court decision it is believed that great activity will arise along the entire Colorado River in the effort to establish prior use. One of the fortunate features of the situation is that there is a great abundance of water. While it is assumed that the state laws will govern in maintaining the right to use the water for irrigation before it is used for power purposes, the prior rights already established in the Imperial Valley and in other sections of the lower Colorado will require such a volume of water as to insure the development of large amounts of power in the canyon sections of the river. Secretary of Commerce Hoover said on June 13 that the decision had simplified greatly the task before the Colorado River Commission. The decision will add greatly to interest in the hearing to be conducted at Santa Fé on Aug. 1. At that hearing suggestions undoubtedly will be made for procedure in establishing prior rights.

A preliminary analysis of the opinion made by one of the departmental law officers, which he specifies is subject to correction, owing to the fact that he did not have a copy of the opinion, is as follows:

> It is a recognition of the doctrine of prior appropriation regardless of state lines between the appropriators in two states on an interstate stream, whether the suit is between individuals in the two states or whether it is between the states themselves, provided both states recognize the doctrine of prior appropriation within their boundary.
>
> The case is distinguished from that of Kansas vs. Colorado, which applied the doctrine of equitable apportionment as between states on the ground that the law in the two states differed, *i.e.*, Kansas recognized the common-law doctrine of riparian right and Colorado the doctrine of prior appropriation.
>
> The contention of Colorado that she as a state rightfully may divert and use the water of an interstate stream, regardless of prejudice to others having right in the stream beyond her boundary, is held untenable on the ground that the stream is but a single stream in which each state has an interest that must be respected by the other.
>
> The contention of Wyoming that a proposed diversion by Colorado was not permissible on the ground that it was a diversion to another watershed from which Wyoming can get no benefit is not sustained, as such a diversion does not necessarily form a ground for a complaint where the practice of diversion is recognized in both states.
>
> A dictum is uttered to the effect that where water is put to a recognized beneficial use in both states the fact that in one state it can be more highly used is not controlling in the matter of the right of the two states to the water.
>
> Another dictum is to the effect that the water originating in Colorado and flowing into Wyoming is not a contribution by Colorado to Wyoming as the river was there long before the states.

No Important Change in Coal Situation

THE proverbial calm which precedes a storm seems to have settled over the coal situation. No additional mines were closed last week and no mine in union territory was opened, so far as reports to the government show. Production is standing still and the same is true of prices. Secretary Hoover has replied vigorously to the critics who accuse him of being "buncoed" by the operators and is continuing his efforts to bring about the co-operation of retail coal dealers.

"The essential thing about the coal prices," the Secretary says, "is that the runaway market has been stopped, prices have receded from those reached on May 15 except for a small percentage of the total production where co-operation is refused, and the public has so far been protected from a repetiton of 1920."

Washington Water Power Company Buys Intermountain Power

THE Washington Water Power Company has recently completed the purchase of the Intermountain Power Company, which was organized about five years ago to construct and operate a transmission line to transmit power from the Long Lake station of the Washington Water Power Company and supply it to the Washington Division of the electrified Chicago, Milwaukee & St. Paul Railway. The transmission is about 100 miles at 110,000 volts. The ownership of this line will place the Washington Water Power Company in a strategic position in furnishing service to central and southeastern Washington. Extensions from the line are already planned as part of the policy of expansion now under way.

Carrier-Current Relay Perfected

OVER three miles of underground cable and one mile of aërial construction two street-lighting circuits at 4,400 volts were turned on and off by means of a relay and carrier currents in a recent test made at Lynn, Mass., by radio engineers of the General Electric Company before representatives of the Associated Edison Companies. In the station a high-frequency generator with a vacuum tube was used to change the 110-volt, 60-cycle energy to carrier-current frequency. The output of the high-frequency generator was then superimposed on the 4,400-volt, four-mile street-lighting feeder circuit supplying Little Nahant.

The demonstration was arranged to control either of two street-lighting circuits in Little Nahant. One circuit consisted of eighteen incandescent lamps and two arc lamps, and the other comprised two 1,000-watt searchlamps, two 500-watt floodlamps and a pendent lantern. Each circuit was controlled by a carrier-current relay, and the turning on or off of the lights was acomplished by control of the frequency of the carrier current supplied to the relays.

No Muscle Shoals Decision Yet in Sight at Washington

THREE reports on the Ford proposal to purchase the Muscle Shoals government plant were introduced into the House of Representatives on Friday of last week by members of the military affairs committee. A "majority" report presented by acting Chairman McKenzie of Illinois and signed only by himself called for the acceptance of Henry Ford's proposal as amended by the committee to eliminate the Gorgas steam-power plant. It declared the money consideration of $5,000,000 "not the vital one" and dwelt on the continued obligations over a hundred years as the real consideration. Supporters of the McKenzie bill believe that Mr. Ford would accept it, despite its elimination of the Gorgas plant from the proposed contract.

Representative Wright, Democrat, of Georgia asked the House to accept the Ford offer as it was finally submitted, without amendment or modification. His report, which was signed by two Republicans and six Democrats, laid emphasis on the nitrate-production feature of the Ford plan and denounced the Alabama Power Company's contract with the government as having "the elements of neither law nor morality and therefore no standing."

Representative Parker, Republican, of New Jersey believed the Ford tender should be altered materially if accepted at all, or that the Shoals properties should be returned to the jurisdiction of the War Department and Secretary Weeks authorized to dispose of them under terms approved by Congress. Mr. Frothingham, Republican, of Massachusetts was the only other signer of the Parker report. Ten committeemen failed to sign any one of the three reports.

Efforts are being made to bring about the consideration of the McKenzie report in the House by circulating a petition among the members asking that it be taken up. If these efforts succeed, the bill may be amended on the floor to include the Gorgas plant. A statement to the effect that the President is opposed to a vote on the bill at this time, which was published widely, was denied emphatically on the floor of the House by Majority Leader Mondell. A Republican conference on legislation is to determine whether to bring the Ford offer on the floor or to take up instead the Senate plan to appropriate $7,500,000 to complete the Wilson dam as a government activity. In the meanwhile another member of the military affairs committee, Representative Morrin of Pennsylvania, will, it is said, present to the House another set of minority views, severely criticising the Ford offer from every angle.

Illinois Commission Holds Hearings on Rural Service Rules

A CONSIDERABLE amount of confusion in the rural-lines rules situation in Illinois culminated last week in a formal hearing before the Illinois Commerce Commission at Springfield. About two years ago the commission promulgated General Order No. 59, in which several methods of establishing service were permitted. Service to the consumers as individuals under a plan by which the line was constructed at the expense of the farmers and turned over to the utility was one of the methods, and the others provided for wholesaling of energy to mutual companies or to regularly organized rural utilities. Recently the order was rescinded as the result of complaints from farmers' organizations, and the hearing on Wednesday and Thursday of last week was devoted to the taking of evidence to show that there are costs in serving rural customers in excess of the cost of serving similar customers in urban territory and that there are other factors involved which make it necessary to treat such consumers as a separate class in determining the fundamentals on which rates for service shall be established. The investigation is not complete, and it is probable that several additional hearings will be held.

Past and Present State Commissioners Oppose Bacharach Bill

HEARINGS on the Bacharach bill, which is designed to limit the jurisdiction of the United States district and circuit courts in the matter of granting injunctions suspending the enforcement of decisions by state and municipal public utilities commissions, were closed at Washington on June 9, when the opposition completed its testimony.

Former Public Service Commissioner Paul P. Haynes of Indiana, who represented the Interstate Public Service Company of that state, said that the real intent of those behind the bill was to strike down state regulation in the interest of municipal executives of the kind unfairly antagonistic to the utilities.

A statement from Carl D. Jackson, chairman of the Wisconsin Railroad Commission and president of the National Association of Railway and Utilities Commissioners, declaring that the state commissions should welcome judicial review and interpretation, was read, as was a letter from J. W. McCardle, chairman of the Public Service Commission of Indiana, declaring that legislation like the Bacharach bill "will lead to inevitable chaos."

It is understood in well-informed legislative circles in Washington that the sub-committee that has had charge of the bill will probably report that it would be unconstitutional. It is not probable that the bill will be made a part of the legislation to be considered at present.

Fuel Costs and Rural Service Brought Up at St. Paul Convention

ASSERTING that the increase in the cost of coal since April 1 has again caused the cost of operating electric utilities to rise, President T. D. Crocker of the North Central Electric Association, in his address at the annual convention of the association at St. Paul on Wednesday, recommended that the utility men compare their rates and the changes since 1914 with the commodity price curves issued by the United States Labor Bureau, using the maximum-rate step and plotting the increases on a percentage basis. While he recommended that utilities maintain a reserve of six to twelve weeks' coal supply, he warned against panic-stricken buying in fear of a shortage next fall and winter. He recommended the adoption of a constructive program to show the farmers the problem involved in rural service and said that with a full understanding the farmer will help in its solution.

L. D. Peavey of the Babson Statistical Organization said that the electric appliance industry afforded a wonderful opportunity if quality were constantly improved and prices kept down. W. H. Hodge of Chicago discussed the customer ownership movement.

R. F. Pack, vice-president of the National Electric Light Association, gave a review of its policies in promoting the development of the central-station industry.

The convention continued through Thursday and the annual banquet took place Thursday evening.

Money Cost Vital Factor in Water Power, Says President of C. E. A.

THE thirty-second annual convention of the Canadian Electrical Association, a geographic division of the National Electric Light Association, was held in Ottawa, Ontario, on Thursday, Friday and Saturday of this week. Although made up of privately owned electric light and power companies operating chiefly in Quebec and Ontario, the Canadian Electrical Association has in the past two years shown remarkable growth, and that notwithstanding that the electrical situation in Ontario is dominated almost entirely by the Hydro-Electric Power Commission. This is evidenced by the fact that in the last year its membership, including manufacturing as well as operating companies, was increased 56 per cent.

The presidential address of Julian C. Smith of the Shawinigan Water & Power Company af Montreal was devoted largely to water-power development in Canada. He said Dominion statistics indicate that the power capacity of water-power stations for all purposes is at present increasing at the rate of about 200,000 hp. yearly, of which approximately three-quarters is for central electric power stations. To care for this increase will require an expenditure of $30,000,000 yearly, one-half of which will be financed in Ontario by the government-owned utilities. The rest would have to be raised through the investment houses of Canada. Hydro-electric bonds and other forms of security, Mr. Smith said, are enjoying a well-deserved reputation in Canada. In 1912 the average cost of money to good hydro-electric enterprises was about 5 per cent. In 1921 this cost had increased to about 8 or 9 per cent, a prohibitive figure for expansion. This year shows improved conditions, good companies being able to obtain money for from about 6 to 6½ per cent, and the indications point to money within a year on a 5½ to 6 per cent basis. This, according to Mr. Smith, is a vital matter, since it means that the electrical industry in Canada can look forward to the development of water power on a large scale. The cost of power on the busbars of a water-power station is made up of about 85 per cent interest and 15 per cent operation charges, maintenance and taxes. Before the war taxes constituted about 1 per cent of the total cost of power, but they now amount to 7 or 8 per cent and in many cases equal or exceed the cost of operation and maintenance combined. This, Mr. Smith said, was of importance in deciding between government-owned and privately owned utilities.

The greater part of the program comprised reports of standing committees. A feature of the convention was a profusely illustrated lecture on illumination by W. D'A. Ryan Thursday night, which was open to all.

The National Electric Light Association was represented by W. H. Onken, Jr., editor of the ELECTRICAL WORLD, who delivered a message from President-elect Frank W. Smith, who was unable to be present.

John W. Lieb Warmly Greeted in Italy

RETURNING to New York on the Paris last Monday, John W. Lieb, vice-president of the New York Edison Company, brought to an end a two months' visit to Italy, the scene of some of his early labors. Mr. Lieb, who was accompanied by his wife, was warmly welcomed in Italy, especially by old friends and business associates in Milan, where he was the guest of honor at meetings and banquets organized by the local branches of the national engineering societies of the nation. While he was in Rome he was appointed United States delegate to the International Railways Congress and made an honorary member of the National Railway Society. In Turin he attended the ceremonies organized by the Associazione Elettrotecnica Italiana in commemoration of the twenty-fifth anniversary of the death of its first president, Galileo Ferraris, and, in the presence of government authorities and leading engineers, deposited on Ferraris' monument two bronze wreaths, one sent by the National Electric Light Association and one by the American Institute of Electrical Engineers, of both of which societies Mr. Lieb is a past-president. Mr. Lieb, who speaks Italian fluently, also delivered a lecture before the Italian Electrotechnical Association at its Turin hall.

A TRIBUTE FROM AMERICAN ENGINEERS TO FERRARIS

A. E. A. Holds Well-Attended Convention

A THOUSAND delegates, representing a membership of 22,000 in 192 chapters and sixty-one clubs scattered throughout the United States, assembled at Salt Lake City for the eighth annual convention of the American Association of Engineers last week.

Officers elected for the ensuing term are: President, A. N. Johnson, Maryland; first vice-president, G. E. Taylor, West Virginia; second vice-president, A. M. Knowles, New York. The secretary and the treasurer are appointed by the board of directors.

Daily Program Now Drawn Up for A. I. E. E. Niagara Falls Meeting

THE tentative program for the annual convention of the American Institute of Electrical Engineers, to be held at Niagara Falls, Ontario, on June 26-30, which was published in outline by the ELECTRICAL WORLD on May 13, has now been arranged by sessions as follows, Monday, June 26, having been set apart for conferences:

TUESDAY, JUNE 27

Morning.—"The Two-Stage Current Transformer," by H. B. Brooks, Bureau of Standards, and F. C. Holtz, Sangamo Electric Company; "Three Thousand Tests on the Dielectric Strength of Liquid Insulation," by J. L. R. Hayden and W. N. Eddy, both of General Electric Company; "Control of Gaseous Conduction," by V. Bush and C. G. Smith, both of American Radio & Research Corporation; "Determination of Temperature of Electrical Apparatus and Cables in Service," by E. J. Rutan, New York Edison Company. Parallel session: "The Economics of Direct-Current Railway Distribution, with Particular Reference to the Automatic Substation," by L. P. Crecelius and V. P. Phillips, Cleveland; "Light Without Glare," by Ward Harrison, National Lamp Works, Cleveland; "Philadelphia-Pittsburgh Section of the New York-Chicago Cable," by James J. Pilliod, American Telephone & Telegraph Company; "A Method of Determining Resultant Input from Individual Duty Cycles and of Determining Temperature Rating," by Bassett Jones, New York.

Afternoon.—"Queenston-Chippawa Development of the Hydro-Electric Power Commission of Ontario," by F. A. Gaby, chief engineer of the commission; description of the 45,000-kva. Queenston generators, by B. L. Barns and F. Bowness, both of the Canadian General Electric Company, and R. A. McCarty, Westinghouse Electric & Manufacturing Company, and H. U. Hart, Canadian Westinghouse Company; "Features of Main Power-House Transformers in Queenston Station," by C. A. Price, Canadian Westinghouse Company, and M. E. Skinner, Duquesne Light Company.

Evening.—President's address, reception and informal dance.

WEDNESDAY, JUNE 28

Morning.—"Questions Relating to Standards of Rating," by F. D. Newbury, Westinghouse Electric & Manufacturing Company; "Probable Values of Conventional Allowance for Alternating-Current Generator Stator Windings," by F. D. Newbury; "Temperature Limits in Large Machines," by Philip Torchio, New York Edison Company; "Higher Steam Pressures or Pulverized Coal?" by F. A. Scheffler, Fuller Engineering Company.

Afternoon.—Visit to Queenston plant.

Evening.—Lecture, "Niagara Falls Plants," by J. L. Harper, vice-president Niagara Falls Power Company.

THURSDAY, JUNE 29

Morning.—Summarized history of the rating of cables in relation to voltage, by the sub-committee on wires and cables of the standards committee; "Dielectric Losses and Stresses in Relation to Cable Failures," by D. W. Roper, Commonwealth Edison Company; "On the Minimum-stress Theory of Cable Breakdowns," by D. M. Simons, Standard Underground Cable Company; "Effect of the Composite Structure of Impregnated Paper Insulation on Its Electric Properties," by W. A. Del Mar and C. F. Hanson, both of the Habirshaw Electric Cable Company; "Potential Gradient in Cables," by W. I. Middleton and E. W. Davis, both of the Simplex Wire & Cable Company, and Prof. Chester L. Dawes of Harvard University; "Corona in Air Spaces in a Dielectric," by J. S. Shrader, Westinghouse Electric & Manufacturing Company; "Action and Effect of Moisture in a Dielectric Field," by Delafield Du Bois, Safety Insulated Wire & Cable Company; "Rating of Cables in Relation to Voltage—Bibliography on Dielectrics," by D. M. Simons.

Afternoon.—Board of directors' meeting, entertainment features and inspection trips.

Evening.—"Some Suggestions for Possible Improvements in Methods of Engineering Education," by B. G. Lamme, Westinghouse Electric & Manufacturing Company; "Education," by S. E. Doane, National Lamp Works, Cleveland; "Principles of Engineering Education," by Philip Torchio, New York Edison Company; "Better Preparation of Students for Railway Work," by I. C. Forshee, Pennsylvania Railroad Company; "Training for Character," by A. M. Dudley, Westinghouse Electric & Manufacturing Company; "Suggestions Concerning the College Education of an Engineer," by Carl Hering, Philadelphia.

FRIDAY, JUNE 30

Morning.—"Baltimore Oil-Circuit-Breaker Tests," by H. C. Louis, Consolidated Gas, Electric Light & Power Company, and A. F. Bang, Pennsylvania Water & Power Company; "Tests on General Electric Oil Circuit Breakers at Baltimore," by J. D. Hilliard, General Electric Company; "Tests on Westinghouse Oil Circuit Breakers at Baltimore," by J. B. MacNeill, Westinghouse Electric & Manufacturing Company; "Transmission-Line Relay Protection," by E. A. Hester, R. N. Conwell, O. C. Traver and L. N. Crichton of relay sub-committee of protective devices committee.

The usual entertainment features have been arranged for delegates and ladies accompanying them, including sightseeing trips, golf and tennis tournaments, baseball and a musical recital by Prof. Vladimir Karapetoff.

The cable research committee, a sub-committee of the transmission and distribution committee of the A. I. E. E., D. W. Roper chairman, will hold an open meeting on the subject of high-tension cable joints on Thursday afternoon, June 29. The evening of the same day is available for continuing the discussions. Since seven papers on cable insulation are to be presented on Thursday morning, this cable-joint discussion will not interfere with the regular technical session, but will supplement the morning session. Methods of testing experimental joints and determining the proper method of filling joints and the question of joint insulation are some of the features under discussion by the committee.

Chicago to Require Permits for Radio Installations

AN ORDINANCE requiring the issuance of permits before the installation of a radio set of any character and in general treating such installations in the same manner that electrical wiring installations are treated has been introduced into the City Council in Chicago. The application for a permit under the new ordinance would have to be accompanied by a drawing showing a plan view of the property, the details of installation of the antenna, and all buildings and wires adjacent to the latter. If the application and the proposed plans are in proper form, a permit authorizing the installation of the apparatus described will be issued. The ordinance provides for inspection during or after installation and for reinspection of such stations. For inspection a fee of $3 for receiving stations only and $5 for transmitting and receiving stations will be charged. Reinspections will be charged for at $1.50 per hour, with no charge less than $1.50. Installation requirements are made for receiving stations only and for combined transmitting and receiving stations. When it is necessary to do any wiring to take power from street mains the ordinance provides that the work can be done by licensed electricians only. Estimates of a yearly revenue of $100,000 have been placed on the license features of the proposed ordinance. Penalties of from $5 to $100 for each violation of it are provided, and each day's use is constituted a separate violation.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Wisconsin Municipal Plants Now Buy Their Energy.—Records of the Wisconsin Railroad Commission are to the effect that only thirty out of sixty-nine publicly owned electric plants now generate their energy, the other thirty-nine purchasing it from central-station or distributing companies.

Electrical Men of Salt Lake City Hold "Forty-niner" Party.—On May 27 an electrical "forty-niner" party was held under the auspices of the Rocky Mountain Electrical Co-operative League at Salt Lake City. Nearly 800 persons were present, representing all branches of the industry in Salt Lake and nearby towns. The "get-together" spirit of the league prevailed.

Hydro-Electric Development on Flambeau River, Wisconsin. — The L. E. Myers Company, Chicago, a concern which has passed its thirtieth annual milestone as builder and operator of public utilities, is developing a hydro-electric project at Big Falls on the Flambeau River, Wis., 10 miles northeast of Ladysmith. A construction gang is forming the foundation of the dam, which will cost $2,500,000 and is expected to be finished in 1923. The electrical equipment is to include two 3,300-kva. turbo-generators, and space will be allowed for the future installation of similar units.

Shanghai's Good Electrical Record.—The 1921 report of the electricity department of the Shanghai Municipal Council shows that this flourishing Chinese port continues the record of electrical progress it has shown in other years. Compared with the five largest municipally owned undertakings in Great Britain, Shanghai outranks all but Manchester in output and shows by far the best load factor. Here are the figures, all for 1921 except Liverpool, for which the 1920 figures were the latest available:

	Kw.-hr. Sold	Maximum Kw. Demand	Load Factor, per Cent
Manchester..	199,618,813	89,500	25.46
Shanghai....	185,364,746	41,074	51.50
Glasgow.....	154,175,830	76,964	22.87
Sheffield.....	141,361,701	66,463	24.28
Birmingham.	136,921,417	67,100	23.29
Liverpool....	86,333,510	38,317	25.65

Southern California Edison Tunnel Men Break World Record.—In its race to keep ahead of the demand for electric power the Southern California Edison Company has just broken a record in tunnel construction, according to a report from the Big Creek headquarters of the company, where 3,500 men are engaged in harnessing the waters of the San Joaquin. In thirty days a crew of miners drove a section of tunnel 21 ft. square a total distance of 476 ft. through solid granite. A standard of 12 ft. daily had been set by the company, but this was raised to 15 ft. by the men themselves. This was accomplished in a section of a tunnel whose length when complete will be 30,000 ft. and which will serve to carry nearly the entire flow of the San Joaquin River from its junction with Big Creek to the site of Power House No. 3, where it will be utilized.

Chicago to Issue Bonds for Street Lighting.—Approval of a new two-million-dollar bond issue for lighting was obtained at the Chicago judicial election on June 5. George E. Carlson, Commissioner of Gas and Electricity, said that this issue will permit an addition of 13,000 lamps to Chicago's lighting equipment. In addition to these new lamps Mr. Carlson proposes to move 3,000 gasoline lamps to outlying districts now without street lighting. The bond issue will provide standard illumination for 300 miles of streets.

Dallas Company to Erect Another Plant.—An authorized statement of the Dallas Power & Light Company announces that it is having plans prepared for the erection of another power plant to cost approximately $2,200,000. C. E. Calder, president of the company, says that the new plant will be immediately adjacent to the present power plant, but will be so arranged that in case of necessity it can be operated independently. The building, which will be 156 ft. x 112 ft., will house a 15,000-kw. turbine, which, with the auxiliary machines and electrical equipment, will cost approximately $700,000. Four boilers of 1,500-hp. rating each will be arranged to burn coal, oil or gas as may prove most economical. By the installation of control devices guesswork in the firing of these boilers has been reduced to a minimum. The cost of the boilers will be approximately $675,000.

New Utility Company Organized to Operate in Arkansas.—The Mississippi Valley Power Company is a new corporation organized to acquire and operate approximately 60 miles of 33,000-volt and 13,200-volt transmission lines in the State of Arkansas, together with distributing systems in eleven communities. Two other towns are connected to the transmission lines and will be served on a wholesale basis. In addition, the company will acquire pole lines serving a number of coal mines in intermediate fields. Energy will be purchased from the Fort Smith Light & Traction Company under a favorable twenty-five-year contract, and delivery of energy will be made at Alma, Ark., the eastern terminus of that company's 33,000-volt transmission line. The territory served consists of a group of prosperous agricultural communities in western Arkansas. The communities are developing rapidly, and the company, which is to be under Byllesby management, has as yet only in small part satisfied their demands for electric power.

Voluntary Daylight Saving Fails in Washington.—The voluntary daylight-saving system tried in the national capital, by which the government departments were opened and closed an hour in advance of the regular time, although the clocks remained the same, is to be abandoned. The system has been found impracticable owing to the failure of the people to readjust their night life. They stay up as late as ever, it is alleged, but have been required, much against their will, to get up an hour earlier.

Associations and Societies

Marconi to Address New York A. I. E. E.—On Tuesday, June 20, William Marconi will address a joint meeting of the New York Section, A. I. E. E., and the Institute of Radio Engineers on "Radio Telegraphy," and the latter society will present to Mr. Marconi its medal of honor for his pioneer work in the field of radio. The meeting will be held in the auditorium of the Engineering Societies Building.

New York Electrical Society.—At the annual meeting of this society last week the following officers were elected: President, J. M. Buchanan; vice-presidents, Erich Hausmann, J. P. Alexander and J. L. Pitcher; secretary, George H. Guy; treasurer, Thomas F. Honahan. The address of Dr. Frank B. Jewett on "Some of Our New Electrical Organs of Speech" was an able summing up of recent developments, especially in radio telephony. Dr. Michael I. Pupin, in his address on "What the Society Has Done and What Its Mission in the Future Should Be," praised the accomplishment of the society in setting a standard of meetings which emphasize the human side of science. He announced that one recognition of the society's work along this line had been given by the Hartley Corporation, which has set aside the sum of $10,000 as the Francis Bacon Crocker fund, the income of which will be devoted to the work of the society.

Coming Meetings of Electrical and Other Technical Societies

N. E. L. A. Geographic Divisions—Iowa Section, Lake Okoboji, June 20-22; New England, New London, Conn., Sept. 5-7; Great Lakes, French Lick Springs, Ind., Sept. 28-30.

Associated Manufacturers of Electrical Supplies—Spring Lake Beach, N. J., June 19-25. (For program see issue of June 3, page 1139.)

Society for the Promotion of Engineering Education—Urbana, Ill., June 20-23.

American Society of Civil Engineers—Portsmouth, N. H., June 21-22.

American Association for the Advancement of Science—Salt Lake City, June 22-24.

American Physical Society, Pacific Coast Section—Salt Lake City, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ont., June 22-24.

A. I. E. E. Annual Convention—Niagara Falls, Ontario, June 26-30. (For program see "News of the Industry.")

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of May 13, page 972.)

A. I. E. E., Pacific Coast Convention—Vancouver, B. C.—Aug. 8-11.

International Association of Municipal Electricians — New Bedford, Mass., Aug. 22-25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

"Going Value" Reflected in Purchase Price Cannot Be Allowed.—A claim for "going-concern value" made by the Republic Light, Heat & Power Company, which supplies natural gas in the Batavia district, was disallowed by the New York Public Service Commission where it appeared that this company had acquired the property by purchase from other companies so that going value, if it ever existed, must have been reflected in the purchase price paid on the various transfers of property.

Demand Rates Under Low Load Factor.—The improbability of a simultaneous demand on a power company's system in rendering service having a low load factor led the Utah Public Utilities Commission to say, in dealing with a complaint made by the Utah Manufacturers' Association against the Utah Power & Light Company: "An examination of the schedules and of their application as shown by the evidence has convinced us of the inapplicability of a uniform demand rate to all classes of consumers regardless of load factor. At the low load factors it is apparent that there is a greater probability of diversity and that the effect of simultaneous demand on the power company's system is much less than the aggregate demands. We believe from the evidence that at the very low load factors a considerably higher average diversity factor than two may be obtained. The effect of this is shown by the high kilowatt-hour charges paid by consumers at less than 6 per cent load factor."

Extensions to Real Estate Tracts.—Maintaining that a public utility should not be required to invest its money in the extension of mains and electric lines along streets of a real estate subdivision where there are no premises to be served, the New York Public Service Commission, adjudicating a case brought by a real estate development company against the Rochester Gas & Electric Corporation, said: "It is unquestionably the duty of a public service corporation to meet and anticipate the development of the territory in which it exercises its franchises. . . . However, if the respondent were required to make the extensions requested by the petition, it would receive no immediate income from the sale of its commodities as there are no customers, and a fair return upon the money expended in such work would have to be borne by its consumers. It would establish a precedent for extensions into territory where no present need of service exists and would involve the expenditure of capital by public utilities upon which, in all fairness, they should be entitled to a return which could only be obtained at the expense of present consumers in the rates charged for commodities."

Public Utility Advertising Indorsed.—Describing newspaper advertising as the most effective and cheapest form of salesmanship, President Brundige of the California Railroad Commission has indorsed the reasonable use of newspaper space by power companies to promote and extend their business. A statement to this effect was made by him in response to a question as to the right of power companies to charge advertising to operating accounts, especially in a territory where competition is not a serious factor. That utilities in certain fields do not have serious competition does not affect the proper use of advertising, the commissioner said, and he pointed out that modern advertising seeks to create new business rather than to take business away from a competitor. When advertising is reasonably and wisely used, measured by results obtained, and is not of the type carrying political propaganda, it is a legitimate operating expense. By creating an increased volume of business the advertising results ultimately in a reduced cost to consumers, thus being not only legitimate on the part of the company but desirable from the standpoint of the ratepayers.

Massachusetts Commission on Service Charge.—In permitting the Malden & Melrose Gas Light Company to make a base service charge of 35 cents (see issue of May 6, page 894), the Massachusetts Department of Public Utilities said: "It seems manifest that customers using little or no gas but desiring nevertheless to have their premises connected with the company's mains not only contribute little to the company's revenue, but not enough to cover the company's out-of-pocket expense incurred solely for them. It is to correct the inequality resulting from the present rates that the company is proposing a service charge. The question is, therefore, not primarily one between the company and its customers, but rather between the customers themselves as to the most equitable method for raising a given amount of revenue. With this as the real issue and recognizing the merit of dividing the rate into a definite service or customer charge and a selling price based upon the units of gas used rather than the uniform selling price now employed, we have been disposed to approve the adoption of such a scheme of charging within reasonable and proper limits whenever a company deems this step expedient. The question, therefore, to which we have chiefly directed our attention has been the amount of the service charge to be approved."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Service Deposit Must Be Asked from All Customers Alike.—It is discrimination to ask some customers to make a service deposit while others are supplied on furnishing a guarantee from some one known to the company. This is the finding of the Kentucky Court of Appeals in Barringer vs. Louisville Gas & Electric Company, where the plaintiff sued to recover his five-dollar deposit and received judgment in the lower court which is thus affirmed. It was alleged that 90 per cent of the customers had their bills guaranteed by a man employed by the company.

Claim that Power Company Furnishing Steam Is Not a Public Utility as Regards the Latter Service Untenable.—The Supreme Court of Pennsylvania, in Beetem vs. Carlisle Light, Heat & Power Company, a suit to recover charges paid for live steam, which were in excess of contract rates but authorized by the Public Service Commission, overruled the contention that in rendering this service the company was not acting as a public utility and was therefore not subject to commission jurisdiction and declared that the courts did not have jurisdiction. (116 At. 676.)*

Whether Excessive Charges Were Paid Under Duress a Question for Jury.—In an action brought by the Piedmont Power & Light Company to recover from the L. Banks Holt Manufacturing Company an amount charged in excess of the rate agreed on, where it was shown that defendant in 1919 tried to get power elsewhere and finally refused to pay the increased price, it was for the jury to determine whether payments made without protest from September, 1918, to June, 1920, at such increased rate were made to prevent the shutting down of defendant's plant, chaotic industrial conditions at that time making it impossible to obtain power elsewhere and rendering protest useless. So holding, the Supreme Court of North Carolina confirmed a judgment of nonsuit and awarded a retrial. It was not the duty of the manufacturing company, the court held, to apply to the state commission for relief against an increase of contract rates, the power company being bound by these rates unless relieved by the commission, and payments in excess of such rates made under apprehension of having to close down the plant are recoverable. (111 S. E. 623.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

David B. Rushmore, chief engineer of the power and mining department of the General Electric Company, has recently been appointed to the staff of consulting engineers of the company. Mr. Rushmore's promotion is to enable him to devote his time more fully to the general engineering problems in which he is particularly interested. His most important work has been the upbuilding of the power and mining department, one of the General Electric Company's largest engineering divisions, the training and development of a staff of engineers and the broadening of the work of a division whose influence has been felt in every line of industrial power activity in the electrical industry. He became connected with this department in 1907 and for the larger part of the succeeding fifteen years was its directing head. Mr. Rushmore was born in Old Westbury, N. Y., in 1873. He took an engineering degree at Swarthmore College in 1895, the degree in civil engineering in 1897, and received a mechanical engineering degree from Cornell University in 1895. His early work was with the Pond Machine Tool Company, the Westinghouse Electric & Manufacturing Company and the Royal Electric Company of Montreal. In 1899 he joined the staff of the Stanley Electric Manufacturing Company of Pittsfield, Mass., and he entered the employ of the General Electric Company in 1905, when the Stanley interests became a part of the General Electric organization. Mr. Rushmore is a member of technical societies here and abroad.

D. B. RUSHMORE

Frank J. Sprague, pioneer in electrical operation of street railways and originator of multiple-unit train control, received the honorary degree of doctor of science from Columbia University at its graduation exercises on June 6.

Dexter S. Kimball, dean of Cornell University, who is the president of the Society of Mechanical Engineers and also the vice-president of the Engineering Council of the Federated American Engineering Societies, left on June 3 on a trip which will take him to the principal cities of the country in an effort to bring about a closer working arrangement between Western and Eastern engineers. The American Society of Mechanical Engineers is planning an elaborate nation-wide program of engineering activities and public service involving co-operation with the federal government. Dean Kimball's mission is largely to familiarize the engineers of the Far West with this program.

L. L. Ferree has been appointed general manager of the Georgia-Alabama Power Company and the Georgia-Alabama Utilities, Inc. Mr. Ferree comes to this new position after some twenty-odd years of construction, designing and executive experience in the electric light and power industry. He was born in Millersburg, Pa., March 10, 1878, and attended the Miffin Academy, where he was graduated in 1897, and later took special post-graduate courses in mathematics and engineering. Following graduation he entered the employment of the Tennis Construction Company, and afterward was with the Philadelphia Rapid Transit Company. In 1902 he became associated with the Paxtang Electric Company of Harrisburg, Pa., during the construction of its power-house and distribution system. After the completion of this work he became superintendent of operations and finally general superintendent of this property. Upon the consolidation of the company with the Harrisburg Light, Heat & Power Company, he was made general superintendent of the consolidated companies. In 1919 he joined the organization of Day & Zimmermann, Inc., and assumed the management of their property at Salem, Ohio. On March 1 of this year he was transferred to Albany, Ga., in the capacity already stated.

L. L. FERREE

H. T. Sands was elected chairman of the Public Relations Section of the National Electric Light Association at its recent convention held in Atlantic City. Mr. Sands was born on Sept. 12, 1867, and attended and was graduated from the public schools of Saco, Me. He entered the electric light and power industry in 1896, when he became connected with the Mechanics Falls Water, Electric Light & Power Company as superintendent of construction of a dam and power house at Mechanics Falls, Me. He continued with this company for nearly six years, during that period acting as superintendent, wireman, meterman, bookkeeper, collector, station mechanician and station operator. In 1901 he became superintendent of the Lewiston & Auburn Electric Light Company of Auburn, Me., which position he held until 1905, when he became manager of the Haverhill Electric Company of Haverhill, Mass. Since that date Mr. Sands has been connected in various capacities with different companies known as the "Tenney companies." He is at present president of the Haverhill Electric Company and of the Montpelier & Barre Light and Power Company, Montpelier, Vt.; vice-president of the Malden Electric Company and the Malden & Melrose Gas Light Company, Malden, Mass.; the Suburban Gas & Electric Company, Revere, Mass.; the Exeter & Hampton Electric Company, Exeter, N. H., and the People's Gas & Electric Company, Oswego, N. Y.

H. T. SANDS

Owen D. Young, chairman of the board of directors of the General Electric Company, was awarded the honorary degree of doctor of laws by Union College of Schenectady at the one hundred and twenty-sixth commencement of that institution.

F. S. Hunting, who has been general manager of the Fort Wayne division of the General Electric Company for a number of years, has resigned to become president and general manager of the Robbins & Myers Company, Springfield, Ohio. Mr. Hunting has been with the General Electric Company for thirty-four years and has spent a large part of this time in charge of the production and sale of small electric motors, such as are produced by the Robbins & Myers Company.

F. S. HUNTING

R. L. Groome has been appointed sales manager of the Chicago Lighting Fixture Company, which firm is the Middle West branch of the Shapiro & Aronson Company of New York. Mr. Groome previous to being connected with the Chicago Lighting Fixture Company was with the Mitchell Vance Company of New York.

Giuseppe Faccioli has been elected a vice-chairman of the American Institute of Electrical Engineers, representing District No. 1, which includes the New England States. Mr. Faccioli comes to this executive position with the Institute after many years of experience as a designing electrical engineer. He was born in Rome, Italy, in 1877 and was graduated from the Polytechnic of Milan, Italy, as a mechanical and electrical engineer in 1899. He designed alternating-current machinery in Europe until 1902, when he came to the United States. After working at the laboratory of the New York Edison Company and for the Interborough Rapid Transit Company of New York City he entered the Crocker-Wheeler Company in 1904 as designing electrical engineer. At the end of the year he was assigned to the study of the new induction alternator and low-frequency exciter with which William Stanley was then experimenting. The following year he went to Great Barrington, Mass., as assistant to Mr. Stanley in the Stanley laboratories. In 1906 these laboratories became a part of the General Electric organization. Mr. Faccioli was transferred to the transformer engineering department of the General Electric Company at Pittsfield, Mass., in 1908, and in 1911 was appointed assistant chief engineer of this department. In 1914 he was appointed chief electrical engineer of the Pittsfield works, which position he holds at the present time. Mr. Faccioli is the author of about twenty papers, read before technical associations and prepared for publication in the technical press.

H. D. Burrell, treasurer of the International Radio Corporation, has been appointed managing director of that company.

M. H. Goldhammer of the Denver office of the General Electric Company, has recently been transferred to the New York offices of that company.

Harry Randall, district manager of the General Electric Company in Denver, is chairman of the committee in charge of displaying the Denver electrical home.

Dr. Richard C. Tolman, director of the fixed-nitrogen laboratory of the Department of Agriculture, Washington, D. C., has resigned to accept the chair of physical chemistry and mathematical physics at the California Institute of Technology at Pasadena.

Paul J. Kruesi of Chattanooga, Tenn., has been appointed Acting Assistant Secretary of Commerce during the absence of C. H. Huston abroad. Mr. Kruesi was born in Menlo Park, N. J., in 1878 and received his first business experience with the General Electric Company at Schenectady, N. Y., and the statistical department of the Chicago Edison Company. He is now president and owner of the American Lava Company, the Chattanooga Electro Metals Company, electric furnace maker of pig iron, and the Southern Ferro-Alloys Company, producer of steel alloys. He has other business interests of varied character.

T. J. Pace has been appointed manager of the supply sales department of the Westinghouse Electric & Manufacturing Company. Mr. Pace has been with the Westinghouse company since 1899. In that year he entered the sales department, remaining there until 1902. At that time he was appointed manager of the illuminating and rectifier section of the supply department. In 1915 he was made assistant to the manager of the supply department and in 1920 was appointed assistant manager of that department.

T. J. PACE

Obituary

Col. H. D. Loveland, in length of service the "dean" of public utilities commissioners in the United States, died at his home in San Francisco on June 11. Colonel Loveland had been a member of the California Railroad Commission continuously since 1907. He was born in New York in 1853 and was one of the best-informed men in the country on transportation problems.

Charles E. Arnold, for many years connected with railroad building and telegraph companies, died this week at his home in Mount Vernon, N. Y. Mr. Arnold was born in Adams, Mass., in 1852 and when but a young man was made general Eastern passenger agent of the West Shore Railroad. He established the Commercial Union Telegraph Company and organized the Saratoga Electric Railway Company. He built numerous other railroads. Eighteen years ago he moved to Mount Vernon and was made manager of the Western Union Telegraph Company in that city, holding that position until two years ago, when he retired.

Herbert M. Tucker, general manager of the Grafton County Electric Light & Power Company, died on May 29, of apoplexy. Mr. Tucker was a self-made man in every sense. He was born in Northfield, Vt., fifty-five years ago and after a small amount of education he spent several years on a ranch in Montana. Upon returning to Lebanon, N. H., he entered the employ of the Lebanon Electric Light Company and worked his way from the bottom up until he finally became general manager of that company some years ago. This company, together with the Mascoma Electric Light & Power Company, was merged about seven years ago into what is now known as the Grafton County Electric Light & Power Company, and on the retirement of its manager Mr. Tucker succeeded to the post.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Volume of Business Jumps 32 per Cent Over Week Before

VOLUME of business for the week ended June 7, as measured by debits to individual accounts reported to the Federal Reserve Board for banks in 165 clearing-house centers, totaled $9,638,000,000, or about 32 per cent in excess of the total of $7,315,000,000 for the preceding week. End-of-month settlements, payments for the $200,000,000 of Treasury certificates of the June 1 series, the larger number of business days in the week (six instead of five in the closing week of May) and a heavier volume of stock exchange transactions largely account for the increase shown.

Trade Continues to Improve

DESPITE continued strikes in some industries and new elements of uncertainty in the labor situation, business recovery is being extended, in the opinion of Dun's and Bradstreet's weekly reviews of industry, throughout the country. Retail trade is better, it is stated, and retailers show more disposition to buy for the future. The industries, especially iron and steel and automobile lines, are more active, and crop reports have improved.

Demand for Fans Increases Materially Throughout the Country

DEMAND for fans has materially increased during the last week, reports made to the ELECTRICAL WORLD show. In Atlanta cool and continued rainy weather has materially interfered, however. While jobbers have closed very satisfactory contracts with their retailers and have shipped many fans under these contracts, retailers' failure to make sales has served to cause an accumulation of stocks.

New England jobbers are looking for an excellent fan season. Stocks in general are as large as last year, and some jobbers report 10 to 15 per cent more on hand. Although there was a considerable carry-over, the expectation of better demand led to broader purchasing by distributors. Last week buying by the public got a fine start owing to severe heat extending through several days. The price reductions undoubtedly stimulated sales to retailers, and the effect carried through to the public.

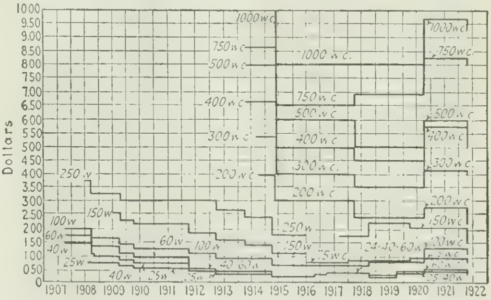
St. Louis reports that absence of warm weather for any continuous period has resulted in very poor fan sales to date. Sales in May were but 50 per cent of the amount anticipated. Unless a real fan business develops by July 4, the entire season's business will be extremely dull. At the beginning of the year all stocks were very low as the result of a small carry-over from last year. Jobbers purchased in fairly good amounts, but what were then considered conservative. The dealers have been extremely conservative in their purchases, and as a result stocks in the hands of the jobbers are mounting to the point of heaviness.

Very warm weather in Portland, Ore., is helping to sell large numbers of fans. Last season was a poor fan season there, and there were large hold-over stocks. A shortage of fans is predicted if the season proves to be very warm.

The fan outlook for 1922 in the Middle West is much better than last year's. Nearly all jobbers state that their stocks are in good shape and that there was very little stock carry-over from 1921. No trouble to dispose of fans has been evidenced. The humid weather of the past weeks has started the season's buying, and while it is too early to estimate the relative percentages, dealers report that the volume of buying is better than that of a year ago. Prices on an average are about 12 to 15 per cent lower than those quoted in 1921. While the public is interested in the cheaper grades, there is, however, a majority who are looking for well-built fans serviceable for several seasons.

Canadian Lamp Committee Finds 40-Watt Size Most Widely Used

THAT the 40-watt vacuum lamp is apparently the most popular size used in Canada, and that the 25-watt and 60-watt sizes closely follow in sales, is the feature of a report just issued by the lamp committee of the Canadian Electrical Association. In the report the lamp committee has confined itself largely to presenting information that will be of educational and technical value to the member companies and to the lamp-buying public in general.



CHANGES IN PRICES AND TYPES OF LAMPS IN CANADA

Of the many million of lamps consumed annually, the following analysis indicates the relative proportion of the various wattages and types:

TYPE B	Per Cent	TYPE C	Per Cent
Sign lamps	3.1	50-watt	2.9
15-watt	1.6	75-watt	4.0
25-watt	20.8	100-150-watt	5.7
40-watt	22.5	200-250-watt	2.1
50-watt	10.2	300-1,000-watt	0.7
60-watt	17.2	Street series	0.2
100-watt	1.6	Others	0.4
Street railway	1.9	Total	16.0
Others	2.1		
Total	84.0		

The accompanying chart shows the dates of introduction of the various types of lamps, also the history of price changes between 1907 and June, 1922.

Cost of Living Decreases

IN THE estimate of the Bureau of Labor Statistics that the total average decrease in the cost of living in the United States from June, 1920, to March, 1922, was 22.9 per cent, a table is published classifying the changes by specified cities. Decrease in living costs during that period was largest in Savannah, Ga., where it declined 25.1 per cent. It was smallest in Los Angeles, Cal., where the decrease was 14.5 per cent. The decrease in other important cities varied as follows: At New York, 22.5; Boston, 23.5; Cincinnati, 24; Kansas City, 23.6; New Orleans, 15.5; Pittsburgh, 21.3; St. Louis, 23, and Denver, 21.2.

Freight Car Shortage Anticipated in Railroad Circles

ALTHOUGH officials of the American Railway Association recently declared it was impossible to estimate the railroad traffic situation six months hence with any degree of accuracy, nevertheless it is known that a shortage of cars by fall is anticipated. There is at the present time a surplus of approximately 70,000 box cars, but this number will be rapidly pressed into service on the termination of the coal strike, which, it is forecast, will end before Aug. 1.

Loading of revenue freight during the week which ended May 27 totaled 821,121 cars, compared with 792,459 cars during the previous week, or an increase of 28,662 cars, according to reports from the American Railway Association. This was also an increase of 25,786 cars over the corresponding week last year, but a decrease of 77,048 cars compared with the corresponding week in 1920.

Credit Conditions in Southern Districts Show Slight Improvement

COLLECTIONS in Southern districts are reported as showing a slight improvement, with the prospect that further improvement will be shown within the next thirty to sixty days. Demand deposits in the last week of April in forty-two banks in the Sixth Federal Reserve District show an increase of $8,000,000, or 3.4 per cent, while saving accounts show an increase of eight-tenths of 1 per cent. Bank clearings for Atlanta for the month of May show an increase of $8,000,000 over May, 1921. These factors, together with the sales that will be realized from bumper peach and apple crops in north Georgia this season, indicate that many old accounts will be liquidated in the near future.

Industrial Building Shows Marked Increase

ONE of the best indications of rapidly reviving industrial activity is seen in the volume of new industrial construction planned, as reported by the Industrial Commissioner of New York. Plans for construction work in that state outside of New York City for the first quarter of this year are in the expenditures proposed nearly double those for the corresponding period last year. This year's plans call for expenditures aggregating $4,022,618 as against $2,191,446 in 1921, an increase of $1,831,172, or over 83 per cent. Over $3,736,000 of the whole amount is for new buildings, the balance covering repairs and alterations to existing buildings.

Another record-breaking month of construction is reported by the F. W. Dodge Company. All previous records were broken in April, May building contracts passing the April total with a margin of 3 per cent. The May total for the twenty-seven Northeastern States was $362,590,000, which was 50 per cent greater than for the corresponding week of last year.

These two record months have brought the volume of construction started from Jan. 1 to June 1 up to $1,352,965,000, the highest recorded figure for the first five months of any year. The year to date is 61 per cent ahead of last year.

From the accompanying figures, it will be seen that there was not only an increase in the money involved but also in the number of plans submitted, this year's plans for the quarter totaling 115 as against ninety-four for the same period last year. The increase also held good on the question of new building, the 1922 figures showing thirty-two new buildings as against twenty-eight for last year. The new building last year involved $1,979,500, while the new building this year aggregated $3,736,500.

COMPARISON OF INDUSTRIAL BUILDING IN NEW YORK

	Number Of Plans	Cost	New Building
First quarter of 1921	94	$2,191,446	$1,979,500
First quarter of 1922	115	4,022,618	3,736,500
Increase	21	$1,831,172	$1,757,000

In commenting on this increase, Commissioner Henry D. Sayer says: "We consider these figures of great value as indicating a decided improvement in manufacturing conditions. We believe they show a marked increase in confidence on the part of manufacturers, who, it would seem, would not be prepared to invest so largely in new buildings if they did not believe there would be a speedy improvement in conditions. No man will tie up his money in new factories that are to remain idle. In other words, these new factories are going to be built, and when they are built will be put in operation. This will mean not only the betterment of conditions through the building of the factories themselves, but will also mean large increases in the number of factory workers employed.

"It should be kept in mind, also, that the figures above do not include Greater New York, and it is without doubt true that they do not represent all of the proposed factory building outside of New York City, as the law does not make it mandatory that builders submit their plans to the department. Because of this it is probable that there are other factory buildings that are going up the plans for which have not been submitted to our engineering division."

Westinghouse Electric Starts 32 Cars of Apparatus to Chile

AS THE first shipment in filling the seven-million dollar contract for electrification of the Chilean State Railways awarded the Westinghouse Electric & Manufacturing Company last October, a train of thirty-two cars of electrical apparatus has been started from East Pittsburgh. This is the largest single consignment of apparatus for railroad electrification that has ever been made, it is stated.

Metal Market Situation

DOMESTIC demand for copper is considered only fair, while foreign demand has shown renewed activity during the last few weeks. Japan has bought a total of several million pounds during the last two days.

Sales of domestic are mostly for July, with some inquiry still for June and a fair demand noted for August. The prices, which have been advancing steadily for more than four weeks, definitely reached the apex at 14 cents a few days ago.

NEW YORK METAL MARKET PRICES

Copper:	June 7, 1922	June 14, 1922
London, standard spot	£ s d. 63 2 6	£ s d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14.00	14.00
Electrolytic	13.87½	13.75
Casting	13.37½	13.37½
Lead, Am. S. & R. price	5.65	5.75
Antimony	5.25	5.12
Nickel, ingot	36.00	36.00
Zinc, spot	5.70	5.75
Tin, straits	32.62½	31.25
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.50 – 11.75	11.00 – 11.50
Brass, heavy	5.50 – 6.00	5.50 – 6.00
Brass, light	5.00 – 5.25	5.00 – 5.25
Lead, heavy	4.70 – 4.75	4.70 – 4.75
Zinc, old scrap	2.87½ – 3.00	3.00 – 3.12½

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in the electrical trade continues at about the same levels as last week without any particular outstanding features. The demand for wiring materials is being well maintained, and as there appears to be no let-up in building activity, the market for supplies promises to be fairly strong through the summer and well into the fall.

Jobbers' stocks generally are in good condition, and shipments on all items are coming through promptly from the manufacturers. Prices are holding to their former levels, although price cutting is not so much in evidence.

Central-station business took on greater activity during the past week and dominates the jobbing field. Demand is for generating equipment, transformers, meters, pole-line materials, in fact, virtually everything a power company can use in the manufacture and sale of its product.

Demand for radio materials is very sluggish. It is now felt throughout the trade that if stocks had been ready for the heavy requirements of the enthusiasts two months ago, approximately 50 per cent more business would have been done in this field. Static conditions are blamed for the diminution in interest, but hope is felt that sales during fall and winter will greatly exceed average expectations.

A slight price increase in the rubber-covered wire market is reported, but the majority of jobbers have not raised prices. The market for this material seems to be unsettled and prices appear spotted. Stocks are good in all cities reporting. The call for bare and weatherproof, while steady, has not increased materially.

NEW YORK

Warmer weather during the past week has brought a heavy demand for fans, and jobbers have been extremely busy filling orders. If sales continue to show the same rate of increase for the remainder of the season as has been made thus far, it is expected that this year's fan business will exceed that of last year by at least 30 per cent. Coincident with the summer weather the radio business has fallen off sharply, and some jobbers state that it is "flat" at the present time and that they expect it to remain so for the next two or three months.

Rigid Conduit.—Demand is moderate, and sales are mostly in small lots. Jobbers are more inclined to hold for the higher schedule of prices, although there are a few houses that still have small quantities of pipe bought before the advance. Prices continue to show the following range: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Prices are steady and demand is only moderate. No. 14, rubber-covered, single-braid, is quoted at $6 to $6.50 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—This material is moving steadily, and prices are firm. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $45 to $47 per 1,000 ft., both for that quantity or more.

Loom.—Non-metallic flexible conductor is in comparatively small demand here, and sales are usually in small lots. The 7/32-in. and ¼-in. sizes, listing at 5.5 cents and 6 cents per foot, are quoted at 70 per cent discount in coil lots. In quantities of 1,000 ft. or more an additional 10 per cent is quoted.

Metal Molding.—Prices are a little lower on this material. The three-wire size in 100-ft. to 500-ft. lots sells for $5 per 100 ft., and in quantities from 500 ft. up to 1,000 ft. it sells for $4.50 per 100 ft.

Outlet Boxes.—In standard-package lots black boxes are quoted at 60 to 62 per cent off list, and galvanized boxes at 55 to 57 per cent off list in the same quantity. Stocks are good and demand is fair.

Tape.—Friction and rubber tape are both quoted at 36 cents per pound in lots of 25 lb. or over.

Fans.—Jobbers report an exceptionally active demand for fans, and so far sales this year show an increase of about 30 per cent over those of last year.

Radio.—It is generally agreed that the demand for radio equipment will be fairly light until fall, when atmospheric conditions will be more favorable and people more inclined to remain indoors in the evening. This lull is expected to be more beneficial than otherwise as it will give the manufacturers, jobbers and dealers a breathing spell and an opportunity to put this business on a more stable basis.

CHICAGO

A few price increases were noticed in this week's electrical market. These changes were on wiring materials—rubber-covered wire and conduit. However, jobbers are holding to their old prices since their stocks obtained before the latest advance are good. The demand for both of these commodities is still active as the building industry is requiring more material every day. The call for lighting fixtures is also riding on the surface of this building activity and dealers are reporting a goodly volume of sales.

An indication of an improved money market is shown by the announcement that call money is now available at 3 per cent. This is the first time since April 17, 1918, that this figure has been so low. Manufacturers are reporting that the efficiency of labor is growing. One tire maker with 2,700 men is doing the same amount of work accomplished by 5,500 men when labor was expensive and its production was at its lowest mark.

Wire.—Although the demand for rubber-covered wire is still good, prices remain spotted. One jobber reports a slight price increase due to the stiffened copper market, but the majority of jobbers have not raised the price. Most of them prefer to allow their customers the benefit of stocks obtained when the rates were lower. The No. 14 rubber-covered is quoted around $6.10 per 1,000 ft. in 5,000-ft. lots. Stocks are good. The call for the bare and weatherproof, while steady, has not increased.

Conduit.—An advance of about 2 per cent was reported on pipe this week, but in general prices have not been advanced, since competition is still keen. The ½-in. black pipe sells around $43 per 1,000 ft. in 5,000-ft. lots, the ¾-in. for $56 and the 1-in. for $84. The galvanized pipe in the same sizes is listed at $49, $64 and $92. The movement has been active and steady with a good volume of small-sized orders. Stocks are ample.

Flexible Armored Conductor.—Most jobbers say that this conductor has slowed up slightly, but market conditions have not changed. The stocks are in ample condition and the No. 14 two-wire, single-strip, retails for $42.50 per 1,000 ft. in 5,000-ft. lots.

High-Tension Equipment.—Business in this line is continuing its healthy growth of the past month. One manufacturer recently shipped an order for fifty 37,000-volt lightning arresters to a utility in Philadelphia. Three 600-kva., 33,000-volt outdoor steel-tower substations were shipped to the Southwest by another company. Manufacturers also report an active demand for 33,000-volt pole-top switches and for farm-lighting equipment.

Lighting Fixtures.—Along with the steady increase in the building of residences and apartment houses there has come an active demand for lighting fixtures. Dealers report that the public are more interested in better designs selling at a fair price than in the cheaper grades. The call for industrial lighting fixtures has also been increased

Washers and Cleaners.—The call for this equipment has been steady, but creative sales effect is still necessary to increase the turnover. Where time payments run from eighteen months to two years dealers report that the interest shown is very active.

Tape.—Although sales are fairly uniform in volume, no changes have occurred. In 25-lb. lots prices range from 36 cents to 45 cents, depending upon the quality.

BOSTON

Increasing activity in electrical circles continues to reflect better business in this district. Jobbers are moving larger quantities of material, though orders are not of spectacular size. Deliveries are excellent in nearly all lines. Prices have stiffened slightly on non-metallic flexible conduit and weatherproof wire, owing to increased costs. Building and engineering contracts in New England for the week ended June 6 totaled $6,666,500, compared with $3,781,700 for the same period last year. Only once in twenty years has this particular week's total been equaled. Downtown Boston is undergoing the most sweeping demolition of old office buildings and construction of new buildings recorded for many years. Residential construction in suburban sections is extremely active. Employees are returning gradually to the textile mills in New Hampshire after prolonged strikes, and conditions in the Lynn shoe factories are improving. Retail trade is very good in New England. Central-station outputs are holding up well compared with last year. Financial conditions are easier and line extensions are going forward on a somewhat larger scale than for several years.

Loom.—On maximum quantities prices stiffened last week 50 cents per 1,000 ft. Stocks are ample and demand is moderate. On 5,000-ft. lots and over, $\frac{7}{32}$-in. loom moves at $14.75 per 1,000 ft., the $\frac{1}{4}$-in. size bringing $17.

Wire.—Rubber-covered No. 14 wire is steady at $6.25 per 1,000 ft. in 1,000-ft. lots. Weatherproof base has advanced to 17 cents, and increased demand due to central-station activities is evident. Bare copper wire is selling in small quantities around $15\frac{1}{2}$ cents to 16 cents base. Building construction is absorbing considerable rubber-covered wire at present.

Washers.—In response to vigorous sales efforts more washers are being moved. Variations in price are still a handicap to broad activity, it is felt in some quarters. The competition of both old and new manufacturers is sharp. Retail sales of washers are spotty, but results are following intelligent and persistent activity.

"Nail-it" Knobs.—In barrel lots these are moving at $15.50 per 1,000. Most of the demand comes from residential or small-store wiring jobs.

Lamps.—Business is better than a year ago, notwithstanding somewhat reduced buying by textile mills. Factory stocks are being increased in anticipation of a very heavy fall business. Prices are firm and the outlook is good.

Ranges.—Sales in the Boston district continue good and the outlook is excellent for the season. Deferred payments are helping to place this class of equipment in service.

Refrigerating Equipments.—Retail interest in this class of apparatus is increasing steadily. Sales during the last two or three months have been very encouraging. Deliveries are first-class and prices are firm.

Flatirons.—A brisk trade in flatirons is apparent, notwithstanding the long-time staple character of these devices. Manufacturers are in close competition.

ATLANTA

Agricultural conditions throughout the section are still very much retarded, with a consequent depression imminent unless weather conditions show immediate improvement. Cotton in Atlanta has reached a new high level for the year of $21.50, and this price is bringing a great deal out of storage. Sale of cotton holdings is assisting materially in stimulating business activities—most of the banks, even in the small towns, reporting an increase in deposits—and merchants seem to be more successful in collections and sales than for some time past. The automobile industry reports sales as the best in many months. Prospects in south Georgia are reported unusually good, with building on the increase and business in general quite optimistic, owing to the prospects of the large peach crop. Building in Atlanta is holding up splendidly, the permits for the month of May numbering 608, with a valuation of $1,743,054.

Schedule Material.—Home construction and small commercial building is causing a very satisfactory movement throughout the entire line, with stocks of material holding up remarkably well. No price changes have been reported recently.

Portable Drills.—This item continues slow, but the prospects are for a pick-up in the next sixty days, due as a result of the activities in the automobile trade. Stocks have been allowed to reach a low ebb, but shipments are satisfactory.

Industrial Motors.—A fair number of orders and a quite satisfactory amount of inquiries are being received in this line, there being a noted tendency toward the larger sizes of the synchronous type. Standard lines are on hand in fair quantities, while shipments on the synchronous type are quite satisfactory. Prices are holding firm.

Oil Switches.—This specialty seems to keep in close touch with the movement of motors, being stimulated somewhat by rulings in some of the cities requiring oil switches to be installed ahead of the compensator on motors of 550 volts and over. Local stocks are in fair to good condition with prices steady.

Panelboards.—Building construction is causing a very satisfactory volume of sales in this line, especially for the moderate-sized installations. Jobbers report shipments as satisfactory and prices steady.

Battery-Charging Outfits.—Sales of the small outfits are reported as quite satisfactory, most of them going in connection with radio equipment. The larger sizes are very slow as the automobile trade's activity has not been of long duration to make purchases felt.

Electric Ranges.—The demand for ranges can be classed as only fair, though in isolated localities sales are reported as comparatively good. The continued high prices tend to hold down the volume of sales in this specialty. Local stocks are in good shape, with shipments satisfactory.

Insulators.—Sales of the glass telephone type are reported very good, with the porcelain type on the increase. Central-station companies are taking increasing quantities. Good stocks and shipments are reported in both types.

ST. LOUIS

Central-station business is a predominating factor in the electrical jobbing field this week. Lower money rates are making possible much-needed enlargements of the power companies' facilities which were out of the question with the high rates of a year or more ago. The demand is for generating equipment, transformers, meters, pole-line materials—in fact, virtually everything that a power company can use in the manufacture and sale of its product. The municipal plants are likewise good buyers, most of the bond issues having been voted upon favorably.

The demand from the industrial companies, while improving, does not yet show the activity of the other sources of demand. Several new industrial projects are under construction, among them being a very large refrigeration plant. Merchandising materials on the whole are moving slowly. The fan season has not opened, and there is a noticeable backwardness toward buying on the part of the public. A contradictory feature in appliance sales is a good demand for heating pads.

Non-employment has diminished materially since the first of the year. All lines of industry are taking on additional men, especially the electrical manufacturers, automobile manufacturers, cement plants and steel mills. The Wagner Electric Company plant has added over 600 employees to its force since the first of March and now has 2,000 workers on its payroll. The normal force is from 3,000 to 3,500.

Collections show very little change. The old long-due obligations are being liquidated slowly, but current obligations are being met comparatively well. The average is generally reported around sixty days. The agricultural improvement in the South has aided credit conditions very appreciably, and betterment in collections is anticipated after this season's crops are sold.

Bells and Buzzers.—The increased building activity has given impetus to sales, and fairly satisfactory business is now reported. A normal stock is generally found. In standard package quantities bells are quoted about as follows: Class C, 2½-in., 41 cents each; class C, 3-in., 44 cents each; class C, 4-in., 50 cents each; class B, 2½-in., 48 cents each; class B, 3-in., 51 cents each. Similarly, class C buzzers sell for 40 cents each and class B buzzers for 46 cents each.

Soldering Materials.—With conservative stocks and steady demand, prices are firm. Representative prices are as follows: Soldering paste, 2-ounce cans, 19 cents each; soldering sticks, 14 cents each; soldering salts, ½-lb. cans, 36 cents each; wire solder, 40-60, 22 cents per pound; bar solder, 40-60, 23 cents per pound; bar solder, 50-50, 28 cents per pound—all prices being for orders of twenty-five units of each class.

Bell-Ringing Transformers.—The demand is improving, though still slow, as the public is backward in adopting this accessory. In lots of ten a small size sells for 80 cents each, and a larger size for 85 cents each. A heavy-duty type, rated at 60 watts, brings $3.70 each.

Heating Pads.—An interesting development in recent sales is a strengthening demand for heating pads, hospitals being good purchasers. Some hospitals report the patients so well pleased with them that they have difficulty in maintaining their supply. One jobber reports he is now selling as many in a month as he formerly sold in a year.

Flatirons.—While the demand is comparatively good, it does not reach the volume anticipated. Special campaign work is under way in the hope of increasing sales. Stocks are slightly inclined toward heaviness.

Radio Supplies.—A diminishing in demand is perceptible, possibly of seasonable nature, but back orders are still heavy and any shipment of tubes is immediately taken. Some representative prices are as follows: "B" batteries, 16½-volt to 22½-volt, $1.80 each; 22½-volt, $1.05 each; head sets in orders of ten, $11.25 each; antenna strain insulators, $8.92 per 100; radio insulators, $7 per 100. Magnet wire in ½-lb. spools, double-cotton-covered, is quoted as follows: No. 20, 52 cents each; No. 22, 61 cents each; No. 24, 78 cents each; No. 25, 86 cents each; No. 26, 95 cents each; No. 27, $1.05 each; No. 28, $1.12 each; No. 30, $1.67 each.

SAN FRANCISCO

As an indication of the growth of building construction this spring, the value of San Francisco building permits for May was $4,377,066, compared with $1,097,151 for last year. Furthermore, the number of building permits for May of this year shows a 50 per cent increase over the number of permits for the preceding month, compared with a 25 per cent increase in the value of the permits, proving that residence building is increasing out of all proportion. The sudden rise of rivers in the interior valleys caused by rapidly melting snow on the Sierras has done a certain amount of damage. A very serious loss was caused to the orange crop by January frosts.

Retail business for the past few months has shown a decrease over previous months, but indications point to an increase. Furthermore, retail business this month will be stimulated by the fact that the Rotary convention in Los Angeles and other conventions in San Francisco will bring close to a half a million visitors to the state during June. The number of business failures is decreasing, collections are slightly better, employment is increasing, and many of the department stores have again taken on part of the employees that were released a few months ago.

Schedule Material.—Ocean shipments at low rates have resulted in excellent local stocks of all schedule material, and the proposed rail freight rate deductions will be a tremendous help, it is said.

Porcelain Material.—Porcelain lines are showing excellent movement, although because of building regulations this is more specialized. No. 5½ split knobs are now generally quoted at about $10.75 per 1,000, and two-wire and three-wire glazed cleats for No. 14 and No. 12 wire at about $19.25 per 1,000 pairs in barrels.

Radio Material.—Shipments are still very slow, and the result has been that many inquiries which would have led to immediate orders had stocks been forthcoming have now ceased to be urgent. There is now comparatively little activity in these lines, and the number of visitors to radio stores has markedly decreased. This may foretell a decline in the radio boom, but, on the other hand, most dealers feel that demand will even surpass its former proportions when stocks at last arrive.

SALT LAKE CITY

At the well-attended convention of the Northwest Electric Light and Power Association just held at Boise, Idaho, the vast development possibilities of the West were pointed out. A hopeful and optimistic spirit characterized every meeting of the convention. Announcement is made that several new concerns for the financing of home building have entered the field in the Intermountain country and they are said to have the co-operation of large firms in the East. Home building is still proceeding at a good rate. "Electrical home" demonstrations are putting over their message in the larger cities with good effect. Contractor-dealers report a growing interest in electrical appliances.

Crop conditions in this region are reported highly favorable. The season when late frosts threaten is well past, and the outlook for heavy fruit yields is very encouraging. Farm labor is plentiful, and agriculturists of all classes are in decidedly better shape financially. Highway construction, which is proceeding at a good rate in the Mountain States, is reflected favorably in general business conditions. Hundreds of men are finding employment, and the general buying tendency is showing improvement.

PORTLAND—SEATTLE

Most lines show a remarkable gain during the first five months of this year as compared with the first five months of last year. Building permits have increased 45 per cent, lumber shipments 206 per cent, and imports of silk entering the port of Seattle 80 per cent. The number of men employed on the docks to handle cargoes is now greater than at any time since the 1919 peak.

Lumber production for the week ended June 3 was 4 per cent above normal, while new business for the first time in many weeks fell below production. Building continues very active and prices of some building materials are stiffening materially.

Electrical jobbers report business improving with orders increasing. Manufacturers report that stocks are not so good, as inroads are made by increasing orders. Dealers' store sales are about normal with fixture business very active and on the increase.

Wire.—Rubber-covered wire is moving particularly well. Prices have been stiffening in recent weeks, and an advance of 2 to 3 per cent has just been made effective. Weatherproof wire is also moving better, and a similar increase applies to this item. Present quotations are: No. 14, rubber-covered, $6.70; No. 12, rubber-covered, $9.10; weatherproof wire, No. 8 to No. 4/0 inclusive, is quoted at 20 cents per pound in 500-lb. lots.

Lamp Cord.—This item is in fair demand at from $12.97 to $13.30 per 1,000 in 5,000-ft. coil lots.

Sockets.—The movement in sockets is very good. Approximate prices now in effect are: pull chain, $25; key $24.75, and keyless, $22.50 per 100, in standard-package quantities.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Multi Electrical Increases Capacity 50 per Cent

The Multi Electrical Manufacturing Company is now at 1848 West Fourteenth Street, Chicago, having moved from 703 Fulton Street. William T. Casey, the vice-president, speaking with a representative of the ELECTRICAL WORLD, said that this change increased the company's floor space about 50 per cent over the 1921 capacity, but rated on a 1920 basis it was an increase of 141 per cent.

More machinery and equipment are being added to allow better manufacturing facilities and maintenance of stocks. Mr. Casey said that the demand for porcelain bushings and fittings had been so active that he had experienced difficulty in maintaining his stocks. C. T. McDonald is president of the company.

X-Ray Reflector Company Increases Staff

The engineering staff of the National X-Ray Reflector Company, 235 West Jackson Boulevard, recently acquired the services of three resident engineers located, respectively, in Philadelphia, Cleveland and St. Louis. George P. Prichett's headquarters will be in Philadelphia, while Robert P. Burrows will be at the Cleveland office. John S. Gulledge, the resident engineer of St. Louis, will assist the Southern district manager, H. O. Bourkard.

American Wiremold Company Moves Offices

Executive and sales offices of the American Wiremold Company, Hartford, Conn., have been moved from the factory to 252 Asylum Avenue.

Indiana Electric Company Interested in Texas

Alexander G. Moore, industrial engineer of the Interstate Electric Company of Indiana, has been assigned by that company to make a survey of Marshall, Tex., and the surrounding territory. Mr. Moore will spend three weeks in making the survey, which will include the raw materials for manufacturing purposes, such as glass, sand, iron ore, lignite, pulp timber and fire clay, together with oil gas and other fuel possibilities. The results of the survey will be made available to new industries seeking locations in this section.

The survey was decided on as a result of the visit to Marshall of Martin J. Insull, president of the Interstate Electric Company. Mr. Insull is said to have been much impressed with the possibilities of Marshall as a center for various manufacturing industries.

Large English Concern to Invade Canadian Market

That British interests are to compete keenly in the Canadian electrical supply and engineering field is an avowed fact, according to P. Pybus, managing director of the English Electric Company, which last year formed a Canadian subsidiary, with a plant at Toronto. The lowered preferential tariff will prove a boon to the English company in its invasion of the Canadian market. According to Mr. Pybus, as much business as possible will be handled through the Toronto plant, although much will be contracted for in the home mills. It is said that the company intends to compete for every electrical contract in Canada.

Coast Equipment Company Made Representative of Meter-Tester Makers

The Coast Equipment Company of San Francisco, Seattle, Los Angeles and Portland, has been appointed representative of the States Company, Hartford, Conn., manufacturers of meter testing and related apparatus. To W. D. Hodgson, formerly representing the States Company and the Sangamo Electric Company in the Southeast, has been assigned the representation of the former in eastern New York State under the title of the Hodgson Electric Appliance Company. At present Mr. Hodgson can be reached at the States Company's headquarters, 72 Francis avenue, Hartford.

Another representative, recently appointed, is the Electric Appliance Company, 701 West Jackson Boulevard, Chicago.

Discussing business conditions briefly last week, C. P. Upson, sales manager of the States Company, said inquiries are very active for the central-station test tables produced by this organization and the sales of radio transformers are holdng up well. The volume of business in general compares favorably with that of earlier spring. A new section (No. 10) is out in the company's catalog No. 1 on "Phasing Transformers," and a new section (No. 2) has been published for use in the company's catalog No. 1 on "Potential Phase Shifters."

Declares Government Would Save $100,000,000 Placing Orders with Navy Yards

In testimony before the House Naval Committee, O. S. Boyer, consulting engineer for the International Association of Machinists, stated that the government would save $100,000,000 annually if it placed orders for equipment, repair work and supplies with navy yards and arsenals instead of with private firms under contract. The suggestion would cover electrical equipment, engines and other machinery.

Organize Hundred-Thousand-Dollar Corporation to Manufacture Radio Sets

The Anderson-Durand Radio Corporation has been organized and incorporated at Rochester, N. Y., for manufacturing radio receiving sets and novelties. Incorporators: Mortimer H. Anderson, Samuel E. Durand and John F. Durand. Capital stock is $100,000.

Traffic Signal Device Invented by General Electric Official

A device intended to supplant the semaphores now in use in New Orleans in controlling street traffic, an invention of Benjamin Willard, local manager of the General Electric Company, is being given a try-out by Commissioner Ray of the Department of Public Safety. This new traffic guard consists of a combination of three lights, each of a different shape—a round red light, a rectangular white light and a diamond-shaped green light. The signal is so constructed as to be visible from all directions and is to be suspended above the street.

New Agent-Jobber for Westinghouse

The Carolina States Electric Company, Charlotte, N. C., has been designated by the Westinghouse Electric & Manufacturing Company as agent-jobber for the company in North and South Carolina, according to an agreement reached May 22.

Heretofore the business of this company handled in the two states was credited to the agent-jobber in Richmond, Va., while the nearest agent-jobber to the south was in Atlanta, Ga. The establishing of the agency at Charlotte will result, it is estimated, in the handling of $200,000 worth of business more through that city. The local company has under a special arrangement been operating as representative in this section for the Westinghouse concern for the past two years, but this is the first actual distribution company that has been established with headquarters in Charlotte.

The company handles all of the products of the Westinghouse company and has connections with other organizations that supply material needed for distribution but not manufactured by

Westinghouse. Offices and warehouse are located at 218 West First Street.

The officers of the Carolina States Electric Company have been formerly connected with the Westinghouse organization and formed and incorporated their company in December, 1919. These officers are: E. B. Graham, president; H. T. Long, vice-president in charge of purchasing; J. P. McMillan, vice-president in charge of sales; W. A. Emerson, secretary-treasury, and J. A. Auten, assistant secretary-treasurer.

Combustion Company Buys the General Combustion Rights

The receiver of the General Combustion Company, Chicago, has sold the name of that company, its patent rights, drawings, patterns, trade marks, good will and contract records, to the Combustion Company, 4256 North Western Avenue, Chicago. The combustion Company will continue the manufacture of the industrial furnaces and parts formerly manufactured by the General Combustion Company, the line including fuel-oil burners. Many inquiries and bookings have accumulated during the receivership, according to William T. Dean, president of the Combustion Company, and the management will give its attention to clearing up these matters.

Screw-Thread Matters to Be Considered

Screw-thread matters will be considered at three meetings which are being planned for the end of this month at Washington. One of the meetings will be that of the National Screw Thread Commission. The sectional committee on general engineering work plans to meet immediately after the meeting of the commission. The sectional committee on standardization and unification of screw threads also expects to meet at about the same time.

Condit to Sell Temperature-Indicating Apparatus

Exclusive sales rights in the temperature-indicating semaphore apparatus developed by the Standard Thermometer Company, Roxbury, Mass., have been acquired by the Condit Electrical Manufacturing Company, South Boston, Mass. All marketing of this equipment, which is of recent application to the transformer rating problem under varied service conditions, will be handled by the Condit organization.

New Instrument Company Established at Stamford

Radio apparatus and other engineering devices are to be manufactured at Stamford, Conn., soon by the Connecticut Instrument Company, a recently incorporated organization which has leased the Lounsbury & Soule factory on Broad Street. R. E. Gilmore, former general manager of the Sperry Gyroscope Company, Brooklyn, N. Y., is president and treasurer.

British Showing Considerable Interest in Radio

That considerable interest has been shown by the British public in the spread of wireless telephony and telegraphy in the United States is the feature of a report made this week to the electric supplies division of the Department of Commerce. It is said in the report that a campaign has been started for the development of similar facilities in Great Britain and that in this connection there may possibly be a market for inexpensive American wireless outfits.

Tuska Company Moves

The C. D. Tuska Company, manufacturer of radio apparatus at Hartford, Conn., has moved from 16 Hoadley Place to larger quarters at 69 Bartholomew Avenue.

The H. E. Gleason Company, lighting fixture manufacturer, Seattle, has moved from 1517 Second Avenue to 418 Union Street, where new and larger quarters will enable the company to care better for its rapidly increasing business.

The Electrical Products Manufacturing Company, manufacturer of electrical supplies, with a plant in Providence, R. I., has recently leased large floor space at 24 Fountain Street, that city, to be used for additions to its plant.

The Wyckoff Engineering Corporation has moved its headquarters from 233 Broadway, New York, to 56 West Forty-fifth Street in order to obtain room for necessary expansion of activities.

The Wagner Electric Manufacturing Company, St. Louis, has moved its Salt Lake City office to 313 Dooly Building.

The Simplex Wire & Cable Company, manufacturer of insulated wire and cable, Boston, has awarded to Stone & Webster, Inc., Boston, a contract for the construction of a four-story 100 ft. x 90 ft. reinforced-concrete fireproof addition to its plant at Cambridge, Mass. The new building will cost about $75,000.

The municipal electric plant at Fort Atkinson, Wis., has placed an order with the General Electric Company for three 333-kva. substation transformers and other apparatus, it is announced.

The Stahl Rectifier Company, formerly at 1401 West Jackson Boulevard, is now situated at 1455 Congress Street, Chicago. William Stahl, the president, states that the new location affords better manufacturing facilities with better lighting and air conditions.

Sale of Surplus Signal Corps Supplies—The War Department reports that up to May 15 a total of $520,981 of surplus supplies of the Signal Corps have been sold or transferred to other government departments. This amount is 65 per cent of the original cost of the materials.

The Radioceive Manufacturing Company, Newark, N. J., has been recently organized to manufacture radio devices and equipment. The following men are connected with the company: Emil F. Johnson, formerly of Emil F. Johnson & Company, New York City, treasurer; E. H. Lindholm, factory manager, and Ernest Mentor, sales manager.

Charles A. Burroughs & Staff, Newark, N. J., have leased a portion of the building at 17-23 Nevada Street for the establishment of electrical experimental laboratories, with manufacturing facilities, primarily for use in connection with wireless equipment. Mr. Burroughs is the inventor of the Everett head receiver, now being manufactured by the Splitdorf Manufacturing Company.

The Crescent Insulated Wire & Cable Company, North Olden Avenue, Trenton, N. J., will build a one-story addition to its plant. The company has recently organized a subsidiary, to be known as the Crescent Armored Wire Company. General C. Edward Murray heads both companies.

The Hygrade Lamp Company, Salem, Mass., has awarded all sub-contracts for the erection of its new four-story plant, 50 ft. x 100 ft., for the manufacture of electric lamps and kindred specialties, and plans to occupy the structure immediately upon completion.

M. M. Fleron & Son, Inc., Trenton, N. J., organized with a capital of $100,000, will specialize in the manufacture of radio equipment. All production for the present will be handled in outside local plants, including the Pyrolectric Instrument Company, Ingersoll-Trenton Watch Company and the Star Porcelain Company. The company is headed by Russell and Louis H. Fleron, 113 North Broad Street.

The Radio Corporation of America announces the opening of a district office of its sales department at 10 South La Salle Street, as well as a warehouse at "Unit B," Central Manufacturing Building, Chicago. This new office is to provide a more central point for distributors and thus offer them convenient facilities for the handling of radio apparatus.

The Federal Telegraph Company, Hobart Building, San Francisco, with the Radio Corporation of America, New York, is perfecting plans for the installation of a series of wireless stations in China, with the largest plant at Shanghai. The total cost is estimated at $13,000,000.

The Grand Central Mine, one of the largest in the Tintic district in Utah, has recently replaced its steam compressor with an electrically driven one, giving a materially increased supply of air at a greatly decreased cost of operation. Plans have been completed for the electrification of the hoist, and the necessary motors have been ordered. A new electric shaft signal system and mine telephone system will be installed within the next thirty days, it is reported.

Foreign Trade Notes

THE SOCIETA ITALO-AMERICANA PER LA ELETTROTRAZIONE has been formed in Italy, the *Electrician* states, for the purpose of constituting an association of Italian power companies and American firms in order to promote the production and distribution of electricity and the construction and operation of electric railways and tramways. The principal object of the company is the adoption in Italy of American systems of continuous-current high-tension transmission for traction systems, and some Italian engineers have been sent to the United States to study electrification methods.

PROPOSED COMMISSION TO PROMOTE NEW ELECTRIC PLANTS IN SOUTH AFRICA.—A bill for the appointment of a commission for establishing and maintaining stations for supplying electricity to government and local authorities, companies and individuals, also for an investigation regarding additional supplies and the co-ordination of existing undertakings with a view of stimulating the supply of electricity, has, according to the *Electrician*, been introduced by Mr. Malan, South African Minister of Mines and Industry, into the South African Parliament.

PAN-PACIFIC COMMERCIAL CONFERENCE.—The first Pan-Pacific commercial conference will be held in Honolulu, Hawaii, from Oct. 25 to Nov. 8, 1922, under the auspices of the Pan-Pacific Union. This is the fourth in the series of conferences which the Pan-Pacific Union is calling. The first was a conference of scientists from about the Pacific, the second one of educators, and the third one of journalists. Frank F. Bunker, Honululu, is executive secretary.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Quotations are desired by a firm in Canada (No. 2,376) for the purchase or agency for radio-telephone outfits, with amplifiers for private homes.

The purchase of any salable electrical novelties is desired by a firm in England (No. 2,436).

A dealer in electrical supplies in Italy (No. 2,438) wishes to purchase electric fixtures from firms in the United States.

Firm in Spain (No. 2,439) desires to purchase electrical machinery and supplies.

A merchant in Canada (No. 2,441) desires to purchase electric waxing brushes.

A firm in the Netherlands (No. 2,443) wishes to purchase or secure an agency for electric motors, pneumatic tools, all kinds of oil motors, steam turbines, etc.

A mercantile firm in Spain (No. 2,450) desires to purchase electrical supplies, etc.

New Apparatus and Publications

FUSES.—The Multiple Electric Products Company, Ltd., 450 Fourth Avenue, New York City, is distributing a four-page leaflet announcing the change in name of its "Atlas" heavy-duty railroad fuses to the "Multiple" time-lag fuses.

SUPERHEATERS.—Bulletin T-1 issued by the Superheater Company, 17 East Forty-second Street, New York City, describes and illustrates its "Elesco" superheaters.

PORTABLE ELECTRIC TOOLS.—The Cincinnati Electrical Tool Company, 1501 Freeman Avenue, Cincinnati, is distributing a six-page folder covering its electric tools.

STORAGE BATTERY CHARGER.—The Wald Electric Manufacturing Company, 248-256 North Tenth Street, Brooklyn, N. Y., is distributing a leaflet describing its new "Niagra" storage battery charger (direct and alternating current) for radio, automobile or motorboat batteries.

CELL FILLER.—The Electric Storage Battery Company, Philadelphia, has recently developed the "Exide" cell filler, a new device for filling storage-battery cells.

LIGHTNING ARRESTER.—A new type of direct-current electrolytic lightning arrester, known as "Type AR," for car or station use on railway, power and lighting circuits, has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SOOT CLEANER OPERATOR.—A new device, known as the "Vulcan ratchet operating head" for operating mechanical soot cleaners, has been brought out by the Vulcan Soot Cleaner Company, Dubois, Pa.

LIGHTING FIXTURES.—"P & S Standard Elexits Sales Information" is the title of an eight-page bulletin distributed by Pass & Seymour, Inc., Solvay Station, Syracuse, covering the "P & S" standard elexits. The company is also distributing a four-page leaflet describing its "B-R Fluto Base" and adjustable adapters for same.

HEATING UNITS.—The Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh, Pa., has issued a six-page pamphlet announcing that it has added to its line of "Chromalox" products a complete line of electric range lids and hot-plate units ranging in sizes from 4¼ in. in diameter, 440 watts, to 8¼ in. in diameter with the maximum input of over 2,000 watts designed for three heats.

ELECTRIC VACUUM CLEANER.—The Eureka Vacuum Cleaner Company, Detroit, has placed on the market a new vacuum cleaner, known as the improved model 9 "Eureka."

INSULATING AND SOLDERING COMPOUNDS.—A catalog supplement, known as 5-A, supplement No. 2, describing the Westinghouse line of insulating and soldering compounds and announcing the extension of that line of products, has been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OVERHEAD CRANE.—A new type of overhead crane, designed for power-plant service, has been brought out by Maris Brothers, Fifty-sixth Street and Gray's Avenue, Philadelphia.

TOOLS FOR HIGH-VOLTAGE WORK.—The W. T. Safety Tool Company, Inc., has issued a catalog covering its tools and equipment for working on high-tension transmission lines without interruption of service, including the sleever and twister set.

GENERATOR TEST STAND.—David W. Onan, 43 Royalston Avenue, Minneapolis, is distributing a leaflet describing the "Onan" generator test stand, lathe and bench and also the "Onan" generator test stand for Ford stations.

BOILER DAMPER CONTROL.—The Northwestern Manufacturing Company, Milwaukee, is distributing a booklet describing its new boiler damper control "Northwestern," for use with underfeed stokers using forced draft or with gas-fired or oil-fired boilers, recently developed by the company. The Southern States Equipment Company, 1921 Powell Avenue, Birmingham, Ala., is exclusive sales agent.

MOTORS.—The Reynolds Electric Company, 2,560 West Congress Street, Chicago, has issued bulletin No. 204, describing its type B alternating-current, split-phase induction motors, ranging from speeds of 840 to 3,450.

ELECTRICAL SUPPLIES.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has issued a new pocket edition of catalog No. 23, covering the entire line of Benjamin products.

POLE-TOP SWITCH.—Bulletin No. 108 issued by Scweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, describes its new three-pole, double-throw type R pole-top switch.

New Companies

THE TENNESSEE ELECTRIC POWER COMPANY, Baltimore, has been incorporated with a capital stock of $40,000,000 by Edward Winslow, George Lee Estebrook and George Rickard Nichols, all of Philadelphia.

THE WEST PENN-WEST VIRGINIA WATER POWER COMPANY, Kingwood, W. Va., has been incorporated with a capital [illegible] by A. M. Lynn, R. B. Keating and C. P. Billings, all of Pittsburgh.

THE [illegible] (PA.) ELECTRIC COMPANY has been incorporated to furnish electricity in the borough of Womelsdorf. The incorporators are John S. Graybill, Jr., R. S. Hull and J. Guy Eshelman, of [illegible].

THE MILLINOCKET & EAST MILLINOCKET LIGHT COMPANY Lewiston, Me., has been incorporated with a capital stock of $150,000 to construct and operate electric and gas plants in the towns of Millinocket and East Millinocket. The directors are: William B. Skelton, Lewiston, president; Charles B. Carter, clerk and treasurer, E. M. Dunn, and C. A. Litchfield, Auburn.

Record of Electrical Patents

Notes on United States Patents

(Issued May 23, 1922)

1,416,929. Art of Electrolysis; William E. Bailey, Washington, D. C. App. filed Nov. 7, 1921. Apparatus for spot plating.

1,416,948. Combination Socket and Resistance; Alfred H. Donahoe, Chicago, Ill. App. filed March 7, 1921. Switchboard panel lights.

1,416,963-1,416,965. Electrical Heater; H. H. Moreton, Venice, Cal. App. filed July 30, 1920. Three patents on heaters with parabolic reflectors adaptable to lamps socket.

1,416,992. Electric Toaster; P. K. Stehman, Elizabethtown, Pa. App. filed Feb. 3, 1921. Toasts on both sides simultaneously.

1,417,007. Process of Making Electric Storage Batteries; Horace M. Williams, Providence, R. I. App. filed Aug. 19, 1920. Solid electrolyte.

1,417,046. Apparatus for Producing Ozone; Harry E. Ellis, Jacksonville, Fla. App. filed Dec. 10, 1920.

1,417,073. Electric Heater; H. Kruesheld, New Washington, Ohio. App. filed Feb. 1, 1921. Means for holding element.

1,417,074. Electrically Heated Cooking Utensil; H. Kruesheld, New Washington, Ohio. App. filed June 29, 1921. Coffee percolator.

1,417,079. Electric Heating Device; William F. Lebzelter, Elizabethtown, Pa. App. filed Feb. 3, 1921. Toaster.

1,417,095. Furnace; R. P. Moodie, Ottawa, Ontario, Can. App. filed Nov. 26, 1920. Electric furnace for house heating.

1,417,109. Phonograph Drive Mechanism; H. K. Sandell, Chicago, Ill. App. filed April 11, 1921. By electric motor.

1,417,114. Electrometer; F. R. Sommer, Brooklyn, N. Y. App. filed June 15, 1920. Design of pole plates.

1,417,143. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed Nov. 10, 1916. For variable-speed battery-charging generator.

1,417,151. Compressible Pile Regulator; A. W. Donop, San Francisco, Cal. App. filed March 26, 1919. Carbon pile regulated by solenoid.

1,417,154. Electric Heating Apparatus; Thomas D. Finizio, Kitchawan, N. Y. App. filed July 15, 1920. Grill plate.

1,417,189. Concentrator; J. B. McCarthy, Copper Cliff, Ont., Can. App. filed Jan. 12, 1920. Separates metals from non-metals.

1,417,214. Storage-Battery Element; J. C. Sundby, Enderlin, N. D. App. filed Sept. 7, 1920. Construction of plates for a Planté battery.

1,417,287. Copper Conductor for Electric Lamp Bulbs and Other Vacuum Tubes; Teizo Yanai, Tokyo, Japan. App. filed May 29, 1918. Copper lead in wire.

1,417,303. Electric Furnace; Hector de Nolly, Lyons, France. App. filed April 8, 1920. For fusion and refining of metals.

1,417,315. Electric Water Heater; W. W. Graff, Cleveland, Ohio. App. filed July 6, 1921. Current turned on by flow of water.

1,417,342. Electric Ship Propulsion; J. Martin and F. H. Clough, Rugby, England. App. filed March 24, 1921. By synchronous motors with variable-frequency source.

1,417,350. Trolley Wheel; Ellyson S. Robinson and J. Bowers, Richmond, Va. App. filed Jan. 3, 1922. Two-wheel trolley for trackless cars.

1,417,408. Wire Connector; George W. Pugh, Leona Mines, Va. App. filed Oct. 24, 1921. For trolley wires.

1,417,409. Electrical Water Heater; T. L. Ralph, Bridgeport, Conn. App. filed Jan. 20, 1921. Operated by flow of water.

1,417,113. COLORATION OF METALLIC SURFACES; Tito Rondelli, Turin, Italy. App. filed June 30, 1920. For bronzing metallic surfaces.

1,417,121. ELECTRICALLY HEATED FLATIRON; Emil Stranszky, Dover, Ohio. App. filed March 5, 1921.

1,417,122. CIGAR LIGHTER; F. W. Strubing, Hartford, Wis. App. filed Sept. 27, 1920. Connected to 110-volt supply.

1,417,427. ELECTRIC HEATER; L. J. Tracy (deceased), St. Louis, Mo. App. filed March 11, 1921. Ornamental room heater.

1,417,430. LOCK; D. M. Tulloch, Dunellen, N. J. App. filed Nov. 9, 1920. Magnetic door lock.

1,417,452. ATTACHMENT PLUG; H. Catlin, Bridgeport, Conn. App. filed April 30, 1919. For electric irons, toasters, etc.

1,417,464. PRODUCTION OF THIN METAL SHEETS OF FOILS; T. A. Edison, West Orange, N. J. App. filed July 16, 1920. By electrodeposition.

1,417,479. TELEPHONE RECEIVER; Sigmund Honig, New York, N. Y. App. filed July 19, 1920. Loud-talking receiver.

(Issued May 30, 1922)

1,417,502. ELECTRIC TROLLEY CAR; Charles H. Copley, Springfield, Mo. App. filed May 28, 1920. Each controller connected to pole on opposite end of car.

1,417,585. APPARATUS FOR USE IN CONNECTION WITH CHEMICAL AND PHYSICAL OPERATIONS; A. T. Stuart and G. N. Middleton, Toronto, Ont., Can. App. filed July 5, 1917. Reaction temperature created by electricity.

1,417,608. HANDLE FOR ELECTRIC LANTERNS; J. W. Knoblock, New York, N. Y. App. filed Oct. 28, 1920. In form of hook.

1,417,620. ELECTRIC CLOCK; Paul Mansel, Charlottenburg, Germany. App. filed Aug. 15, 1918. Secondary clock with striking train.

1,417,649. PLUG-IN ATTACHMENT; D. P. and J. F. Williams, Sandusky, Ohio. App. filed May 21, 1921. For radio circuits.

1,417,662. RADIO-SIGNALING SYSTEM; Lee De Forest, New York, N. Y. App. filed June 16, 1917. One tube receiving circuit.

1,417,668. SHAPING AND IRONING TOOL; F. E. Kern, St. Louis, Mo. App. filed Feb. 14, 1921. For millinery work.

1,417,671. ELECTRICAL MEASURING INSTRUMENT; Paul M. Lincoln, Pittsburgh, Pa. App. filed Sept. 16, 1918. Calibrating device for thermal demand meter.

1,417,692. DRY BATTERY; D. Rosen, New York, N. Y. App. filed Nov. 13, 1920. Materials kept apart until time for use.

1,417,696. CAR-LIGHTING SYSTEM; G. F. Smith, Wilkinsbrug, Pa. App. filed June 9, 1919. Motor-generator trolley car set.

1,417,710. SYSTEM OF ELECTRICAL DISTRIBUTION; E. C. Ballman, St. Louis, Mo. App. filed Dec. 18, 1919. Control of lights connected to magneto.

1,417,715. RECORDING LOCK; J. W. Bryce, Binghamton, N. Y. App. filed June 26, 1920. For protection of stores, offices, etc.

1,417,731. MEANS FOR AND METHOD OF ACCELERATING INDUCTION MOTORS; R. E. Helmund, Swissvale, Pa. App. filed Aug. 10, 1918. Operated from variable primary frequency.

1,417,732. MEANS FOR AND METHOD OF ACCELERATING INDUCTION MOTORS; R. E. Hellmund, Swissvale, Pa. App. filed frequency changers and phase converters.

1,417,733. SYSTEM OF CONTROL; R. E. Hellmund, Swissvale, Pa. App. filed May 7, 1919. Accelerating and regenerative operation of railway motors.

1,417,734. SYSTEM OF CONTROL; R. D. Hellmund, Pittsburgh, Pa. App. filed July 5, 1919. Regenerative control for railway motors.

1,417,735. SYSTEM OF SPEED CONTROL FOR INDUCTION MOTORS; R. D. Hellmund and H. G. Jungk, Swissvale, Pa. App. filed Aug. 26, 1918. Accelerating induction motor associated with frequency changer.

1,417,750. MOTOR-CONTROL SYSTEM; Edwin S. Lammers, Jr., Elmira, O. App. filed May 28, 1919. Regulating speed of controller after abnormal condition.

1,417,786. SOUND-RECEIVING APPARATUS; William L. Walker, New York, N. Y. App. filed Nov. 19, 1917 Detects sounds in water.

1,417,787. RAILWAY LIGHTING SYSTEM; L. A. Watson, Port Washington, N. Y. App. filed Jan. 29, 1916. Axle driven generator with a storage battery.

1,417,803. MAGNETOMETER FOR MEASURING WEAK MAGNETIC FIELDS; J. L. Valente Da Cruz, Newcastle-Upon-Tyne, England. App. filed April 23, 1918.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HERMON, ME.—The Black Stream Electric Company contemplates extending its transmission lines to Levant to furnish electrical service there.

PERHAM, ME. — The Public Utilities Commission has granted Charles O. Austin of Washburn permission to furnish electricity in Perham.

PORTLAND, ME. — The Cumberland County Power & Light Company has applied to the Public Utilities Commission for permission to issue $1,000,000 in bonds, the proceeds to be used for building a new steam-driven power station at South Portland.

SKOWHEGAN, ME.—Work has started on the new mill of the New Main Spinning Company on Skowhegan Island. The building will be three stories high, 82 ft. x 218 ft., and will be equipped with electric motor-driven machinery.

HYANNIS, MASS.—Arrangements have been made whereby a direct transmission line will be erected from Wareham to Buzzards Bay over which the New Bedford Gas & Edison Light Company will supply electricity to the Cape & Vineyard Electric Company at Cape Cod Canal.

WEYMOUTH, MASS. — The Weymouth Light & Power Company has applied to the State Department of Public Utilities for permission to issue $460,000 in capital stock, the proceeds to be used for extensions and improvements.

PROVIDENCE, R. I. — The Wanskuck Company will build a one-story power house at its Geneva textile mill.

NAUGATUCK, CONN.—Estimates of the cost of a new electric lighting system for Main, Maple and Church Streets have been submitted to the Chamber of Commerce by C. L. Campbell, secretary of the Waterbury division of the Connecticut Light & Power Company.

WALLINGFORD, CONN. — A special committee has been appointed to investigate the question of appropriating $30,000 to equip the municipal electric plant so that it could purchase electricity for distribution, or to appropriate $70,000 for new equipment to meet the increasing demand for electrical service.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by T. J. Drennan, Fire Commissioner, Municipal Building, New York City, until June 27 for constructing a portion of the underground fire-alarm system in Brooklyn.

COLLINS, N. Y.—The Seneca Transmission Company has applied to the Public Service Commission for permission to construct an electric lighting system in Collins. The company will acquire an existing station here.

MIDDLETOWN, N. Y.—The Public Service Commission has granted the Orange County Hydro-Electric Corporation permission to construct a hydro-electric plant on the Mongaup River. The company has also been authorized to furnish energy in Orange and Sullivan Counties.

NEW YORK, N. Y.—A power plant will be built in connection with the proposed municipal ship-repair plant on Staten Island, to cost about $500,000. Grover A. Whalen, Municipal Building, is commissioner, Department of Plants and Structures.

POUGHKEEPSIE, N. Y. Plans are being prepared by the Adirondack & Southern Power Company for a double-circuit, three-phase, 60-cycle, 110,000-volt transmission line from Schenectady to Catskill, a distance of about 15 miles. O. H. Bundy, Poughkeepsie, is engineer.

POUGHKEEPSIE, N. Y. — The Public Service Commission has granted the United Hudson Electric Corporation permission to erect an electric transmission line through the towns of Athens, Coxsackie, New Baltimore and Coeymans. Permission has also been granted the Adirondack & Southern Power Company to build a line in the towns of Princeton, Voorheesville, Guilderland, New Scotland and Bethlehem. This transmission line is to connect the United Hudson Electric Corporation with the Adirondack Power & Light Corporation, Amsterdam, for the purpose of serving the Hudson River communities with additional power.

MILLBURN, N. J.—The Morris & Somerset Electric Company, Morristown, has applied to the Board of Public Utility Commissioners for permission to extend its transmission line from Boonton to Millburn, to furnish electricity to the Millburn Electric Light Company.

TRENTON, N. J.—The Department of Parks and Public Property will install a high candle-power lighting system on West State Street. Ornamental lamps will be used on a section of the thoroughfare.

BEDFORD, PA.—The Broad Top Power Company, recently organized, has been granted permission by the Public Service Commission to acquire and merge ten companies organized to operate in Bedford and Huntingdon Counties. Extensions and improvements will be made.

BRADFORD, PA.—The Niagara, Lockport & Ontario Power Company, Niagara Falls, N. Y., has applied to the Public Service Commission for permission to acquire the Bradford Electric Company.

GIRARDVILLE, PA.—Plans are under consideration by the J. S. Wentz Company, Land Title Building, Philadelphia, for equipping its local coal plant and colliery for electrical operation.

PHILADELPHIA, PA. — The Firth & Foster Company, Emerald and York Streets, will build an addition to the power house at its dye works.

ROCHESTER, PA.—The American Borax Company will build a power plant in connection with its proposed local factory, to cost $90,000. E. L. Dawes, care of the Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, is president.

WESTON, PA.—The Pennsylvania Power & Light Company, Allentown, will extend its transmission line to Weston and will install local distributing systems here and at Fern Glen and Rock Glen.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has issued $10,000,000 in bonds, part of the proceeds to be used for extensions and improvements. Plans have been completed for the erection of an addition to the substation on West Pratt Street.

PATUXENT, MD.—The Patuxent Clay Products Company, Equitable Trust Building, Baltimore, will build a power house in connection with its proposed local plant, to cost about $100,000. I. P. Mills is in charge.

WELLSBURG, W. VA. — The Brooke Electric Company, the Wellsburg Electric Light, Heat & Power Company and the Hancock County Electric Company have been consolidated under the name of the Brooke Electric Company, which will furnish electricity for lamps and motors in Brooke and Hancock Counties.

CEDAR BLUFF, VA.—A power house will be built in connection with the proposed new local textile plant of the Clinch Valley Blanket Mills.

NEW MARKET, VA. — The Federal Power Commission has granted Edward T. Brown a preliminary permit to develop water power on Cub and Pitt Springs Run to furnish electricity for lighting Engless Caverns and the town of New Market.

SCOTTSVILLE, VA. — The Big Bend Power Company contemplates the construction of a hydro-electric power plant on the James River, with transmission system.

WASHINGTON, D. C.—Bids will be received by the Constructing Quartermaster, Room 2306 Munitions Building, until June 20 for improvements and repairs to the street-lighting system at the Washington barracks.

North Central States

DETROIT, MICH.—Parke, Davis & Company, 2951 Atwater Street, will build a one-story power house, 70 ft. x 100 ft., at their drug factory.

CLEVELAND, OHIO. Plans are being prepared by the Power Improvement Company, Williamson Building, for altering and building a three-story factory addition at Cedar Avenue and Ashland Road, to cost about $350,000.

LATCHIE, OHIO.—Bids will be received by L. J. Lalp, clerk of the Board of Education, until June 23 for the construction of 1½ miles of pole line, transformers and other electrical equipment for service at the Lake Township Centralized School. Langdon Hohly & Gram, Nicholas Building, Toledo, are architects.

SUGARCREEK, OHIO. The Ohio Public Service Company, New Philadelphia, has purchased the property of the Sugarcreek Electric Company. A transmission line will be constructed to Dover for connection with the Ohio system.

TOLEDO, OHIO. — The Toledo Edison Company, successor to the Toledo Railways & Light Company, has applied to the Public Utilities Commission for permission to issue $777,000 in bonds, the proceeds to be used for extensions and improvements.

LOUISVILLE, KY. — Plans are under consideration for the installation of ornamental lamps on Broadway from Second to Eleventh Street. The Louisville Gas & Electric Company has the contract for street-lighting service.

GREENFIELD, IND.—The Mutual Electric Lighting Company contemplates extensions to its transmission line on the Shelbyville Road.

APPLETON, WIS.—Bids are being taken by the Wisconsin Traction, Heat, Light & Power Company for the erection of a garage, service station and repair shop, to cost about $45,000. D. C. Beaulier is engineer.

DANE, WIS.—Bids are being asked by the Wisconsin Power, Light & Heat Company, Gay Building, Madison, for the erection of a 35-mile transmission line from Dane to Beaver Dam, with a substation at Columbus.

GRAVESVILLE, WIS. — The Calumet Service Company will extend its transmission line from Chilton to Gravesville and will install a local distributing system.

JANESVILLE, WIS. — The Janesville Electric Company has plans under way for a new substation. A transmission line will be erected to Edgerton.

NEENAH, WIS.—A power house will be built in connection with the proposed new mill of the Valley Paper Mills, Inc., in the Blair Springs district, to cost about $800,000. G. W. Burnside is secretary and general manager.

OSHKOSH, WIS. — The Oshkosh Gas Light Company contemplates improvements to its plant, to cost about $20,000; also the erection of a 4,000-volt transmission line to supply electricity to residences along the Doty Road.

BARNESVILLE, MINN.—Work will soon commence on the installation of a municipal electric distributing and street-lighting system. Charles L. Pillsbury Company, Minneapolis, Minn., is engineer.

VIRGINIA, MINN. — The Water and Light Commission has awarded a contract to Frederick Gorham, Virginia, for the erection of an addition to the municipal electric plant. A. T. Harding is engineer.

CEDAR RAPIDS, IOWA.—Negotiations are under way between the City Council and the Iowa Railway & Light Company for the installation of a new street-lighting system.

OSKALOOSA, IOWA. — Bonds to the amount of $300,000 have been voted for the construction of a municipal hydro-electric power plant on the Des Moines River, near Harvey.

CLINTON, MO. — The West Missouri Power Company is having plans prepared for a new power plant.

KIRKSVILLE, MO.—All bids submitted for additions and equipment to the power house at the Northeast Missouri State Teachers' College have been rejected. New bids will be asked for on revised plans. R. H. Sanneman, Lee Building, Kansas City, is architect.

SLATER, MO.—Improvements are contemplated to the municipal electric light plant, to cost about $25,000.

HURON, S. D.—Plans, it is reported, are under consideration to increase the output of the local electric light and power plant and install a new street-lighting system, to cost about $100,000. J. H. A. Brahtz, Metropolitan Opera House Building, St. Paul, Minn., is engineer.

LAWRENCE, NEB.—The Council will soon award a contract for the construction of a municipal transmission and distributing system, to cost $12,000. The Hollister Engineering Company, Bankers' Life Building, Lincoln, is engineer.

ANDALE, KAN.—Bids will be received by the City Clerk until June 20 for the construction of a transmission line from Andale to Wichita, Kan., a distance of about 20½ miles, and the installation of distributing systems at Andale, Colwich and Maize. The Ruckel Engineering Company, Hutchinson, is engineer.

ROSEDALE, KAN.—The Board of Administration, Topeka, will build a power plant, to cost about $50,000, in connection with the new local Bell Memorial Hospital. J. A. Kimball, business manager, is in charge.

Southern States

RALEIGH, N. C.—A. S. Partin will establish a small electric plant to serve a community in this section. Inquiries are being made for a generator and auxiliary electric equipment.

RAMSAUER, N. C.—The Columbia Manufacturing Company will build a steam-operated electric plant at its mill.

FLORENCE, S. C.—The Palmetto Power & Light Company contemplates improvements and extensions to its system to cost about $84,000. The work will include rebuilding and extension to the distribution system, installation of a 500-hp. boiler and cooling tower, etc. P. A. Tillery, Raleigh, N. C., is vice-president and general manager.

WEST POINT, GA.—Extensions and improvements to the municipal electric light plant are under consideration.

GAINESVILLE, FLA.—Bids will be received by the City Council until July 3 for construction of addition to the municipal electric light and water plant, including piping and wiring systems. Robert & Company, Inc., Red Cross Building, Atlanta, Ga., are engineers. G. H. Cairns is city manager.

MIAMI, FLA.—The Miami Mattress Company will build a power plant in connection with its new local factory. Richard M. Wells is head.

LAFAYETTE, LA.—J. C. Barry is negotiating for a lease of the municipal electric plant. A company will be organized to operate the property, and plant extensions and improvements will be made.

ZWOLLE, LA.—The Zwolle Mill & Light Company contemplates improvements to the local power plant, recently acquired from the Sabine Lumber Company.

CARTER, OKLA.—The Council will hold in temporary abeyance a special election to vote bonds for a municipal electric plant, estimated to cost $23,500. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, Okla., are engineers.

LOCUST GROVE, OKLA.—Bids will be received by E. S. McCoy, town clerk, until June 28 for the construction of a 6-mile transmission line, 13,200-volt, three-phase, No. 6 bare copper wire; a step-down transformer station and complete distributing system, with street-lighting circuit. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

OKEENE, OKLA.—Bids will be received by W. F. Wooten, city clerk, until July 5 for extensions and improvements to the municipal power plant, to cost about $40,000. Bids submitted June 1 have been rejected. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

OKLAHOMA CITY, OKLA.—The Oklahoma General Power Company will build a 60,000-volt transmission line from its new generating plant at Muskogee to Oklahoma City and also to Fort Smith, Ark.

PAWNEE, OKLA.—Bids will soon be asked for extensions and improvements to the municipal electric plant, to cost about $65,000. The Benham Engineering Company, Kansas City, Mo., is engineer.

SHAWNEE, OKLA. — The Southern Oklahoma Power Company has issued $1,380,000 in bonds, part of the proceeds to be used for extensions and improvements.

TULSA, OKLA. — The Public Service Company has awarded a contract to the Midland Engineering & Construction Company, 332 South Michigan Avenue, Chicago, for the construction of a power plant of about 10,000 kw. capacity. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

VIAN, OKLA. — The Oklahoma Gas & Electric Company has taken over the local electric plant and contemplates extensions and improvements.

AUSTIN, TEX.—Plans are being prepared for the erection of a new power plant at St. Edward's College, to cost about $40,000. A. W. Harris is architect.

Pacific and Mountain States

SPOKANE, WASH.—Tentative plans are under consideration by the Washington Water Power Company for the construction of a new hydro-electric plant at the lower Spokane Falls or rebuilding the present plant below the Monroe Street bridge.

TACOMA, WASH.—The Council has appropriated $29,000 for site investigations, plans and specifications for a municipal hydro-electric power plant on Lake Cushman.

ALBANY, ORE.—The Mountain States Power Company has made arrangements with the California-Oregon Power Company for the purchase of 12,000 kw. of electricity for distribution in the Willamette Valley, Oregon. Under the terms of the contract the California-Oregon company is to erect a 115-mile transmission line to connect its hydro-electric plant at Prospect, on the Rouge River with the substation of the Mountain States company at Springfield. The line is being built to operate at 110,000 volts. The Mountain States company is erecting interconnecting lines between its various divisions to operate in conjunction with the main line, which includes a 20-mile, 66,000-volt line to connect the Dallas district with the Albany district. An 11,000-volt line is being built to connect with the town of Jefferson. A third line will extend from Springfield to Cottage Grove.

PORTLAND, ORE.—The Pacific Power & Light Company has applied to the State Engineer for permission to appropriate 8,000 second-feet of water from the Snake River for power development in the States of Oregon, Washington and Idaho. The present plans provide for the construction of ten hydro-electric plants along the river in the above-named states.

PORTLAND, ORE.—The Federal Power Commission has granted the Northwestern Electric Company a permit for one year for a hydro-electric project on the Lewis River, about 35 miles from Portland. The project includes a dam 200 ft. high to create a storage reservoir of 200,000 acre-feet capacity. A power house will be built at the base of the dam to develop 20,000 kw. The proposed plant will be built near Yale, Wash., and will cost about $3,000,000.

DINUBA, CAL.—Bids will soon be asked for the installation of an electric lighting system, consisting of 325 metal lamp standards and about 40,000 ft. of conduit and cable. C. E. Sloan, Santa Fé Building, San Francisco, is engineer.

LOS ANGELES, CAL.—The Power Bureau has tentative plans under way for the construction of a municipal hydro-electric power plant on the south fork of the Kern River in Tulare County. Application has been made to the Federal Power Commission.

PASADENA, CAL.—The City Directors have adopted an ordinance for the installation of underground conduits in thirteen principal streets, including Euclid, Oak Knoll and El Molino Avenues.

VERNON, CAL.—The Wilson & Willard Manufacturing Company will build a power house at its oil-machinery plant.

DUCHESNE, UTAH.—The Uintah Power & Light Company is preparing to extend its transmission line from Lakeforth to Duchesne, a distance of 14 miles, to serve several large ranches in this section.

MILES CITY, MONT. — The Buffalo Rapids Hydro-Electric Company will build a hydro-electric plant on the Yellowstone River about 7 miles from Miles City. Permission has been granted by the Federal Power Commission.

VIRGINIA CITY, NEV. — The Truckee River General Electric Company is making surveys for the construction of a 60,000-volt transmission line to Comstock City.

Canada

VANCOUVER, B. C.—The construction of a hydro-electric power plant at the Ocean Falls sawmills of the Pacific Mills, Ltd., to cost about $500,000, including power dam, is under consideration.

HALIFAX, N. S.—The Premier Paper & Power Company, recently incorporated, has purchased the property of the H. Croix Paper & Lumber Company and is planning to construct a new paper mill and power plant, to cost about $1,500,000. The equipment will include two hydraulic turbines to generate about 3,300 hp., four waterwheels, etc. Phil H. Moore, 91 Hollis Street, is managing director, and George F. Hardy, 309 Broadway, New York City, is consulting engineer.

BELLE RIVER, ONT.—Plans are being prepared for the installation of an electric lighting and power distribution system, to cost about $35,000. E. D. Lawler, 190 University Avenue, Toronto, is engineer.

EUGENIA, ONT. — Three schemes for increasing the power service of the Eugenia branch of the Hydro-Electric system are said to be under consideration by the Hydro-Electric Power Commission of Ontario—linking up with the Niagara system, putting in a pipe line or developing the Saugeen River near Burgoyne.

OAKVILLE, ONT.—Tenders will be received by M. C. Irvine, secretary, Oakville Water & Light Commission, until June 22 for extension to pump house, including gasoline or oil engines, turbine pumps and electric generator. Chipman & Power, Toronto, are engineers.

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Electrical World

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W. H. ONKEN, JR., and D. H. BRAYMER, *Editors*

Contents

Why the Vehicle Waits 1255

Frontispiece—Rudolph Frederick Schuchardt 1256

Editorials 1257
- Government Control Means Higher Taxes.
- A Basis for More Intelligent Selection of Insulating Oils.
- Export Trade and Foreign Standards.
- The Muscle Shoals Muddle.
- The Queenston Station—Another Step in the Development of Great Lakes Power.
- Temperature Control of Transformers Needs Further Investigation.
- Bay State Industries Believe in Central-Station Service.

Arrangement for Handling 500,000-Kw. Load from Queenston Plant 1261

Most Economical Utilization of Water Power Available and Protection Against Interruption of Service Were Chief Factors Influencing Design of This New Station of Hydro-Electric Power Commission of Ontario.

Conditions in Europe that Affect American Electrical Exporters 1264

BY JOSEPH MCELROY, 3D, AND P. S. SMITH.

Discussion of the Obstacles to and the Benefits from Export Business—Where the Market Lies for Specific Lines of Manufactures—European Standards Which Differ from Those of American—Local and Economic Conditions.

Textile Mills Lead in Industrial Energy Consumption in Massachusetts 1267

BY ROBERT M. DAVIS.

Almost Two-thirds of the 1,606,105,000 Kw.-Hr. Consumed by Industrial Plants Was Purchased from Central Generating and Distributing Systems—Of the 117,038 Installed Motors More than Half Are Under 5 Hp.

Oil Qualities Desirable for Transformers and Circuit Breakers 1271

BY C. J. RODMAN.

Explosive Limits, Dielectric Strengths and Sludging Properties Are Particularly Important—A Study of the Practical and Theoretical Behavior of Oils Under Service Conditions.

Letters from Our Readers 1274

Industrial and Station Practice 1275
- Jewel Inspection Essential for Proper Meter Operation.
- Improved Design of Heavy-Duty 6,600-Volt Double Bus.
- Considerations for the Construction of Rural Distribution Lines.
- Rotary Switch Operates Satisfactorily on 17,000-Volt Line.
- Cost of 33,000-Volt Transmission Line Is $1,757 per Mile.
- Transportation and Handling of Standard Meters.
- Specifications for Welding Wire Issued.

Management and Policy 1279
- An Electrical Home Designed and Built by Electrical Men.
- Comprehensive Commercial Policy Brings Results in Illinois.
- Vancouver, B. C., Has 85 per Cent of Houses Wired for Electric Service.

Manufacturing and Distributing 1281
- Interpreting the Corporation to the Workers.
- The Small Manufacturer's Pressing Distribution Problem.

Digest of Electrical Literature 1283

News of the Industry 1285

Current News and Notes 1291

Associations and Societies 1291

Court Decisions 1292

Commission Rulings 1292

Men of the Industry 1293

Trade and Market Conditions 1295

Manufacturers' Activities 1300

Trade Notes 1302

Record of Electrical Patents 1302

Construction News 1303

Advertising Index—Alphabetical, 88; Classified, 82, 84, 86; Directory of Engineers, 38-39; Searchlight Section, 40-51

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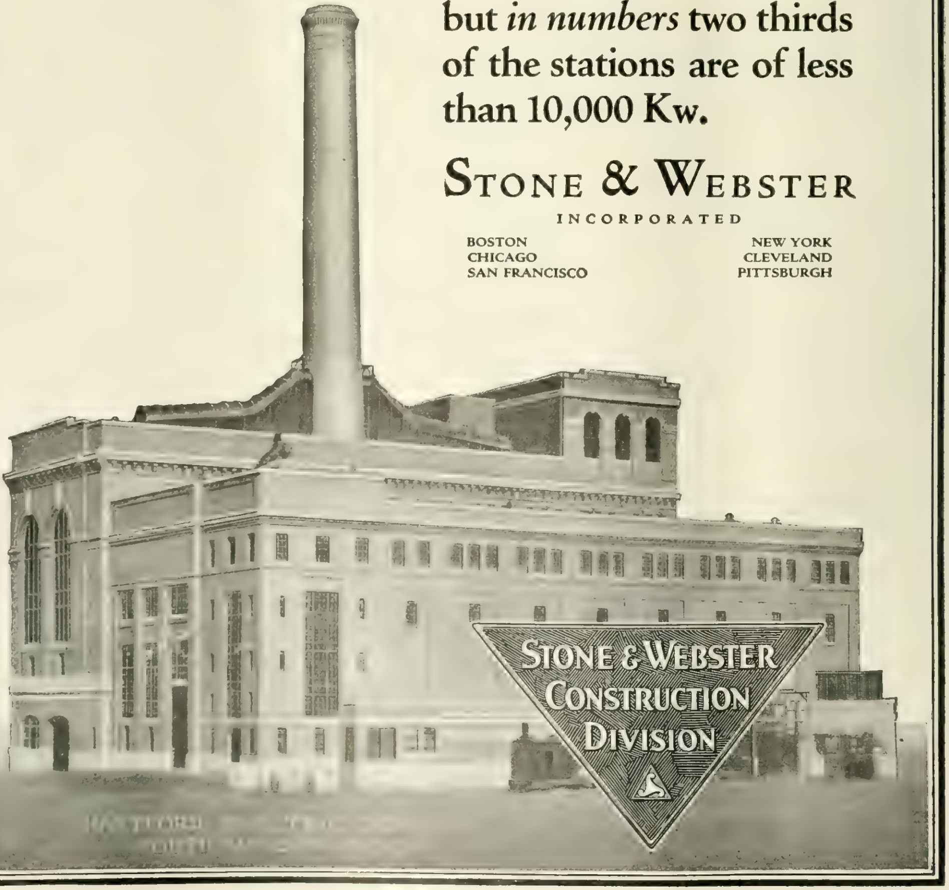

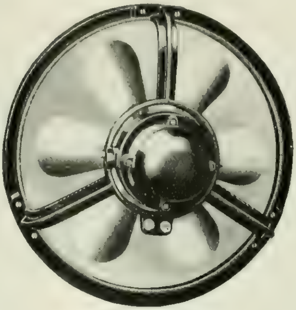

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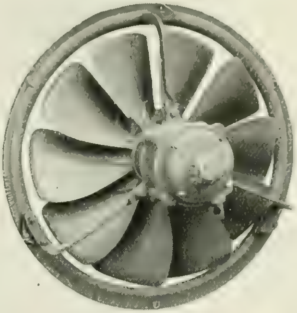
12 in. and 16 in. diameter



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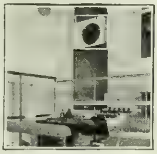

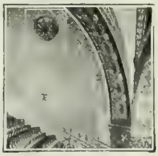

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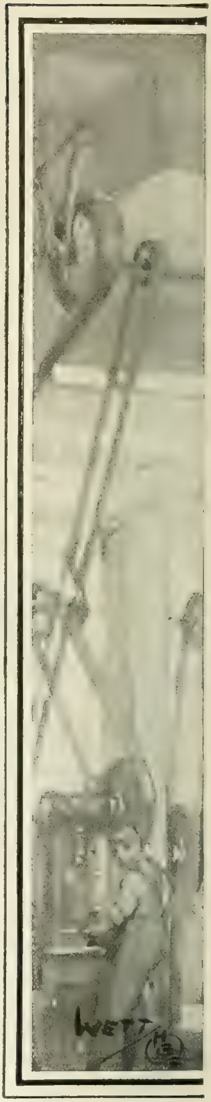

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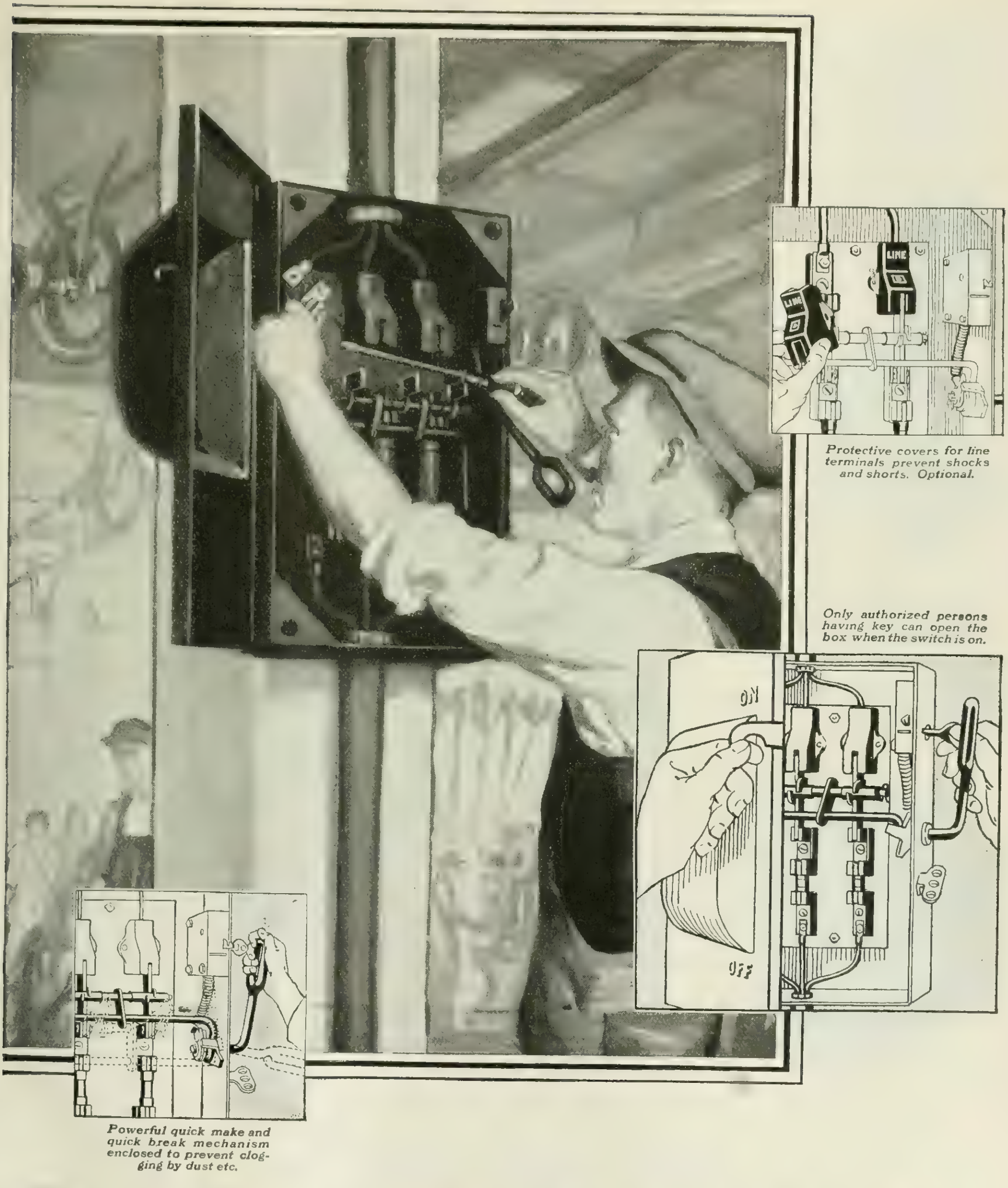

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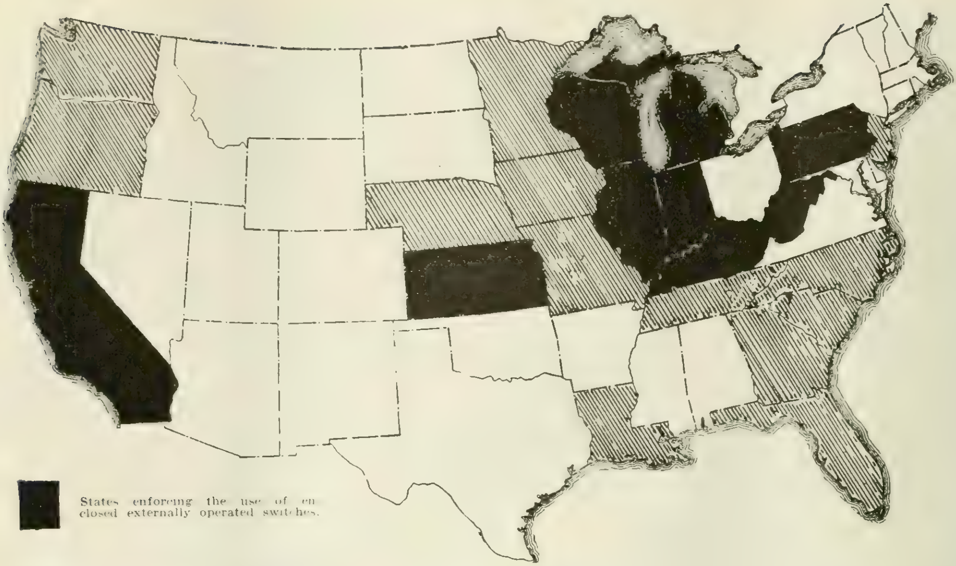

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▨ States in which many principal cities have laws requiring enclosed externally operated switches.

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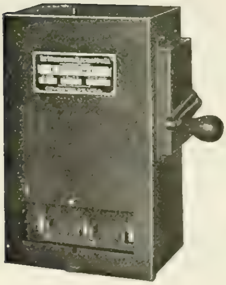

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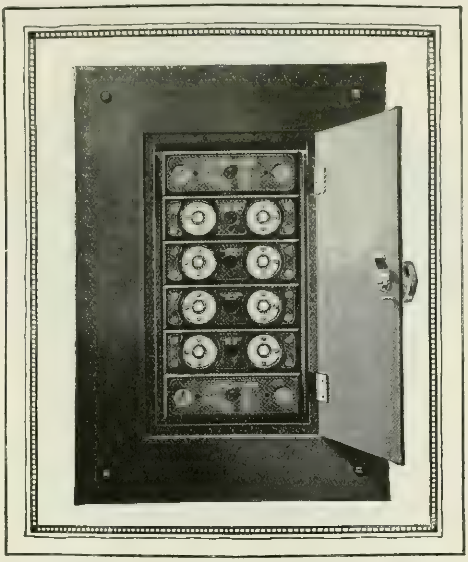

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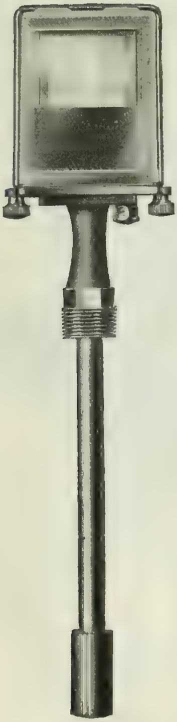

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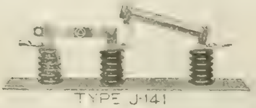
HIGH TENSION EQUIPMENT

Would You Build Your Own Automobile?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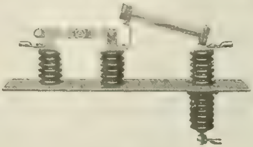
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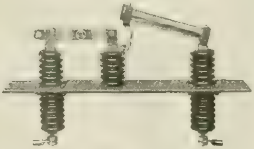
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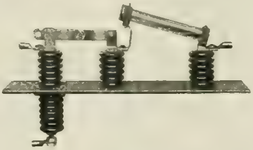
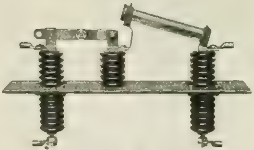
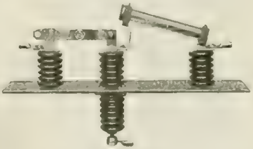
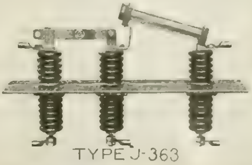

TYPE J-341


TYPE J-343


TYPE J-161

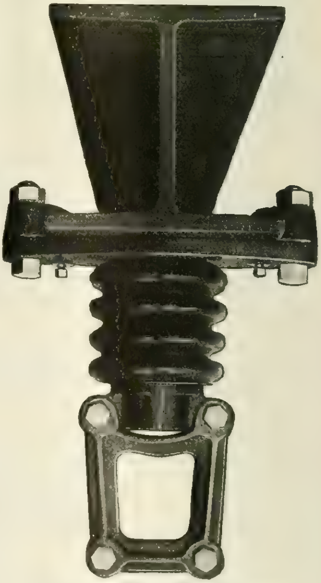

TYPE J-363

WOULD you build your own automobile or truck, motor or starter, just because you had a man on the payroll who was handy with tools? In these days of highly developed automobile manufacture and dependable service it is not economical to use up time in building a car in your own shops.

Just so with station switching and bus support equipment. A specialized organization, devoting its entire time to the design and construction of a particular class of equipment, builds better equipment and gives greater service. The substantial character of the equipment produced, the accuracy with which it meets your conditions and the continued low maintenance expense assured by this specialized manufacture all make it desirable.

DELTA-STAR is such an organization. Our "Unit Type" Switchboard and switching equipments have behind them a specially trained organization and a record of service that means dollars to you.

Write for our catalogs and see for yourself why DELTA-STAR equipment is the kind to use.

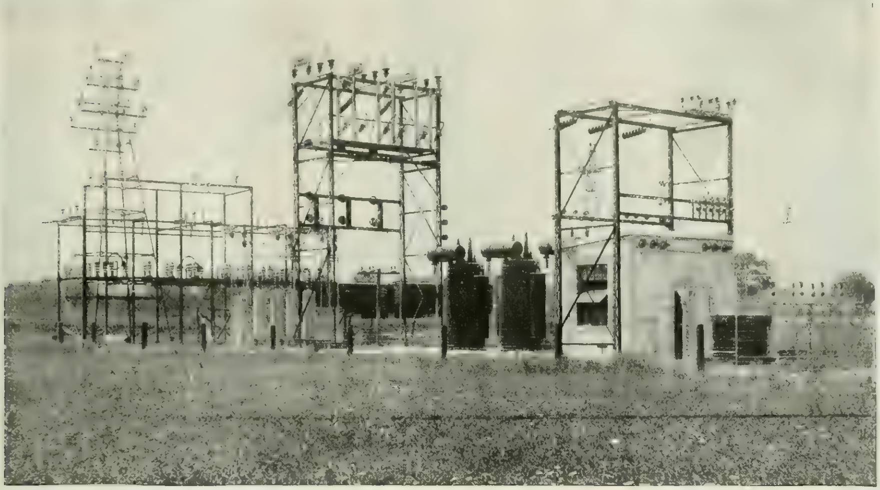

Unit-Type Bus Support with Fitting to Clamp Beam Up to 24 Inches Adjustable Top and Bottom

DELTA-STAR HIGH TENSION EQUIPMENT

UNIT-TYPE INTERCHANGEABLE PARTS

HIGH TENSION EQUIPMENT

No "Customer Ownership Campaign" Can Succeed Without Skillfull Advertising



A Unit-Type Substation Continually Advertising the Public Utility with a Frank, Direct, Telling Message.

A successful utility executive says:

"No customer-ownership campaign can succeed without skillful and adequate advertising. The very nature of the undertaking makes it necessary to address the whole public and to carry the message to every person in the community who can be induced to receive it. Upward of one-half of the whole equipment needed for customer-ownership effort consists of advertising—newspaper, direct-by-mail, follow-up literature, etc. The advertising necessarily covers the whole basis of approach to the public. If the advertising is out of line with public acceptance, if it presents the innovation in a bungling manner, or if it is overdone or underdone in quantity, success cannot be expected."

A Real Effective Advertisement

is a neat steel tower outdoor substation. It adds the impression of dignity to the fascination which always, in the mind of the public, is attached to high voltage electricity.

To the small town citizen the impression made by the local outdoor substation represents his conception of the public utility company and every individual in the town sees the substation time and again—it is an advertisement every day in the year. Why install a shaky looking wood pole substation when there is so much at stake?

DELTA-STAR ELECTRIC CO., 2433-59 Fulton Street, Chicago, Ill.

Manufacturers of High Tension Equipment

New York, N. Y., 25 Broad St.
Boston, Mass., 294 Washington St.
Rochester, N. Y., 119 Main St., E.
Syracuse, N. Y., City Bank Bldg.
Buffalo, N. Y., 595 Ellicott Square
Kansas City, Mo., Interstate Bldg.
St. Louis, Mo., Railway Exchange
Salt Lake, Utah, 313 Dooly Bldg.

Toronto, Ont., 67 Yonge St.
Indianapolis, 518 Trac. Term. Bldg.
Seattle, Wash., Hoge Bldg.
Philadelphia, Pa., 1333 Real Estate Trust
Columbus, Ohio, 600 Joyce Realty Bldg.
Minneapolis, Minn., 310 Security Bldg.
Los Angeles, Cal., 411 South Main St.
Denver, Colo., 1633 Tremont St.

Pittsburgh, Pa., Union Arcade
Soc. Francaise Ohio Brass & Electric,
7 Rue de Tilsitt, Paris, France.
A/S, Kraftoverforing, Kristiania, Norway.
Carrick Wedderspoon & Co., Christchurch, New Zealand.

DELTA-STAR HIGH TENSION EQUIPMENT

UNIT-TYPE INTERCHANGEABLE PARTS

KEYSTONE

TRUSS PINS

This type of Keystone Truss Pin is used for Steel Angle Cross Arms.

Keystone Round Top Wood Cross Arm Type.

Keystone Flat Top Wood Cross Arm Type

2,000,000

In Use

No man needs better proof of the superior qualities of Keystone Truss Pins than "2,000,000 in use." They provide Security — Sturdiness — Reliability and Mechanical Safety—all that their tradename "Keystone" implies. You'll see them on pole tops, the world over, giving full satisfaction to the men who purchased them.

Send for data sheets

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material and Electrical Supplies

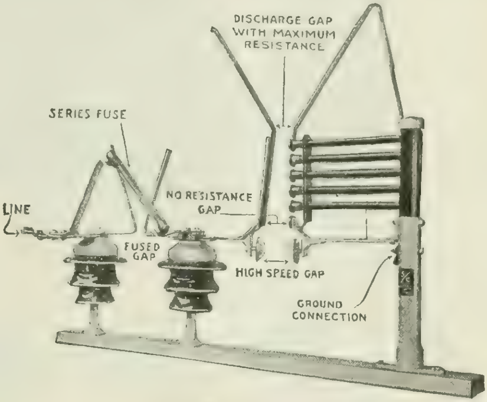
PHILADELPHIA
17th and Cambria Streets

NEW YORK
50 Church Street

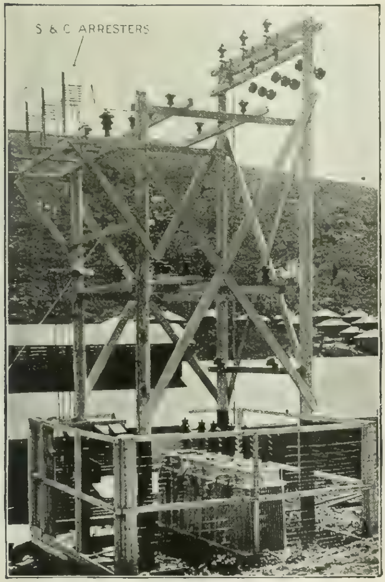
CHICAGO
Monadnock Building

Canadian Distributors: Lyman Tube & Supply Co., Montreal, Toronto, Winnipeg

S & C Lightning Arresters



Form 3A, 25,000 Volt Type H Arresters



44,000 Volt, Form 1, Type H Arresters

Instantaneous Relief Without Disturbance to the System

Effective Protection is only secured from a Lightning Arrester which successfully discharges the high potential surge, prevents the excessive flow of dynamic or generator current, and does this *without itself producing other disturbances* on the system.

S&C Type H Graded Resistance Sphere Gap Lightning Arrester consists of a Horn Gap with a Subdivided Resistance so arranged that the discharge *adjusts itself automatically* to the correct value of resistance according to the energy capacity of the discharge. That this ingenious arrangement of the resistances effectively handles discharges of large or small volume is attested to by the every-day operation of the ***S&C*** Type H Arrester on important circuits of many of the largest utilities in this country, where they have been in operation for years.

Are you getting this class of protection on your important high voltage lines?

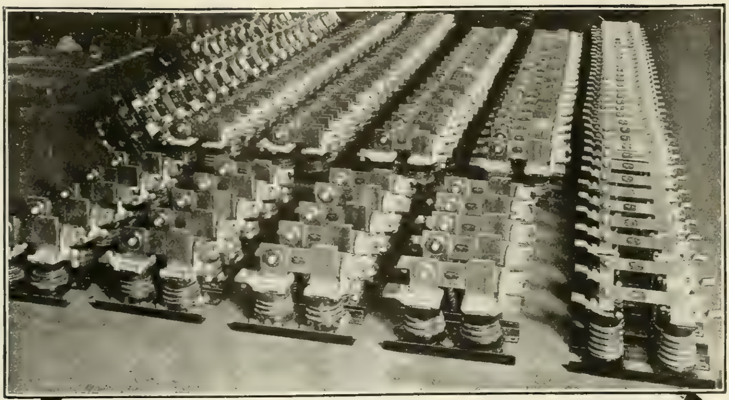
SCHWEITZER & CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.

New York, 50 Church St., Room 2070.
Buffalo, 950 Ellicott Square Bldg.
Boston, Mass., 88 Broad St., Room 910
Pittsburgh, Pa., 1306 Keenan Bldg.
Cleveland, Ohio, 1202 Illuminating Bldg.
Minneapolis, 915 Metropolitan Life Bldg.

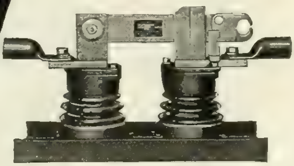
St. Louis, 1004 Federal Reserve Bank Bldg.
Kansas City, 717 Bryant Bldg.
Omaha, Nebr., 513 Electric Bldg.
Denver, Colo., Denham Bldg.
Los Angeles, 211 I. W. Hellman Bldg.
San Francisco, 76 Folsom St.

Seattle, Room 1127, L. C. Smith Bldg.
Portland, 308 Lewis Bldg.
Winnipeg, Man., 703 Confederation Life Bldg.
Vancouver, 609 Credit Foncier Bldg.
Toronto, 24 Adelaide St., East
Montreal, 131 Coristine Bldg.

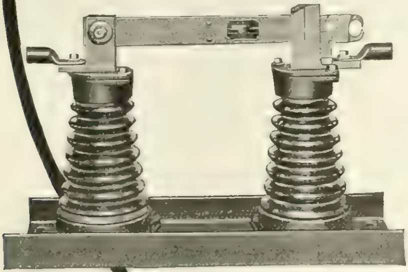


Westinghouse Disconnecting Switches ready for shipment

Discriminating Engineers Specify Westinghouse Type S Disconnecting Switches



200 Amperes, 7500 Volts



200 Amperes, 25,000 Volts

BECAUSE they stand up under the enormous mechanical strains incident to severe short circuits.

One of the most complete and exhaustive series of tests ever run on disconnecting switches emphasizes these important characteristics of the type S switch:

A lock that is absolutely dependable.

The lock cannot fail thermally because it carries no current.

The lock is not supported by, and is separate mechanically from the break jaw, so that possible spreading of the jaw blades cannot unlatch it.

Mechanical stresses, which act to spread the insulators apart and to blow the switch blade open—only tighten the grip of the Type S latch.

The hinge jaw blades are solid (not split) preventing the hinge bolt from pulling out with the resultant opening of the circuit at the hinge jaw.

The hinge and break jaws are permanently sweated and pinned to jaw blocks.

The large head and broad base of the insulators furnish sturdy mechanical support.

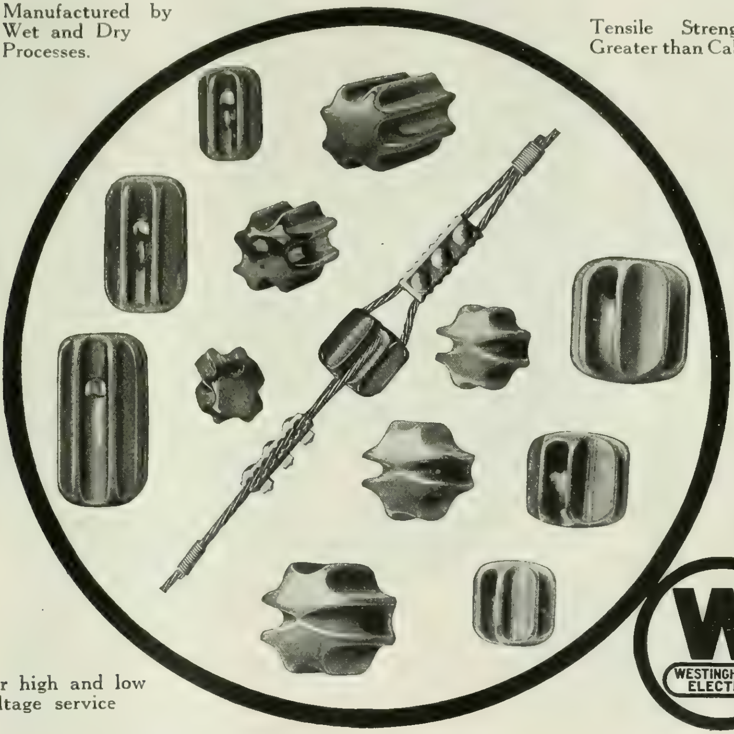
Ample cross section of copper parts and rugged construction of all fittings, assure the full utilization of all the other superior points of construction.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

W
WESTINGHOUSE ELECTRIC

Westinghouse

Westinghouse Porcelain Strain Insulators



Manufactured by Wet and Dry Processes.

Tensile Strength Greater than Cable

For high and low voltage service

WESTINGHOUSE ELECTRIC

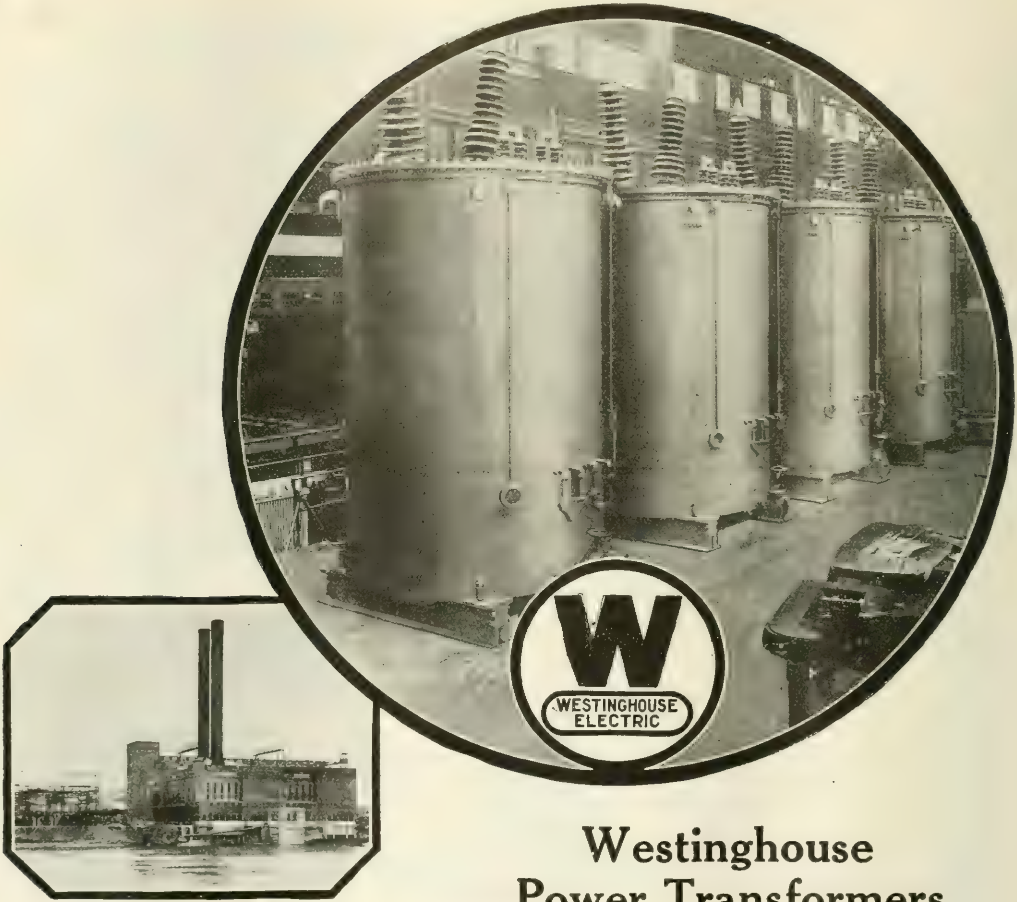
Westinghouse Porcelain Strain Insulators are made of a grade of porcelain much superior to that ordinarily used for such appliances. Their glaze is of a uniform brown color so that the insulators do not readily attract attention. Sharp corners, that would be apt to chip, have been avoided, and the shape of the grooves is such that the wires lie naturally in them. Large creepage distance between the cables is also provided.

These insulators will stand more strain than the cable ordinarily used in line construction. For this reason the danger of breaking is entirely removed.

There is a size and design to meet every service requirement for dead ending lines, and for insulating guy wires.

Westinghouse Electric & Manufacturing Company
Agents for Westinghouse High-Voltage Insulator Company
Successors to Pittsburgh High-Voltage Insulator Company
General Office and Works, Derry, Pa.

Westinghouse



A view of the Colfax Power Station

Westinghouse Power Transformers

The main transformer installation at the Colfax Station of the Duquesne Light and Power Co. consists of four Westinghouse 23,600 kv-a. transformers, stepping up the generated voltage of 12,000 volts to 66,000 or 132,000 volts.

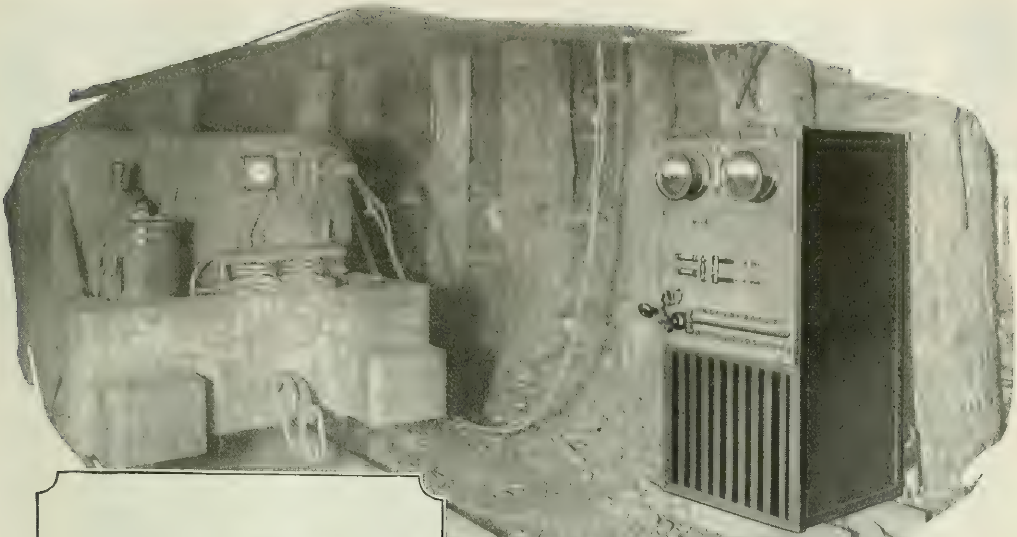
The station transformers consist of three Westinghouse 833 kv-a. units, stepping the current down from 12,000 to 2,300 volts.

In addition to these, the starting, station lighting and auxiliary power transformers are all Westinghouse.

The main transformers in this station have a rated capacity greater than any single-phase, two winding transformers heretofore built, and at the same time, are among the most efficient high-voltage transformers in service, having an efficiency of over 99 per cent at full load.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
Offices in All Principal American Cities

Westinghouse



Mancha Mule being charged by C-H *Mine Type Charging Panel*

Putting the Kick in the Mule

The tapered charge fed to storage batteries by C-H (Mine type) Battery Charging Equipment is provided without manual adjustment and the rate is kept at a *safe* value at all times, insuring absolute uniformity of all charges from day to day.

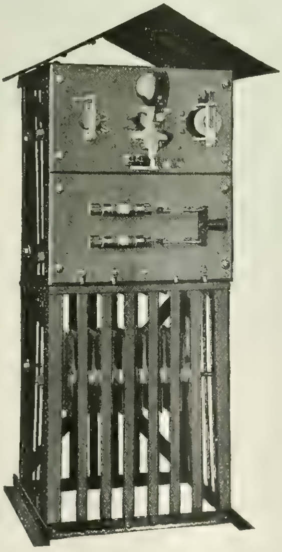
This one feature gives "C-H-charged" batteries full restored power, long life, and low maintenance.

The automatic Low Voltage Protective Relay prevents connection to the lines at all times, when the line voltage is too low for charging. This insures against draining of batteries through discharge back into the lines.

But after a temporary failure—an operator need not chase around to re-connect the battery—the C-H Automatic Re-Closing Relay re-established the circuit. There is no attention required from the operator, and there is no danger of finding the batteries uncharged when the operator comes to take out the locomotive.

When fully charged a Tripping Relay, used in conjunction with an ampere-hour meter on the locomotive, disconnects the batteries.

C-H Mine Type Battery Charging Equipment takes all responsibility out of human hands—a complete description is contained in Publication 836. Let us mail you a copy.

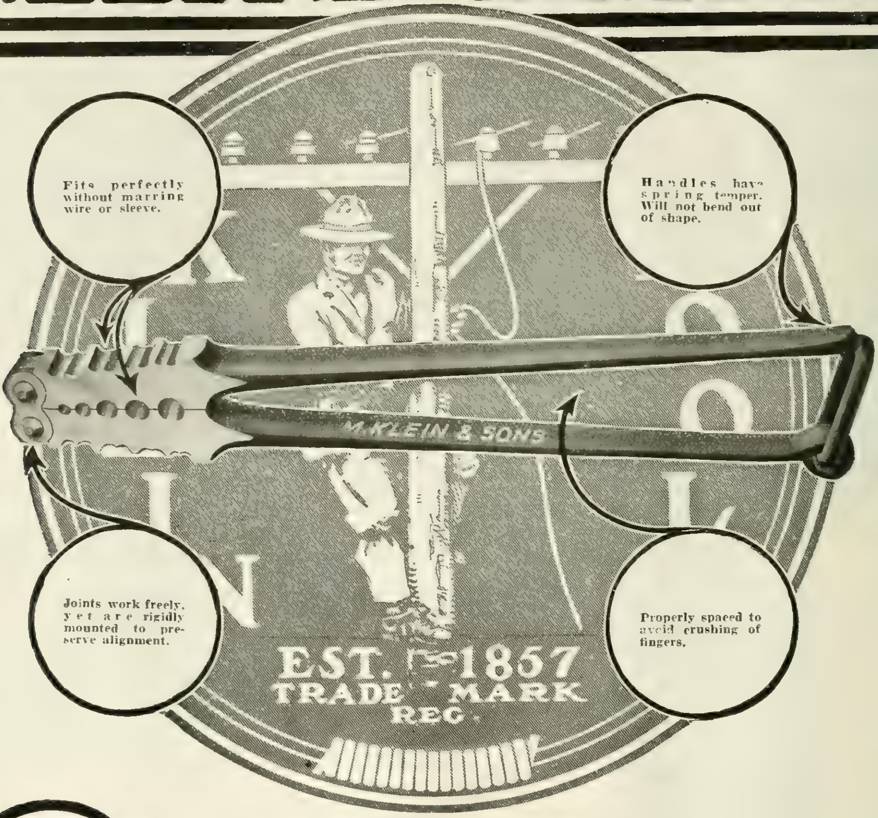


The C-H *Charging Panel may be located at the point where the locomotive ends or starts its day's work, thus eliminating unnecessary mileage.*

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Can.

C-H CHARGING EQUIPMENT

KLEINS CLAMPS



Fits perfectly without marring wire or sleeve.
Handles have spring temper. Will not bend out of shape.
M. KLEIN & SONS
Joints work freely, yet are rigidly mounted to preserve alignment.
Properly spaced to avoid crushing of fingers.
EST. 1857
TRADE MARK
REG.

- Pliers
- Splicing Clamps
- Sleeve Twisters
- Climbers
- Tool Belts
- Safety Straps
- Lag Screw Wrenches
- Wire Grips
- Tree Trimmers
- Tool Bags
- Charcoal Furnaces
- Staysalite Torch

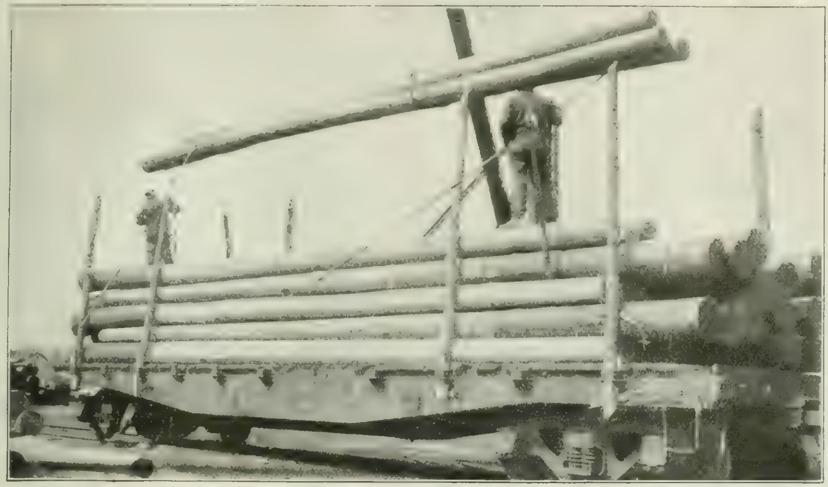
The First Splicing Clamp Was a Klein Splicing Clamp!

It is a fact that the Klein Splicing Clamp is the ancestor of all splicing clamps. Sixty-seven years of experience in making linemen's tools still keeps it the first!

The old-timers know that specially designed joints permit a Klein Splicing Clamp to work freely without loss of alignment—that the handles are properly spaced to avoid crushing of fingers—and that the dies are snugly fit to gage and will not injure the wire or sleeves when twisted.

Equip your outside gangs with the best! Buy Klein Splicing Clamps!

Mathias KLEIN & Sons
Established 1857
Chicago, Ill. U.S.A.



NAUGLE POLES

NAUGLE

—SERVICE
gratifies
—PRICE
satisfies
—QUALITY
identifies

Service—our corner-stone—is employed to the complete satisfaction of all our customers. 24-hour loading from centrally located concentrating yards.

Uniformity makes for a good-appearing pole line. Care in selection of your poles is emphasized by our yard men, who cooperate in our endeavor to satisfy you.

Proper Butt-Treatment at our modern plants serve to make your poles last a lifetime. We PENTREX treat—half-inch penetration guaranteed. Send for our free book just issued, "Butt-treatment of Cedar Poles."

Northern and Western Cedar

NAUGLE POLE & TIE CO.

5 South Wabash Ave., Chicago, Ill.

Branches: *New York, Columbus, O., Kansas City, Boston, Spokane*
Main Yards: **Chicago, *Pinconning, Mich., Green Bay, Wis.*

**Pentrex and treating plants at these yards.*

Hearth Stones and Duct Lines

THE nearness of a great building expansion is already felt. Homes are so fundamentally essential that they defy economic laws, baffle predictions, and mock depression.

Authoritative reports show that $2,500,000,000 will be spent on the 1922 building program, and each new settlement or expansion means extended feeders and enlarged trunk lines for electrical service.

It is now time to plan these expansions, and opportune to consider how to meet the call as economically as possible.

The function of Johns-Manville fibre conduit in any such work is so basic that it must be reckoned with in relation to labor, maintenance, and even finance. And here is its claim, now plainly proven by years of testimony—it is the most economical system per trench-mile-year.

By all means send for our fibre conduit booklet, which is replete with information on conduit installation in all its details. Sent from any Johns-Manville branch.

JOHNS-MANVILLE Inc.
Madison Avenue at 41st Street, New York City
Branches in 57 Large Cities
For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT
Through
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and its allied products
Electrical Materials
Brake Linings
Insulations
Roofings
Packings
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Fire Prevention Products

JOHNS-MANVILLE
Fibre Conduit

LAST CALL

July 15th—The Last Day!

You must act quickly if you want your Power Plant Library at the special price of $14.50

THIS is the last chance you will ever have to get the POWER PLANT LIBRARY at $14.50. On July 15th the special offer which we have been making on the Library will be withdrawn for all time. Never again will we be able to make an offer like this—never again will you be able to get these great books at such a low price and on such easy terms.

Do you realize the importance of these things?

Do you know how to lay a boiler or engine foundation? Can you accurately figure the horsepower of boilers, and do you thoroughly understand the care and management of boilers, renewing tubes, etc? Have you a working knowledge of combustion and proper firing? Can you figure heating surface?

Is your knowledge of shafting and belting complete? Are you familiar with line shafting, with the governors of different types of engines?

How about piping? Can you connect a boiler to a steam main? Do you know the difference between iron and steel piping? Can you estimate stock?

Pumps? Can you set up, operate, set the valves, figure the horsepower and make repairs on centrifugal, duplex and boiler feed pumps?

Can you set up the valves on all types of engines? Have you a thorough knowledge of valve gears, exhaust valves, slide valves, etc?

Steam turbines? Do you understand the Curtis, the Allis-Chalmers and other types of turbines? Would you like a complete working knowledge of all operating details connected with turbines and auxiliaries?

The Power Plant Library supplies the answers to all these questions.

The Power Plant Library

8 Handsome Volumes—3000 Pages—1200 Illustrations and Diagrams—over 2000 Questions and Answers—The Standard Work on Power Plant Practice

EVERY man who expects to become a top-notch power plant engineer needs the Power Plant Library. It is the one set on the market containing every item of information needed by the practical power-plant man, and yet within reason as to price and terms. The men who wrote these books get down to brass tacks. They tell you what you want to know in the way you want to know it. They give you in clear, understandable terms the right and wrong of power plant operation. Their aim throughout is to make you thoroughly familiar with every detail of power plant work—to give you a sound working knowledge of every type of plant—large and small. The Power Plant Library is arranged in such a way that it furnishes the beginner with a complete course of study on power plant work, and also supplies the trained engineer with a reference library that answers all of the problems that come up in his work.

The Sure Way To Bigger Pay

HOW can you earn more—how qualify for a bigger job with bigger pay? That's the question that's troubling you, isn't it? The one way—the sure way is through knowledge. The more you learn, the more you'll earn. The Power Plant Library gets down to facts—the facts that you need on the job every day. Mastery of these facts means quick promotion. There can be and is only one result from studying these books a few minutes each day—more money in your pocket.

The Power Plant Library covers the whole field—mathematics, engine running and repair, valve setting, boilers, pipes, pumps, shafting, belting, governors, turbines, refrigeration, electricity. Nothing is omitted. The solution of every problem has been worked out in advance for you, by practical engineers who have been through the mill.

Examine these great books for 10 days, FREE

Every page of this 3000-page Home Study Course will take you a step nearer 100% efficiency. Everything in it is clearly written—easy to understand—easy to apply. It deals only with actual practice. It gives you more available engineering information than one man could possibly gain in a lifetime of experience. And, remember, that you see the books before you buy them. They are sent to you without obligation for 10 days' FREE EXAMINATION. If you keep them, $2 a month for a few months pays for the entire set. But remember, your order must be mailed by July 15th to get the benefit of the Special Price.

July 15 is the Last Day

Send no money—just the coupon!

See them first—pay later

McGraw-Hill Book Co., Inc.
370 Seventh Ave., New York.

Gentlemen: Ship to me, charges paid, your Power Plant Library, eight volumes, SPECIAL PRICE, $14.50. If satisfactory after examination I will send $2 in ten days and $2 per month until paid. If not wanted I will write for shipping instructions.

Signature

Res. Address

City and State

Employed by

Occupation

W 6-24-22

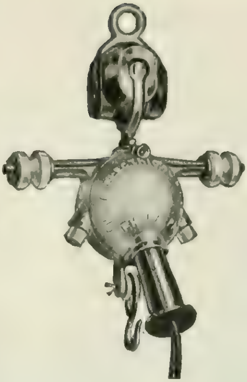
Countless Tiny
Clinging Fibre Feet in
ROCKWOOD PAPER PULLEYS
Reduce belt slip - Decrease belt tension
Transmit more power
Lower total cost of drive, due to
narrower belts.

THE ROCKWOOD MFG. CO.
INDIANAPOLIS, IND.

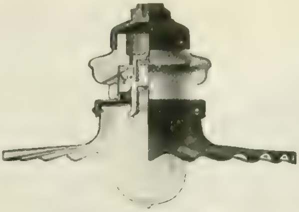
All the Power—All the Time

ROCKWOOD PULLEY SERVICE

No. 507 Absolute Cutout



No. 501 Absolute Cutout



No. 325 High Voltage Series Fixture

No. 326 High Voltage Series Fixture

HERE ARE A FEW

of the products which we carry
in stock awaiting your orders.

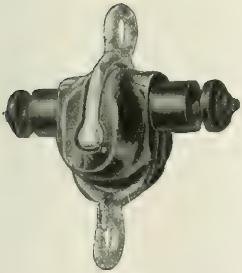
PHILADELPHIA ELECTRICAL & MFG. CO.

1228-36 North 31st Street, PHILADELPHIA, PA.
Pacific Coast Representative: C. E. Ingalls, Rialto Bldg., San Francisco, Cal.

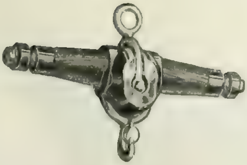
Send for Catalog and Prices

PEMCO

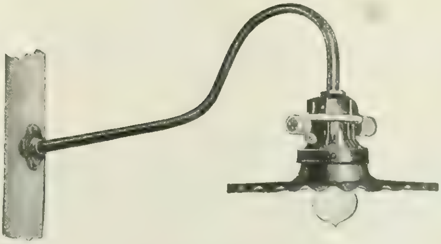
Made in a factory that has produced QUALITY lighting appliances for thirty years.



No. 4 Arc Lamp Hanger

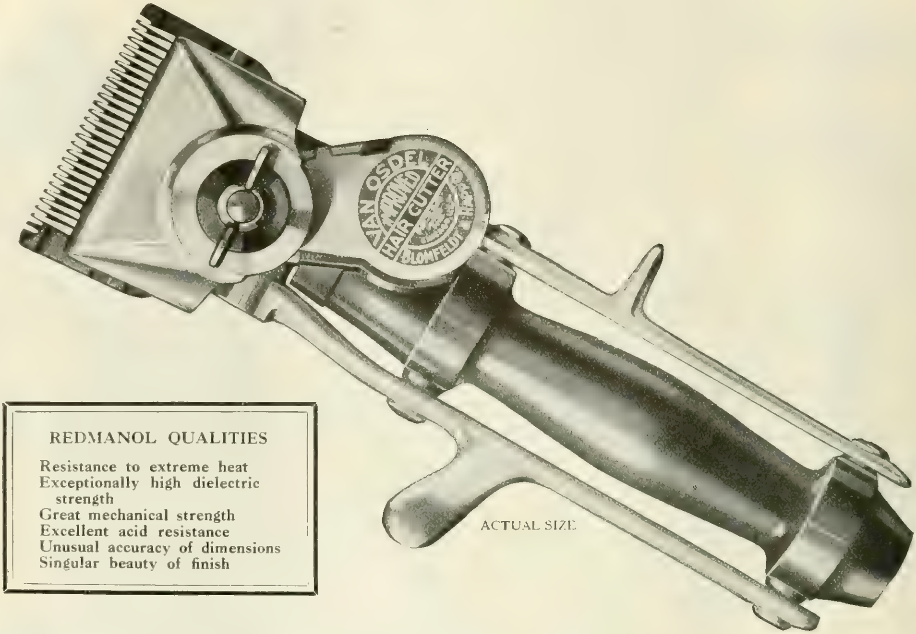


No. 5 Arc Lamp Hanger



No. 327 Series Fixture

No. 1000 Series Socket wth Film Cutout



REDMANOL QUALITIES

Resistance to extreme heat
Exceptionally high dielectric strength
Great mechanical strength
Excellent acid resistance
Unusual accuracy of dimensions
Singular beauty of finish

REDMANOL Makes the Van Osdel Hair Cutter Easier to Use, and More Economical to Manufacture

The *REDMANOL* handle of the Van Osdel Electric Hair Cutter serves as the bearing for the driving shaft and is also the gear housing.

For appliances where non-conduction to continuous heat is necessary (for example that caused by the driving shaft in the handle of the cutter) and where lightness in weight must be combined with exceptional strength, *REDMANOL* excels.

Finished in one operation with inserts accurately placed and lettering or threads sharp and distinct—resistant and non-conductive to continuous heat—very light in weight—exceptionally strong—with a glossy finish unchanged thru constant use, adverse conditions or age, *REDMANOL* enables designs which are impossible without the use of this exceptional material.

And *REDMANOL* outlasts the appliance of which it is a part.

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REDMANOL CHEMICAL PRODUCTS COMPANY
606 W. 22nd St., Chicago, Ill.

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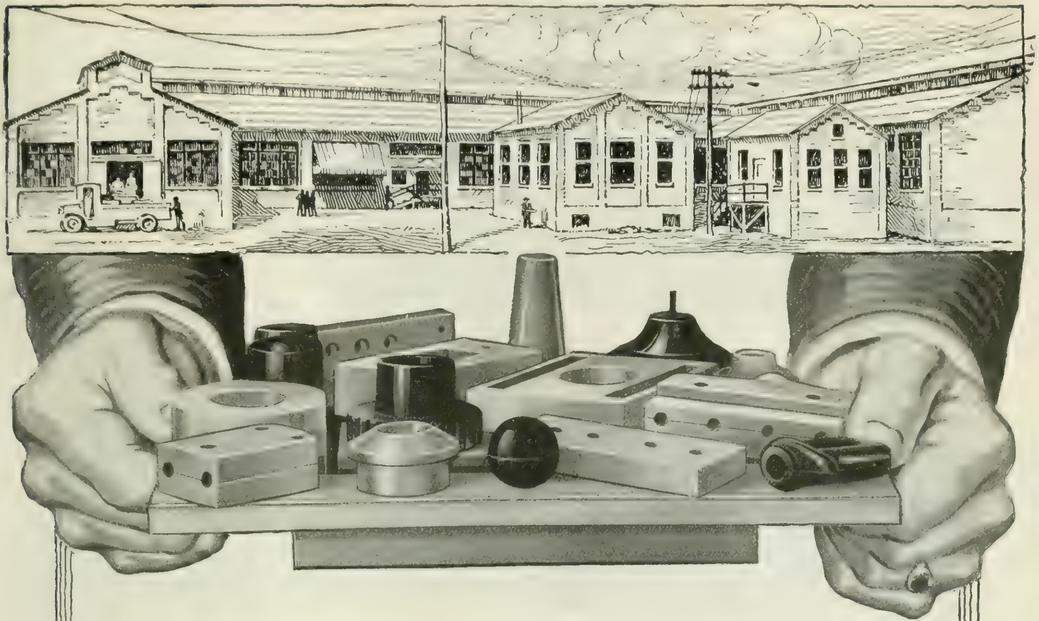
The Basic Material of Many Industries



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and are making hundreds of other moulded specialties of every description, including those of the highest dielectric character.

Send us samples of any moulded parts you are now using, and get our quotations and suggestions.

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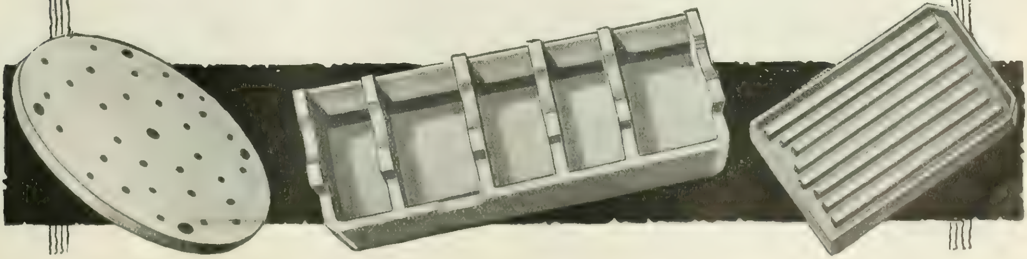

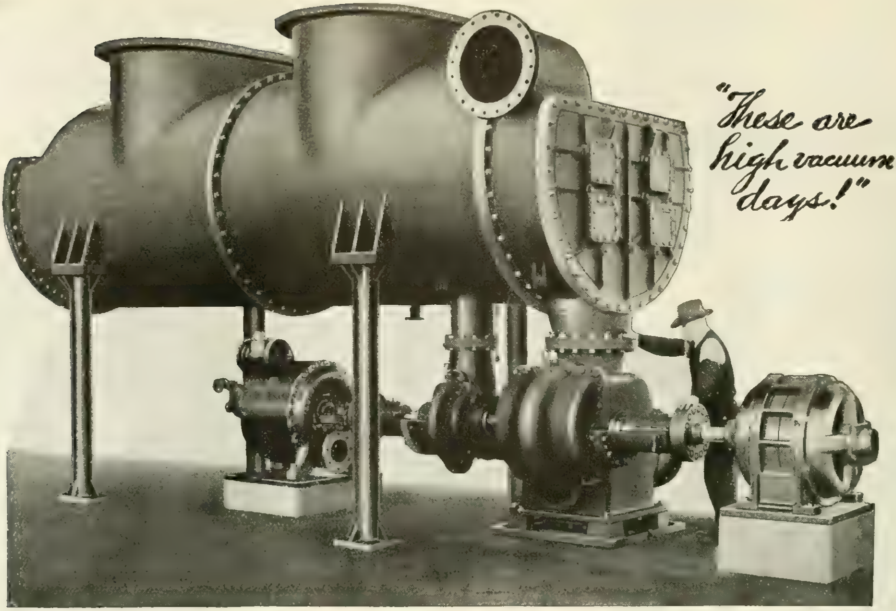

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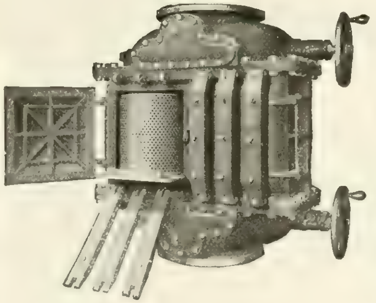
of Elliott-Ehrhart Surface Condensers

For Condensers up to 5000 K.W. Capacity, the Elliott-Ehrhart "Compactype" Surface Condenser is unsurpassed for compactness, simplicity and accessibility.

Condensate and circulating pumps are mounted on the same shaft, two bearings sufficing for both pumps. The pumps may be driven from either end of the shaft, or both motor and turbine drive can very conveniently be utilized. Minimum piping under vacuum and minimum foundations are other noteworthy features.

The Elliott-Ehrhart Air Ejector used with all Elliott-Ehrhart Condensers harmonizes with the complete Condenser in compactness and simplicity.

Bulletin "C," fully descriptive of Elliott-Ehrhart Condensers, — Jet, Barometric and Surface, also contains valuable general Condenser information.



Protect Your Condensers

from damage due to fish, trash and debris of all kinds carried in with the circulating water. Twin Strainers can be placed in any position in the suction line to the Condenser, and make one of the most necessary and profitable accessories to your Condenser installation.

C-240 A

Condensers
Air Ejectors
Deaerators
Twin Strainers
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The electro magnetic stirring action in electric casting gives Chase Brass a fine smooth composition and accurate alloy

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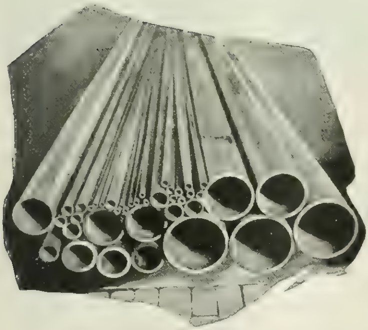
Rod
Wire
Sheet



Chase Tubes are made in an infinite number of sizes to meet every need of industry

Large quantities of Chase Brass are consumed in the manufacture of electrical apparatus and supplies, and many of the most important power plants such as the new South Meadow Station use Chase Condenser Tubes.

Throughout the Chase Metal Works advanced methods of manufacturing prevail, that industry may be furnished with an ample supply of uniformly high grade brass. By laboratory analyses, tests and inspections at every step in the process—with immediate rejection of anything that does not measure up to highest standards—brass tubes, rods, wire and sheets of the finest quality are produced.

Specify Chase Brass.

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Division of Chase Companies Inc.
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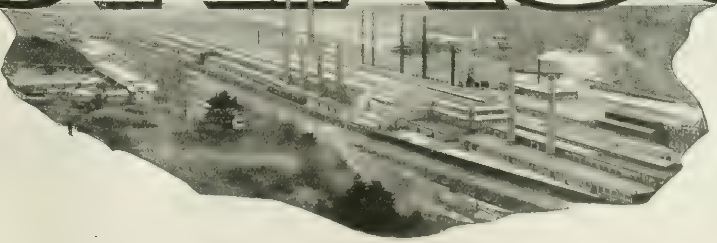
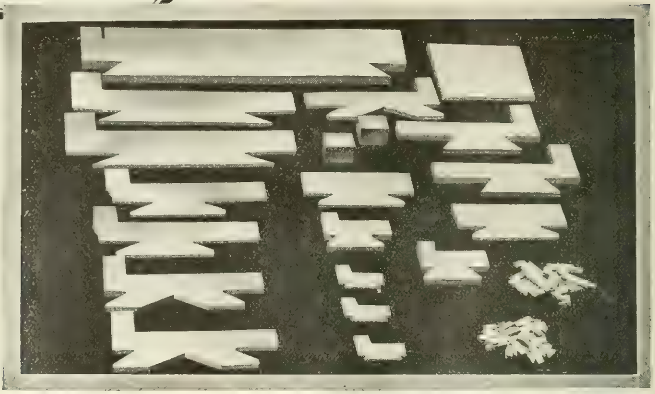
BRASS



ROME Quality BRASS & COPPER



Rome Quality Signifies Service

The idea behind their making, that of correct method and practiced care, is the fundamental reason why Rome Quality products give the satisfaction and service for which they are so widely known. Rome Quality is far more than a name—it is an obligation on the part of its makers to provide only brass and copper that measures to certain high standards of uniformity and quality, so that the prestige of the Rome name may be ever maintained.

Rome Quality commutator bars and segments are the selected equipment of many motor manufacturers, the country over. To them and their patrons Rome Quality bars and segments have long given evidence of their worth.

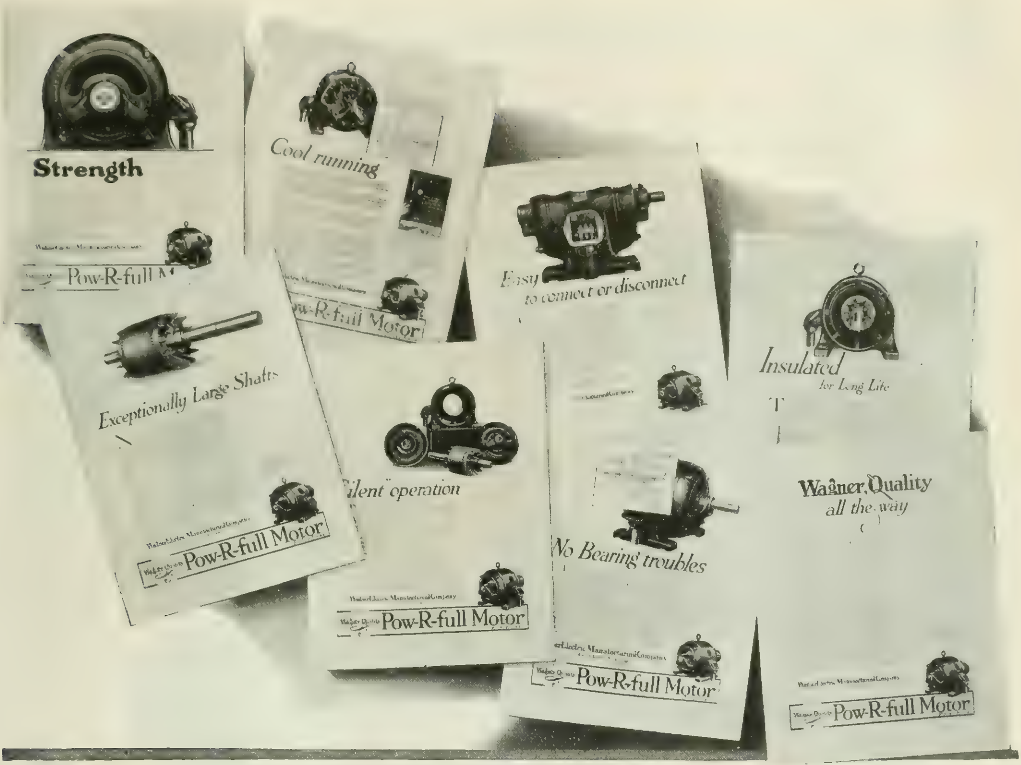
Place Rome Quality in your product and gain the credit which its use will reflect.

BRASS COOPER BRONZE

Sheets; rolls; rods; anodes; tubes, brazed and seamless; strips; extruded shapes; angles and channels; tapered tubes and hose pipes; door rail; commutator bars and segments; electrical copper bar; and rivets and burs.

ROME BRASS AND COPPER COMPANY–ROME, N.Y.

BRASS ROME COPPER



These features please motor users

Why shouldn't they? For each and every one of them is the result of a demand on the part of these same motor users.

For over ten years our men in the field have been gathering data on what motor users want and the Pow-R-full Motor supplies them all.

These features are just what you want in your motor. Bulletin 1294 describes and illustrates many important features of Wagner Pow-R-ful Motors. Ask for it.

Wagner Electric Manufacturing Company,
Saint Louis, Missouri

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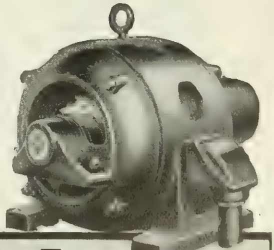

Wagner Electric Manfg. Company Saint Louis U.S.A.
Wagner Quality
Pow-R-full Motor
Polyphase

The development of a rural load produces desirable business for central stations

The G-E Novalux Highway Lighting Fixture

A G-E Novalux Lighted Highway

Highway Lighting— the Missionary of Central Station Service

As a part of the good roads movement, highway illumination is engaging the attention of communities everywhere.

G-E Novalux Highway Units

offer an inexpensive and effective means for lighting rural roads, rendering them safer for traffic and pedestrians.

Highway lighting, wherever installed, serves as a constant advertisement of central station service to the farmers and others using the road. It also makes extension of lines easier as many farms along the lines of the highway can be served cheaply and easily.

G-E street lighting specialists will assist any central station in awakening local interest in highway lighting.

Address our nearest office

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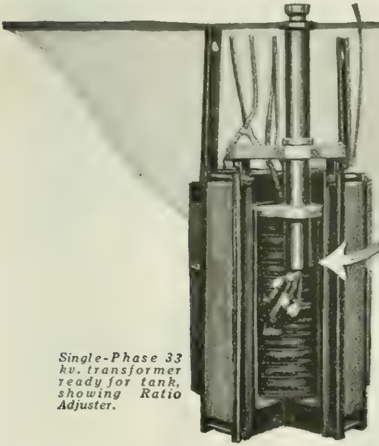
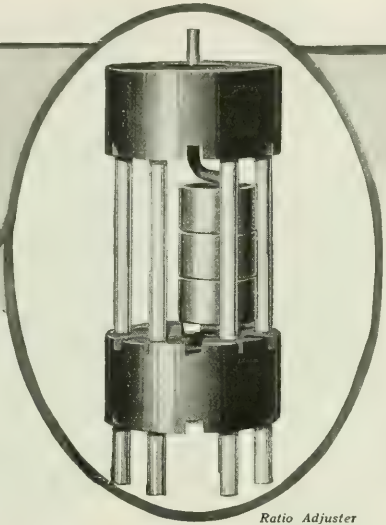
35C-88

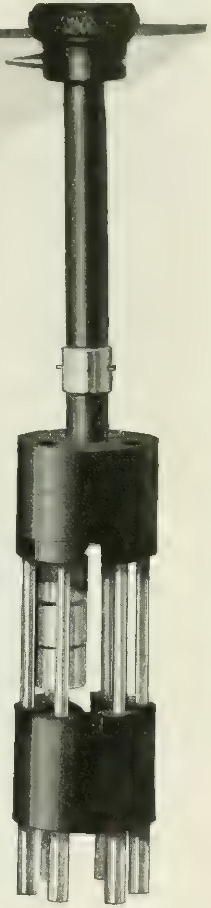
The Most Convenient Accessory Ever Added to a Transformer



Single-Phase 33 kv. transformer ready for tank, showing Ratio Adjuster.



Ratio Adjuster Contact Unit.



Ratio Adjuster Complete.

Transformer Ratio Adjuster

Just a fractional turn of the knob above the surface of the oil near a hand hole opening—and the adjustment is made.

The principal advantages are:

1. Ease and safety of changing taps.
2. No waits for better weather or transformers to cool.
3. No loose parts to be accidently dropped into the windings.
4. No contacts that can be left loose.
5. Contacts are thorough and ***positive***.
6. No diagrammatic sketches to be unravelled with possibility of errors.
7. Error proof. No open or short circuits by failure to make right connections.
8. Elimination of complicated and live terminal boards.

The Ratio Adjuster is an exclusive and original G-E development. Its merit has been established by five years of excellent service records. It is designed for the maximum possible conditions of service, i. e., full circuit current of the transformer and full line voltage between the tap leads.

The Adjuster is regularly supplied on standard distribution and small power transformers, sizes 50 to 500 Kv-a. above 6000 volts and 10 to 500 Kv-a., 13,200 volts and higher.

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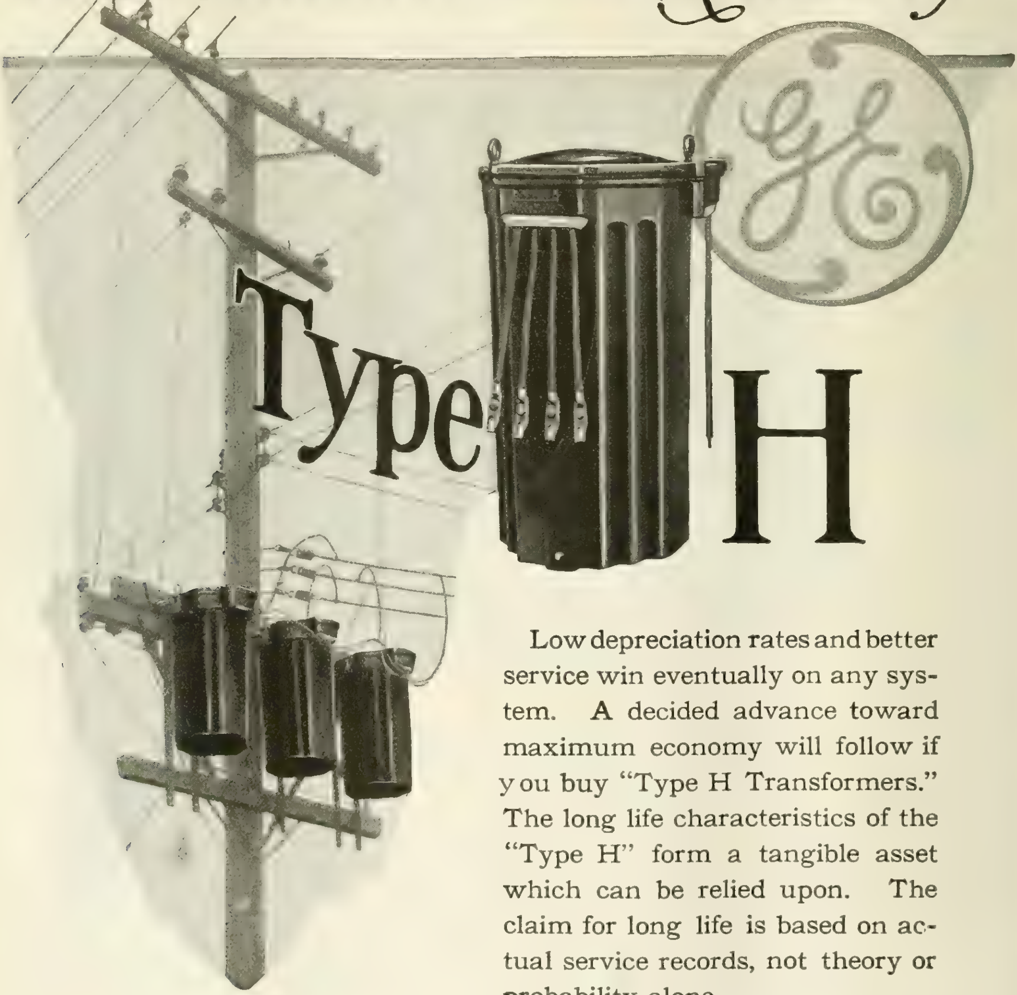
51-40

The Standard of Quality



Low depreciation rates and better service win eventually on any system. A decided advance toward maximum economy will follow if you buy "Type H Transformers." The long life characteristics of the "Type H" form a tangible asset which can be relied upon. The claim for long life is based on actual service records, not theory or probability alone.

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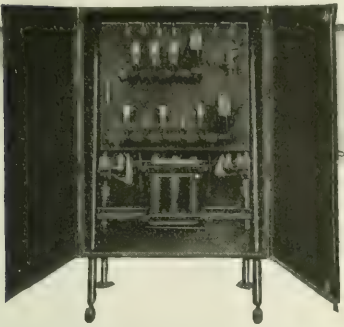
33A-97

Automatic Starting Compensators for Squirrel Cage Induction Motors up to 600 Volts



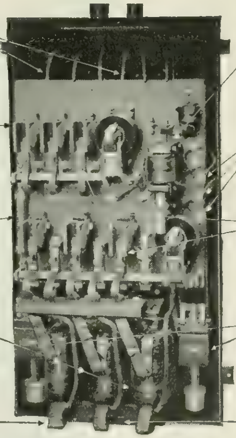
G-E CR 7052 Automatic Starting Compensator—for floor mounting. For 3-phase 50- and 60-cycle motors 60 HP and larger, 220 V.; 125 HP and larger, 440 V.; 150 HP and larger, 550 V. For 3-phase 25-cycle motors 60 HP and larger, 220 V.; 100 HP and larger, 440 and 550 V. Minimum 2-phase ratings are somewhat different.

G-E Ammeter and Disconnecting Switch Attachments, and separable conduit wiring box of wall-type Compensator are designed with small knockout holes for convenient installation of either or both Attachments. These Attachments are for wall-type Compensators only.

G-E CR 7052 Automatic Starting Compensator—for wallmounting. For 3-phase 50- and 60-cycle motors up to 50 HP, 220 V.; 100 HP, 440 V.; 125 HP, 550 V. For 3-phase 25-cycle motors up to 50 HP, 220 V.; 75 HP, 440 and 550 V. Maximum 2-phase ratings are somewhat different. Equipped with separable conduit wiring box designed to be used with or without Ammeter Attachment or Disconnecting Switch.

Thousands of G-E Automatic Starting Compensators are used today because of their incomparable performance—and their flexibility of application for Industry's needs.

Their construction is such that they can be installed easily, inspected readily, and operated with convenience and economy. Enclosing cases for all live parts provide safety for operators, and prevent tampering by others.



Terminals for motor and line leads. Liberal space for connections.

Contactors are suitable for severe service. They have solid copper tips, magnetic blowouts and moisture resisting coils, all accessible for easy inspection.

Fuse protects control circuit against accidental short-circuits when inspecting the equipment.

Three compensator coils for three phase give balanced starting conditions and maximum torque per ampere line current.

Accessible taps for selecting the most desirable starting voltage for any particular starting condition.

Current limit relay automatically opens starting contactor and closes running contactor immediatly upon proper acceleration of the motor.

Terminals for control leads. Liberal space for running wires along edge of base to conduit wiring box.

Starting and running contactors open all lines to three-phase or two-phase three-wire motors.

Two inverse-time overload relays.

Padlock may be attached here to lock cover on.

CR 7052-A1 Automatic Compensator with cover removed

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43A-75

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AN INVESTMENT

When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form.

KERITE remains long after the price is forgotten.

KERITE INSULATED WIRE & CABLE **COMPANY**
NEW YORK CHICAGO

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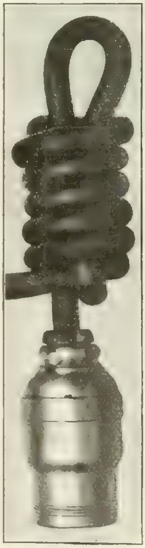

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Tirex Cord is noteworthy because of its clean outer surface. It may easily be wiped clean when soiled and is always ready for the next job. It does not collect and hold dirt or grease and will not absorb moisture.

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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New York, Saturday, June 24, 1922

Volume 79 *Number 25*

Why the Vehicle Waits

THE other day there appeared in the leading New York newspapers a full-page advertisement by an electric vehicle manufacturer. It was well displayed, well illustrated, full of interesting facts, convincing in argument and strong in selling appeal. It offered one of the best-known trucks at a newly reduced price, with an easy-payment plan, quantity discounts and a money-back guarantee.

Every electrical man who read it was surprised. For electrical men have got into the habit of not taking the electric vehicle very seriously.

YET this same electric vehicle offers one of the greatest economic benefits which electricity has ever brought to industry. It promises one of the most productive loads the central station has ever known. It will some day provide a volume of business that will probably rival any other branch of our great industry. And this has been apparent to many minds for many years. But it has waited on development by the vehicle manufacturer and acceptance by the central station.

The central-station man has stalled because he tried to use the earliest vehicles unintelligently for every class of service and, being disappointed, turned against them. The vehicle manufacturers have resented this lack of sympathy and vision and been out of patience with the central station. They have also wrangled among themselves and wasted time and energy.

As a result the evolution of the electric vehicle has been lamentably delayed. But it has not stood still, because it embodies fundamental advantages and principles that are economically sound and no combination of prejudices could permanently block it.

ELECTRICAL men can no longer afford to ignore the electric vehicle. Vehicle manufacturers can no longer afford to weaken their influence by friction between the road-truck and industrial-truck factions, by antagonistic competition between individuals, and by disregard of the vital need of selling the idea to the central station.

To the public all kinds of trucks are electric vehicles, and people will inevitably continue to go to the central-station man to ask advice. And as long as the battery must be charged with electric power, it will remain in the popular mind an electrical appliance.

The electric vehicle will never come into its own until the central station believes in it, uses it, supports it and co-operates in the establishing of adequate local servicing facilities. This already-possible load of inestimable value both in profit and good will and this great undeveloped branch of the electrical industry are held back waiting for the vehicle men and the central-station men to get together.

Rudolph Frederick Schuchardt

An outstanding figure in the electric power and light industry and the new chairman of the N. E. L. A. Technical Section.

FEW engineers can do many things well, and still fewer can be counted upon at all times when the electrical industry calls upon them for assistance. R. F. Schuchardt is one of the most versatile men in the industry and has attained an outstanding technical position as electrical engineer for the Commonwealth Edison Company. In addition, he has been a very influential factor in the upbuilding of all phases of the electrical business through his active participation in the work of the national and local organizations. His versatility is indicated by the fact that, on the one hand, he won the Chanute medal of the Western Society of Engineers for an able paper on "The Rotary-Converter Substation" and was responsible for the electrical features of the Northwest and Calumet stations of his company, while, on the other hand, he has written a play which was produced by the students of the University of Wisconsin, his alma mater, and a booklet entitled "Panama and the Isthmian Canal." In the civic affairs of Chicago Mr. Schuchardt has taken an active interest and has held responsible positions. He was president of the Lake View Civic League for eleven years, is now a member of a committee studying the electrification problems of Chicago, and is active on the ways and means committee of the Chicago Association of Commerce.

He was born in Milwaukee, Wis., Dec. 14, 1875, and received the degree of electrical engineer from the University of Wisconsin in 1897. After graduation he was connected with the Janesville Electric Light & Power Company and then was an engineer with Mysenberg & Badt of Chicago. Entering the employ of the Commonwealth Edison Company in 1898 as a substation operator, he rose rapidly in the organization and became chief electrical engineer in 1909. While with this "big policy" company he has been very active in the development of all phases of its business. His work in laying out the new stations and in solving the problems in protection and distribution has furnished the material for many articles in the technical press and has given him the experience and knowledge that have made his services so valuable to the Technical Section of the National Electric Light Association. The operating system of the company, the school for the education of the employees and the Edison Round Table are largely the result of his activities. In addition he has served and is serving on some of the most important committees of the A. I. E. E. and the N. E. L. A., and is a past-president of the Chicago Section of the Illuminating Engineering Society.

The titles of some of the papers that Mr. Schuchardt has contributed to the A. I. E. E. are "The Use of Power-Limiting Reactors with Large Turbo-Alternators," "The Protective Equipment on the System of the Commonwealth Edison Company" and "The Use of Reactors on Large Central-Station Systems." He is a fellow of the Institute and chairman of the power-stations committee. As a member he is active in the I. E. S., the Western Society of Engineers, the Society for the Promotion of Engineering Education, and the Institution of Electrical Engineers of Great Britain. Director of the City Club of Chicago and a member in the Chicago Engineers' Club and the University Club of Chicago, he still finds time to act as president of the University of Wisconsin Club of Chicago.

Mr. Schuchardt's breadth of mind, industry and vision will as never before be devoted to developing the industry during the coming year.

Editorial Comment

Electrical World, June 24, 1922
Volume 79 Number 25

Government Control Means Higher Taxes

A VIVID picture of how government operation of public utilities paralyzes the taxpayers was set forth in a recent statement by the Real Estate Board of New York. The real-estate men view with misgiving the "growing tendency," because municipal operation means tax exemption for the utility, and if no new revenues are discovered, "the old standby," real property, must take on the extra burden.

In the United States there are privately owned electric power and street railway utilities valued at something like eleven billion dollars. There are municipally owned utilities of the same kind estimated to be worth two billion dollars. If all public utilities are to be acquired and publicly owned, it will mean new bond issues of eleven billion dollars, which added to the seventeen billion dollars of tax-exempt securities already outstanding would make a total of twenty-eight billion dollars, or close to one-fifth of all our taxable national wealth, relieved from the burden of taxation.

In Manhattan Borough, New York City, it is said, only 2 per cent of the heads of families own their own homes. To 98 per cent of the householders, therefore, the question of whether or not a city-owned public utility returns a profit on its operation is apt to be of less pressing interest than obtaining lower rates for service or than more extensive service. As a matter of fact, the present annual loss of ten million dollars to the city on money invested in subways on which there is no interest return receives very little attention and small adverse criticism, although it adds ten points to the tax rate.

Many excellently sounding reasons are advanced why there should be public operation of public utilities, but it does not necessarily follow that public operation is profitable or desirable. Virtual public ownership can best be obtained by the natural process of selling the securities of the utility to the people of the community. The interests of the people are then safeguarded because they own the utility. And, because professional operation has always proved less costly than political operation, the people who own the company through security holding always prefer to operate that way.

A Basis for More Intelligent Selection of Insulating Oils

CONCLUSIONS from real research on insulating oils for transformers and circuit breakers are presented in this issue by C. J. Rodman, who points out that erroneous conceptions have been held in the past regarding the behavior of such oils. One correction which he emphasizes is that mineral-oil vapor is not spontaneously explosive and that even when subjected to an arc it has a narrow explosive range, dependent on the amount of air mixed with it. Owing to the greater hazard with circuit breakers, due to the violent agitation of the oil during the rupture of the current, Mr. Rodman advocates the omission of air vents on the tanks of such apparatus and suggests that inert gases might be used to fill the space required over the oil to allow for expansion. In view of the research on which these suggestions are based, they should receive serious consideration. However, it may be pointed out that the mufflers now used on some circuit breakers virtually preclude the possibility of oil explosion following current rupture.

Sludging of oil has been experienced so extensively in both transformers and circuit breakers that the author's explanation of the three most common causes of sludge formation should be a most welcome help in eliminating this operating trouble. Evidently the principal remedial steps in both cases will be to design the containing tank so that the oil will not be brought in contact with air, to prevent corona discharge, to avoid hot spots and to use materials which will not react with the oil selected. As for the oil itself, or a substitute therefor, it is obvious that the ideal dielectric for transformers and circuit breakers would be a non-inflammable fluid of high dielectric strength, and it should also be resistant to chemical action and should not act as a solvent for the materials immersed in the oil. An additional requirement for transformer oil, of course, is that it should possess sufficient fluidity to insure adequate cooling. Certain of the saturated mineral oils best fill these requirements, but much room for improvement still remains.

Export Trade and Foreign Standards

THERE is an interesting problem before the electrical manufacturers of America in the question whether they should imitate the designs and standards of foreign countries or insist upon selling their own standards or nothing. Customers abroad have long been accustomed to types and styles which differ widely from those which we use in this country. Manufacturers here are equipped to make their own goods in their own way and can naturally produce most profitably by adhering to their established standards. But the purpose in export business is to sell goods to foreign peoples, and there are other considerations to be counted in. For instance:

Many of our wiring devices do not appeal to foreign buyers because their custom has been to use wall switches and few pull chains or key sockets, and they prefer the tumble switch to the snap switch.

Many of our devices are too costly for the foreign market because regulations are less stringent there and more economical materials and fittings may be used. In Europe they use iron conduit with a wall much thinner than ours, as well as Bergman tubing, which is made of insulating paper impregnated with compound and surrounded by a brass shell. This tubing is installed exposed and has been long in use with apparent satisfaction. At the same time bayonet-type sockets, lamp bases and plugs are in general use. Wire is often sold in millimeter sections and of certain lengths. And there are naturally other local trade conditions.

To attempt to force our more rugged, supersafe devices and materials and our different standards upon the foreign market often places us at a serious disadvantage. The question is, however, just how far the American manufacturers want to go in the production of special export types and styles, for, of course, one of the reasons why export business is so profitable is that it provides a market for surplus stock and surplus capacity and a diversity of demand that fills up the valleys of the local seasonal business.

During the war we were able to force our standards upon the foreigner to a degree not possible today. It would be ideal if all the world would accept our ways, but it will not. And we must not forget that the success of the German in export trade in the days before the war was due in no small measure to his readiness to adapt himself to the habits and tastes of his customer and make for foreign markets what the foreign people want to buy. It is an element in our export opportunity that must not be overlooked.

The Muscle Shoals Muddle

INSTEAD of bringing order out of chaos, the various committees of Congress that have had the Muscle Shoals matter under investigation for some time have only added still further to the confusion. The House military committee, for instance, has returned four sets of recommendations. The majority report recommends the acceptance of the Ford proposal except that it would exclude the Gorgas steam plant. One minority report recommends compliance with all the Ford provisions and asserts that excluding the Gorgas steam plant would defeat the entire offer. The second and third minority reports are adverse to the Ford proposal as presented. Thus the House committee proposes three courses to Congress—one, government ownership and operation; another, government ownership and private operation, and a third, making the necessary appropriations for the dams, authorizing the sale of all the plants and properties and the leasing of the power developed, thus freeing the government from further expense for operation and maintenance. The government has expended approximately $106,000,000 on the Muscle Shoals property, which expenditure, though extravagant, was deemed necessary as a war measure. Certainly the House committee is not lacking in humor, since Mr. Ford's offer of $5,000,000 in cash is labeled "a mere bagatelle."

The Senate, as was to be expected, is more definite and constructive in its recommendations. The Norris committee recommends that a sufficient appropriation be made to complete the uncompleted work, thus conserving the large investment already made, after which time due consideration can be given the several offers made for the government property. Of course, the government will never get back any considerable part of the money it has put into the property, and it cannot, or if it can it ought not to, operate the project. We doubt whether, after having committed itself to a definite water-power policy, there is any likelihood of the government tying itself up for one hundred years in a contract with Henry Ford, but the House committee obviously has done nothing to clear up the matter. When all phases of the situation have been canvassed there is no escape from the conclusion that electric public utilities are best equipped to develop water-power resources economically and efficiently and to make the power available to the greatest number of people. That, after all, is the function of government, and no public property should ever be turned over to a private individual—be it Henry Ford or any one else—for his personal benefit and profit.

The Queenston Station—Another Step in the Development of Great Lakes Power

REGARDLESS of how one may view the Hydro-Electric Power Commission of Ontario or what may be thought of some of the outstanding features of its chief station on the Niagara River at Queenston—and we have been among the severest critics—there is much that is commendable in the plant. Passing over the choice of frequency, which we feel is a colossal blunder, and the high cost of the development, we are free to acknowledge the boldness, enterprise and daring shown in much of the electrical work undertaken. In conception no fault can be found with the general plan—it is ideal. It embraces a superpower hydro-electric station, the largest in the world, and a vast network of interconnected lines. This makes for efficiency and, if the costs are carefully watched, ought to result in cheapness of energy as well.

The station at Queenston is remarkable in that it utilizes nearly 94 per cent of the drop between Lake Erie and Lake Ontario, and because of the ideas embodied in the layout and construction to assure high plant efficiency and continuity of operation. With plans for an ultimate rating of 500,000 kw. and involving units of 55,000 hp. and larger, care had to be exercised in the Queenston station to prevent excessive damage from short circuits. The very complete investigation of this subject by engineers of the Hydro-Electric Power Commission is an indication of the thoroughness with which the major problems of design were attacked. One of the most interesting observations was that the star bus, with reactors only between generators, is the most desirable for four or fewer units, whereas the loop bus is preferable where more units are operating in parallel. The design of generators for an overspeed of 185 per cent and the precautions taken to guard against the units dropping out of step and other similar protective measures were all accomplished happily without adding complexity to the system.

Certainly, there is much that is worthy of emulation in the study made of the destructive forces exerted on busbars and the methods of mounting to offset these forces as well as to avoid interphase short circuits. The unusually extensive use of differential relay protection is another feature worthy of comment. Why the high-tension equipment was not mounted on the roof of the station or on the top of the escarpment is a question which engineers might properly ask, but a little thought will show that the engineers of the Hydro-Electric Power Commission made the best selection possible since space was available between the generator room and the side of the gorge, and housing did not add an appreciable expense. An innovation which will commend itself to other plants using vertical units is the practice of building the generator-room floor on the level of the top of the generator frames, allowing the direct-connected exciters to project above the floor. Such an arrangement facilitates ventilation of the units, provides a convenient location for the auxiliaries, braces the superstructure, and, what is most important from an operating viewpoint, removes obstructions from the generator-room floor. No doubt, operating engineers will also find much to interest them in the arrangement of the busbar structures.

Unlike most municipally or governmentally owned electrical enterprises, a much higher order of engineering skill than usual has been manifested in the work of the Hydro-Electric Power Commission. While it is only just that the engineers responsible for the design should receive all the credit that is due them and which we feel every engineer will gratefully accord them, this, of course, will not cause blindness to the economic questions involved and the larger issues of public policy.

Temperature Control of Transformers Needs Further Investigation

OPERATION of distribution transformers on a temperature basis rather than by the hit-and-miss method of trying to estimate the actual load from a book record of connected load on the consumers' premises is making progress despite the difficulties in the development of methods. That there are distinct advantages seems evident from the data presented in the recent discussion of the report of the overhead-systems committee at Atlantic City. L. L. Elden, in presenting the data on about five hundred transformers in Boston operated with temperature control, said that it had been possible to operate transformers at 175 per cent of rating day after day, and, even with the high summer temperatures, ratings of better than 100 per cent have been maintained. The data presented indicated that much higher average ratings have been maintained than has been possible under the older methods. All of this points to possibilities of better use of existing equipment and possible reduction of investment charges.

There is a decided difference of opinion among authorities as to the way in which temperature should be measured. Some contend for a correction for ambient temperatures. Others contend that the actual temperature inside the transformer, regardless of the outside temperature, is the proper measure. A good deal of difficulty is experienced in getting at the real answer because of the lack of instruments for general use that will reveal what actually happens in the transformer. In recent investigations maximum-reading thermometers, similar to the clinical thermometers used by physicians, seem to be gaining favor because of the ease with which they can be put in different positions in the transformer under observation. But, even with the results of investigations with such thermometers available, different authorities are inclined to disagree as to the best position for the thermometer. In one case it is stated that the instrument should be placed directly over the core in the stream of heated oil rising to the surface from the coils and core. Others claim that the instrument should be worked into the oil ducts, or down into the coils, or against the core.

It seems clearly proved that there is a distinct advantage in temperature control. There is yet an open question as to the most practical means of obtaining the advantage. Further investigation like that in Boston will aid materially in supplying the answer.

Bay State Industries Believe in Central-Station Service

MASSACHUSETTS industries are being electrified along progressive engineering and economic lines, according to the extended analysis of this important subject presented by R. M. Davis on another page of this issue. This analysis, which is the fifteenth in the series of industrial electrical surveys being conducted on a country-wide basis by the McGraw-Hill Company, under the supervision of the editorial departments of the ELECTRICAL WORLD and *Power*, shows very clearly that if the good work already accomplished by electrical engineers continues, it will not be many years before Massachusetts will furnish a superb example of industrial electrification from the standpoint of varied and carefully designed installations.

It is particularly gratifying to observe the extent to which manufacturers are depending upon central-station energy for the operation of their plants. Nearly two-thirds of the inconceivable total of 1,600,000,000 kw.-hr. consumed by Massachusetts industries in 1920 was purchased from central-station systems. The war was an enormous stimulus to the buying of energy, and industry has stuck to its new friend, the electric utility, because the latter has made good year in and year out in efficiency and reliability of service. It is not easy to measure the influence of central-station power engineers upon industrial-plant electrical practice, but it is unquestionably far-reaching. It would be less so were industrial managers, superintendents and engineers less open-minded; but, fortunately for all concerned, there has been and still is a very high grade of co-operation in making electrical applications along the lines of the best modern thought in this immensely important field.

More than half the motors in Massachusetts industries are under 5 hp. in rating, out of a total of some 117,000. This subdivision of driving makes for admirable control of manufacturing processes and waste reduction in power use. The textile industry, as might be expected, is much the largest user of industrial energy, taking about 41 per cent of the total in 1920. Individual motor drives have made mighty strides in this field in the last decade, and so the small motor has come sharply to the front. More than a third of the motors in this state's industries are in textile mills. Other industries, however, are extensively electrified now, and the general use of alternating current is marked, though requirements of variable-speed motor service have retained a relatively large amount of direct-current service in the metal-working industries.

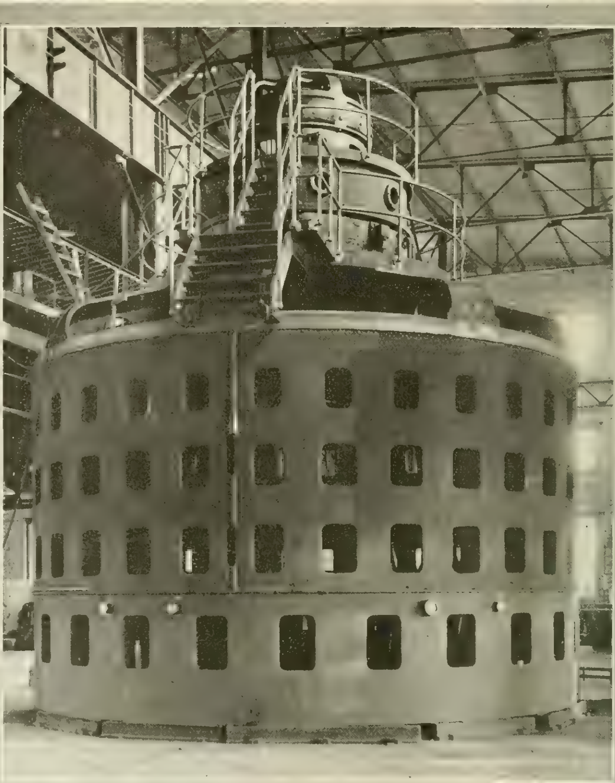
Notwithstanding the splendid development thus far attained, industrial electrification in Massachusetts, as elsewhere, challenges the best efforts of the engineer for future achievement. There are possibilities in the way of control equipment application, voltage standardization and drive design which will interest manufacturing plants for a long time to come. Fewer voltages for motor service are in use in Massachusetts than in some other highly industrial states, and this is to be commended. We are nowhere near finality, however, either in the collateral problems of motor driving or in the advance of the motor itself into fields at present served by other kinds of power equipment. Switching, fusing, rating—these and other matters await the attention of the engineer in pursuit of betterments in existing installations as well as in new applications. To the alert electrical man the figures presented in this article are vibrant with suggestiveness.

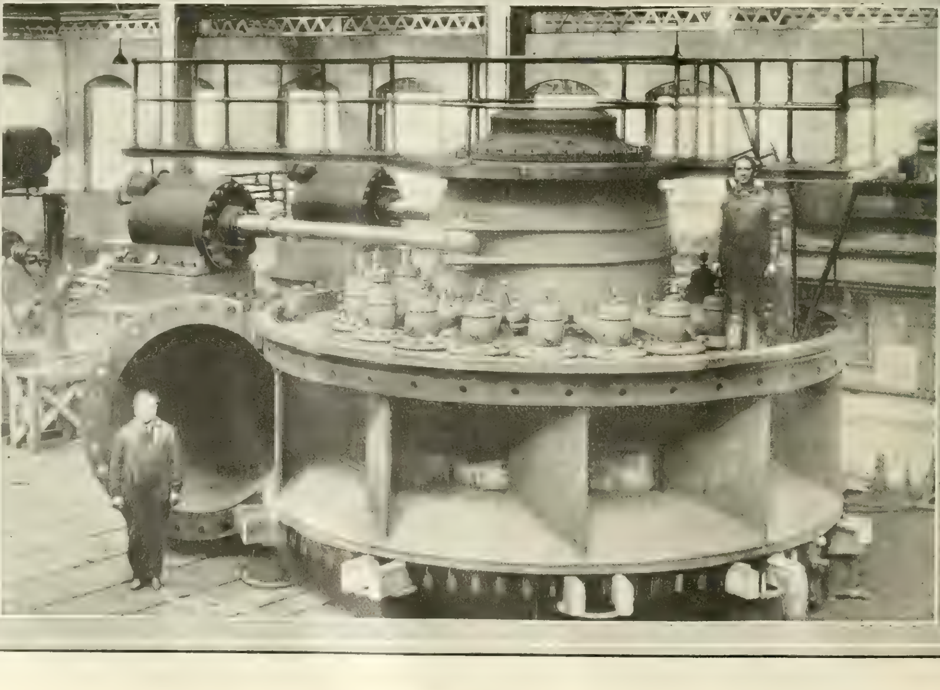
55,000-Hp. Generator and Waterwheel of the Chippawa-Queenston Development

TWO waterwheel-driven generators rated at 55,000 hp. (45,000 kva.) are now installed and operating in the new Chippawa-Queenston development of the Hydro-Electric Power Commission of Ontario. These units are fed from a forebay at the top of the Niagara River gorge, under a head of 305 ft., by 10-ft. penstocks. Gates are provided at the top and Johnson valves at the bottom of the penstocks. Both Moody spreading and ordinary curved draft tubes are installed.

The generators operate at 12,000 volts, three-phase, 25 cycles, and are capable of operating continuously at 49,500 kva. with either voltage or current 10 per cent in excess of rated value. The units are completely inclosed, air being drawn either from outside or from the generating room. Ample heat is available from the ventilating air (1.2 kw. per 1,000 cu.ft. of space) to heat the building at all times. Speed regulation is not difficult because of the ratio of penstock length to head and because of the flywheel effect of the generator rotors, namely, 21,500,000 WR^2.

The generator room floor runs along the level of the upper frame of the generator, leaving only the direct-connected exciter projecting above the floor. This relieves congestion on the generator floor yet allows placing auxiliaries closely to their corresponding generators.





Arrangement for Handling 500,000-Kw. Load from Queenston Plant

Most Economical Utilization of Water Power Available and Protection Against Interruption of Service Were Chief Factors Influencing Design of This New Station of Hydro-Electric Power Commission of Ontario

Considered from any point of view, the new Chippawa-Queenston hydro-electric development of the Hydro-Electric Power Commission of Ontario is a remarkable and unusual development. From a hydraulic viewpoint, it is particularly interesting in utilizing nearly 94 per cent of the available head between Lakes Erie and Ontario, for the unusual facilities provided to prevent ice troubles and minimize the loss in head from intake to wheels and for its hydraulic efficiency (approximately 30 hp. per cubic foot). Its waterwheels, of which there are now two installed and operating (ultimately there will be nine or ten) have the highest rating in existence, namely, 55,000 brake horsepower.

Electrically the plant is no less interesting. Chief among the features are the arrangement of the equipment and the provisions for handling the large power demand without interruption to service. For example, the generator room floor is on a level with the top of the generator frame, allowing auxiliaries to be placed closer to the unit; the control room is over the turbine room, and the electrical equipment is between the generator room and the side of the gorge in which the station is built. In addition, the circuit breakers are isolated from each other; a unit system will be used, involving double 12,000-volt buses and reactors between generators; exceptionally rugged bus structures are employed; differential relay protection is used extensively; the main units are designed for 185 per cent over speed, and facilities are provided for readily overhauling the turbine runners.

Water is taken from the Niagara River about 1 mile (1.6 km.) above the falls at Chippawa and is conveyed through an improved section of the Welland River a distance of 4½ miles (7.2 km.), thence by a canal 8½ miles (13.6 km.) long to the forebay and screen house situated on the Niagara River about a mile south of Queenston. From the screen house steel penstocks incased in concrete carry the water down the cliff to the power house, which is at the bottom of the gorge. Of the 327 ft. (99.6 m.) available head between Lake Erie and Ontario approximately 305 ft. (92.9 m.) will be utilized when the installation is complete.

The structure required to house five main units is 350 ft. (106.6 m.) long, but this length will be doubled ultimately for nine or ten units. Location of the transformer and switching equipment on top of the escarpment was considered, but owing to the difficulty of carrying the current at 12,000 volts from the generators to this point, the operating advantages in having a combined station, and the space available between the generator room and the cliff, it was decided to have the building house the transformers and switching equipment as well as the generating equipment. By constructing the generator-room floor on a level with the top of the generator frames space was provided at small cost for the exhaust air ducts, fans and generator-field equipment adjacent to the units, without obstructing the space around the generators on the main floor. As may be noted, the generator cooling air is drawn through ducts on the east wall of the station either from outdoors or from the inside. A longitudinal tunnel in the substructure facilitates the handling of the turbine runners and piping.

One generator, one bank of transformers and a line constitute a unit with a normal capacity of 45,000 kva. Since it is impracticable to dispose of power in blocks of this size, however, grouping of units is essential. For this purpose 12,000-volt and 110,000-volt buses are provided. At present only one 12,000-volt bus, with reactors between generators, is installed, but space is provided for a second or emergency bus.

To determine the mechanical, magnetic and thermal effects on conductors and the normal and abnormal operating conditions, extremely interesting studies were carried out with different groupings of equipment. From the studies it was found that the star bus has a slight advantage over the ring bus with not more than four generators operating in parallel in so far as short-circuit currents are concerned. With more than four generators in parallel, however, the short-circuit current with the star bus is considerably higher.

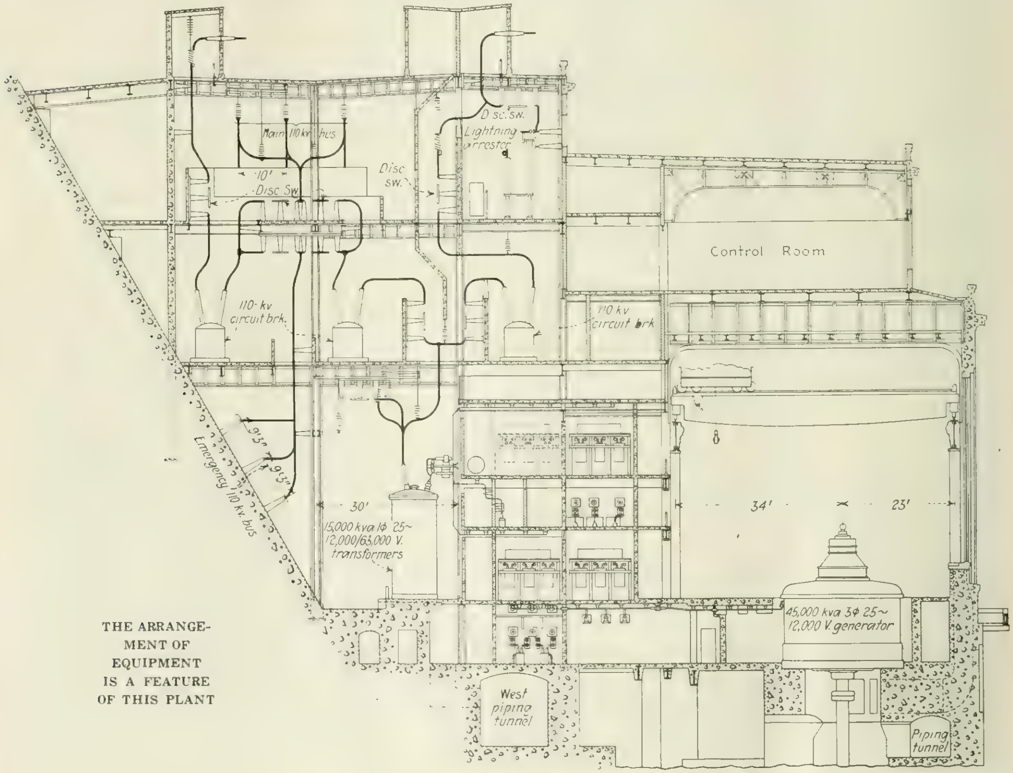
Reactors Used Between Generators

With eight generators operating in parallel and no reactors between units, the root-mean-square value of the first wave of the symmetrical short-circuit current may reach a value of 140,000 amp. Using 4 per cent reactance (based on a 45,000-kva. generator) in bus reactors between generators connected to a ring bus 73,000 amp. would result. If the star bus were used 104,000 amp. would result. Under such conditions the forces exerted between buses would be extreme with a 2-ft. (0.6-m.) spacing, so it was decided to install 5 per cent bus reactors between the generators and to mount the buses 48 in. (1.2 m.) apart. Further increase in the reactance between generators would cause only slight reduction in the short-circuit current.

The generating units are each rated at 45,000 kva., 80 per cent power factor, 12,000 volts, three-phase, 25 cycles, at 187.5 r.p.m. They are capable of being operated continuously at 49,500 kva. with 110 per cent normal voltage or current. As may be observed the units are the vertical type with direct-connected exciters. The over-all efficiency of the units is slightly in excess of 97 per cent at the rated power factor.

Units Nos. 1, 2 and 3 are all of the same make, having a rotor with cast-steel spider and laminated sheet-steel rim dovetailed to the spider. The upper and lower brackets are provided with Kingsbury thrust bearings. In the slot portions of the armature the windings are insulated with iron on sheet-mica insulation, whereas the end portions are insulated with mica and varnished-cambric tape. Units Nos. 4 and 5 were made by a different manufacturer and have a rotor made up of seven cast-steel sections, five of which carry the pole pieces and the other two, one above and one below, provide additional flywheel effect (21,500,000 WR^2 total). Spring-supported thrust bearings are used in these units. The armature coils are insulated throughout with mica tape. The rotors of all the units are required to withstand 185 per cent of normal speed, and the armature insulation is tested for 30,000 volts.

Aside from the normal excitation furnished by direct-connected exciters, auxiliary or emergency excitation can be furnished by a motor-generator set which can be connected to work with the voltage regulator belonging to any one of the main units At present there is only one auxiliary exciter for five units, but in the completed station additional sets will be installed.



THE ARRANGEMENT OF EQUIPMENT IS A FEATURE OF THIS PLANT

Vibrating relay-type voltage regulators are employed which are equipped with compensation to prevent cross-currents when units are in parallel and to allow for ohmic and inductive drop in transformer banks and lines. Each regulator is also provided with a device maintaining a low maximum of exciter voltage in case of a drop of voltage due to short circuit, and also with a device for limiting the voltage in case of overvoltage due to overspeed or other causes. No main-generator-field rheostats are used.

Oil circuit breakers for 12,000-volt service are rated at 15,000 volts, 3,000 amp., continuous capacity. One type, used principally with units Nos. 1 and 2, is solenoid-operated and has one 36-in. (90-cm.) steel tank per pole. Inverted brush-type contacts with two breaks in series are used. To obtain a high rupturing capacity a large amount of oil under considerable head is employed.

Motor-operated oil circuit breakers with two grounded tanks per pole are used with units Nos. 3, 4 and 5. The arc is broken under oil in an explosion chamber arranged with baffles to direct a stream of cool oil under pressure across the path of the arc. Contacts of the wedge and finger type are used.

For 110,000-volt service oil circuit breakers rated at 135,000 volts, 600 amp., continuous capacity, are used. They are operated by solenoids and have one tank per pole. Each pole has four breaks in series, arrangement being made for quick separation to increase the rupturing capacity.

The 12,000-volt circuit breakers are installed in separate rooms on two floors between the generator room and the transformers, with the main buses occupying an intermediate floor. These rooms are ventilated to the generator air-discharge shaft. The breaker leads run through bushings in the rear wall.

The position of the 110,000-volt circuit breakers is shown in the accompanying cross-section of the plant. The breaker on the direct circuit from the transformer bank to the transmission line is separated entirely from all other breakers by walls. Each unit group of breakers is in one room.

Very strong construction was required for the 12,000-volt bus and connections from the generator terminals to the transformer terminals. No cable could be used for any of these connections. On the basis of the short-circuit current analysis previously mentioned, it was finally decided to adopt a spacing of 48 in. (1.2 m.) for the main buses, breakers and transformer connections and 37 in. (0.92 m.) for the generator lead to the buses. With these spacings and a calculated short-circuit current having an asymmetrical peak of 170,000 amp., the maximum forces exerted on the buses per foot of length would be 485 lb. per foot (720 kg. per m.) for the 48-in. spacing and 630 lb. (907 kg.) for the 37-in. spacing. By using a single-unit porcelain bus support having an ultimate cantilever strength of 10,000 lb. (4,535 kg.) it was possible to space the supports along the bus about 5 ft. (1.5 m.) apart and still obtain a factor of safety of three under maximum load conditions. These supports have a smooth surface, cemented-on cast-iron hardware, and a flashover strength of 80,000 volts at 25 cycles.

Three 4-in. x ¼-in. (10-cm. x 6.3 mm.) copper bars laid flat on the insulator cap were adopted for buses. By attaching the bus supports directly to the floors and walls it was possible to dispense with the usual barriers and also to place the buses in the position of greatest resistance to mechanical deformation. Since the sagging of the copper due to its own weight is a limiting factor in the arrangement adopted, it was not possible to space the bus supports at the maximum distance considering the short-circuit forces involved. Another interesting fact brought out in laboratory tests prior to the installation of buses was that there is a real danger in supporting the buses in such a manner that their natural period of vibration will coincide with the frequency of the stresses set up by magnetic action.

On each side of every oil circuit breaker are 3,000-amp. disconnecting switches mounted in separate rooms behind the breakers and operated by hand wheels outside the room. The mechanisms may be locked in the open or closed position by individual Yale locks. Beside the hand-operating mechanism are pilot lamps indicating the position of the switches and whether the corresponding oil circuit breakers are open or closed. This system was chosen to avoid the complication of a mechanical or electrical interlock.

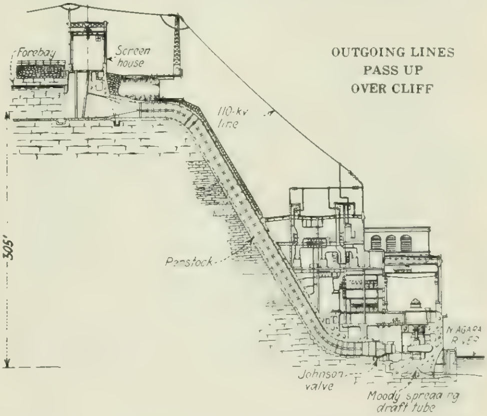
To allow a continuous current-carrying capacity of 600 amp. in the 110,000-volt circuits, it was necessary to use 1-in. (2.5-cm.) (iron-pipe-size) copper tubing. Since the potential may ultimately be raised to 135,000 volts, standard 42-in. (106-cm.) corrugated single-piece porcelain posts with cemented-on cast-iron hardware were installed. These posts have a cantilever and torsional strength of 40,000 in.-lb. (45,500 cm.-kg.) and a dry flash-over value at 25 cycles of 350,000 volts. For the high-voltage circuits 600-amp. double-break disconnecting switches operated by hand mechanisms in gangs of three were adopted.

Reactors are installed only between the main 12,000-volt bus sections—that is, between generators. They are of the cast-in concrete type with the concrete and conductors impregnated with varnish. They will safely carry short-circuit current for twelve seconds and are rated at 5 per cent, based on the normal current of the generators. Protective resistors are mounted within the reactors and connected to the terminals. These reactors are located on the generator floor below the 12,000-volt circuit-breaker rooms.

The main step-up transformers are of interest particularly because of their great physical size and heavy short-circuit currents to which they may be subjected. They are rated at 15,000 kva., 25 cycle, 12,000/75,000 volts, and are connected in delta-star. The interleaved type of construction with alternate groups of primary and secondary coils is employed.

The simplicity of the main connections in the plant, and especially the absence of 12,000-volt feeders, made it possible to use differential relay protection extensively. To insure correctness of operation the following precautions were taken: First, current transformers of special design were used to give correct ratio even with heavy current; second, impedance in secondary wiring has been kept low by short connections; third, current transformers are placed outside the oil circuit breakers which would isolate any group so that a defective breaker would be cleared on both sides.

All differential relays are of the instantaneous overload plunger type except for transformer differential protection, in which case inverse-time overload induction-type relays are used. The generator differential relays also have a hand-reset feature to increase the certainty of operation. Each differential group of relays is arranged with multiple-contact relays to trip the circuit breakers isolating the defective equipment. The generator differential relays also trip the field breakers.



Besides the differential relays, the following protective equipment has been installed: (1) A ground circuit relay giving an alarm in case of a ground current; (2) a directional relay on each generator, which will trip the generator oil circuit breakers in case of careless synchronizing; (3) a ground relay on the 12,000-volt connections close to the transformer bank on each unit; (4) a set of inverse-time overload relays of the induction type on each outgoing line; (5) a set of inverse-time overload relays in the main 12,000-volt bus between generators to separate them in case any units drop out of step with each other.

All current transformers on the main circuits are of the bushing type, those for 12,000-volt circuits having the core and secondary winding mounted on condenser bushings over the busbars. This arrangement permits several secondary lines on the same bushing.

For the information incorporated in this article the ELECTRICAL WORLD is indebted to E. T. J. Brandon, electrical engineer of the Hydro-Electric commission. F. A. Gaby is chief engineer of the commission.

Conditions in Europe that Affect American Electrical Exporters

Discussion of the Obstacles to and the Benefits from Export Business—Where the Market Lies for Specific Lines of Manufactures—European Standards Which Differ from Those of America Local and Economic Conditions

By JOSEPH McELROY, 3D, and P. S. SMITH*

WHEN we consider the possibilities of the sale of American electrical products in Europe we are confronted by an entirely different condition from that which faces us when considering South American business or business with the Orient in general. The reason is that Europe is the great manufacturing section of the world and in many instances does not consume all that she herself produces. Moreover, the existing exchange rate in nearly every country of Europe at present exercises a decided influence against us in our business relations with these countries.

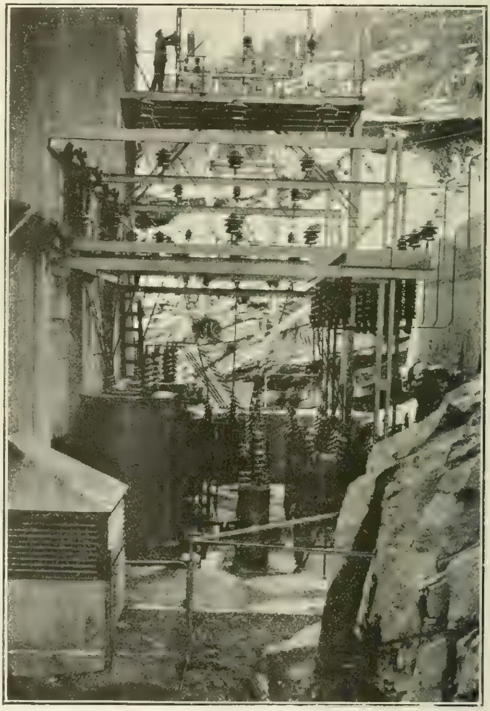
The most recent reliable figures indicate that about 22 per cent of the population of Norway use or are served with electricity, 18 per cent in Sweden, 17 per cent in the British Isles, 17 per cent in Germany, 15 per cent in Holland, 13 per cent in Italy, 12 per cent in France, 5 per cent in Portugal, 3 per cent in Spain and 2½ per cent in Russia, with a smaller percentage in smaller countries not named. Therefore, roughly speaking, there is a diversified potential market for the sale of electrical apparatus and appliances in the countries specified, embracing a population of 34,075,000. The next question is whether the American manufacturer is in a position to take advantage of this potential market.

The Producing Countries

It is generally conceded that Germany, next to the United States, is foremost in electrical development and in the manufacture of electrical machinery and supplies, and if any industry in Germany has come through the war in good condition, it is the German electrical industry, which has succeeded in paying large dividends to its stockholders in the last two years. Germany, therefore, is to be considered as a formidable competitor if an American manufacturer attempts to sell his wares in Europe.

England also is a large manufacturer of electrical machinery and supplies. France, Italy, Switzerland, Spain, Norway and Sweden too manufacture electrical material of various kinds, and on account of the low cost of labor their prices are usually cheaper than those of the manufacturers of the United States, especially on small articles. To this at present is to be added the handicap of adverse exchange, so that until conditions become more settled in Europe it will be difficult to sell American electrical articles on that continent. By difficult, however, is not meant impossible, but that each individual manufacturer must give the matter intensive study if he is to succeed.

The electrical products of these principal European countries are naturally manufactured according to their own designs and standards, which in many ways are different from ours. The prejudices formed by the consuming public are naturally very strong because the people have always been accustomed to these types. The introduction of entirely new designs is therefore attended by expense and demands determined effort. The willingness with which these conditions are met will mean much in determining the measure of success attainable by outside manufacturers, who, in addition, have to contend with the handicap of greater distance from their prospective markets.


NEW BJOLVE OUTDOOR TRANSFORMER SUBSTATION, NORWAY, BUILT OF WESTINGHOUSE MATERIAL

It must be remembered, however, that against this export business offers many distinct advantages and benefits. It provides an even market in periods of depression at home, with a broad diversity factor that tends to equalize the demand and eliminate seasonal peaks and hollows. Foreign business is apt to be very permanent in character, and it reduces naturally the overhead on domestic business.

A very comprehensive table showing the value of all

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*Mr. McElroy is export sales manager for Pass & Seymour, Inc. Mr. Smith is associate editor of *Ingeniería Internacional.*

electrical material sent to Europe was published in the issue of the ELECTRICAL WORLD for March 4, 1922. In it are shown separately the principal countries and each item of manufacture as listed by the statistical division of the Department of Commerce. A close analysis of these figures tells where American goods have gone in the past. It is the purpose of this article to show where they can be expected to go in the future, and it is reasonable to believe that the countries which have purchased these American products in the past will be the most likely customers in the immediate future.

GENERATING AND TRANSMISSION EQUIPMENT

Generating equipment in both large and small sizes is in constant demand in Europe. The amount of new installation possible during the last eight years was far below normal, but the demand has been growing, and owing to the readjustments in the industrial centers it will continue its upward trend. In some sections plans are already made to take care of it by developing water-power sites on a very ambitious scale. This may not always open a market for equipment from the United States in the immediate vicinity of the producing centers, but it surely will in the outlying districts and smaller countries. Our control and measuring devices, switchboards and protective apparatus should enjoy a large share of this business.

Towers and the smaller structures for transmission lines will come in for a big increase in sales, in which American types may expect to participate. Recent information regarding prices and production costs in the steel industry tend to place American material, both raw and fabricated, well ahead of many of the principal competitors in Europe. There is scarcely any other source of supply than the United States for wire and cable of copper or aluminum. The competition, however, is much keener on the insulator, both low-tension and high-tension.

Electric power has long been employed in the industrial countries, thus making a constant supply of motors, switches and all accessories indispensable. Standard types are oftentimes supplied by home manufacturers, but there is room for our numerous special devices, such as oil switches and "safety first" apparatus. The motors themselves are more difficult to sell. This is partly due to features of design with which American motors are not equipped, as, for example, slip rings and wound rotors on small sizes.

Two prominent factors in an even greater future use of electric power are the loss of man power due to the war and the increasing cost of production due to a multiplicity of more or less obvious reasons. It is necessary only to recall the kinds of manufacturing carried on in Europe, such as iron and steel, boot and shoe, furniture, automobile and textile, to realize the quantities of material required to keep the wheels turning.

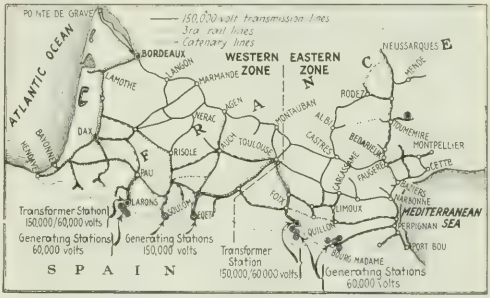
RAILWAY ELECTRIFICATION

Railway electrification provides one of the large markets for heavy materials. The three different systems of electrification—direct-current, single-phase and three-phase—have each had their advocates, with the two former in the lead. An earnest effort is being made now to arrive at some criterion by which standardization may be put into effect in so far as possible. This field, however, offers relatively small attraction to American manufacturers, since the local engineering firms are well equipped and able to handle any business.

More interesting possibilities seem to lie in the light traction or street-railway field, especially for overhead supplies, rail bonds and similar materials. Welding equipment, track grinders and shop machinery in general are coming more into vogue than ever, and much of this is new abroad. It should be brought to European attention in an educative manner, the economical features being brought out prominently.

TELEPHONE AND TELEGRAPH

Telephone and telegraph systems are in general operated by the several governments as income-producing utilities. This restricts the sale of appropriate materials to comparatively few customers and introduces many special features into all transactions, as is true in every case where it is necessary to sell to a government bureau or department. For this reason all attempts to introduce new material should be carried on personally by a competent representative of the manufacturer, and a resident representative is frequently of imperative necessity for handling the larger deals. In point of design it should be borne in mind that many telephone systems want only the type of instrument consisting of a combined transmitter and receiver rather than the separate devices to which we are accustomed.



MAP OF FRENCH RAILROAD ELECTRIFICATION NOW UNDER CONSTRUCTION

The wireless telephone is now being used for broadcasting in England, France and Germany. In both France and Germany broadcasting is controlled and operated by the government, for reasons of economic necessity, as a further source of income. The sets are rented and are fixed as regards wave length so that only the class of service paid for can be received on any one instrument. It has been provided that a greater degree of liberality in their use will be permitted before long, thus opening up a field of many possibilities.

WHERE SPECIFIC MARKET LIES

It is impossible, of course, to lay down any hard and fast rules as to what to sell in Europe and where to sell it, but the following list of outstanding export lines will indicate the present trade tendencies and the most promising fields for development by American manufacturers:

Batteries may be sold in Denmark, France, Italy, Netherlands, Norway, Portugal, Spain, Sweden and Great Britain.

Carbons may be sold in France, Italy, Netherlands, Norway, Portugal, Spain, Sweden and Great Britain.

Generators may be sold in Denmark, France, Italy, Norway, Portugal, Spain and Great Britain.

Fans may be sold in Spain and Great Britain.

Heating and cooking appliances may be sold in France, Italy, Norway, Portugal, Spain and Great Britain.

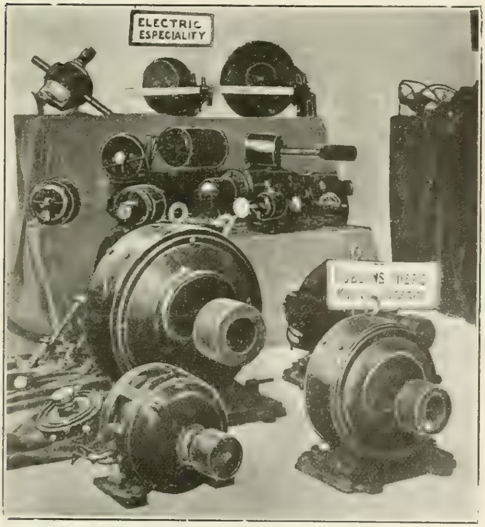
Insulated wire and cables may be sold in Denmark, France, Italy, Norway, Portugal, Spain, Sweden, Switzerland and Great Britain.

Interior-wiring supplies, etc., including fixtures, may be sold in Denmark, France, Italy, Norway, Portugal, Spain, Great Britain and Switzerland.

Arc lamps have practically no market in Europe, as they are giving way to incandescent units.

Carbon-filament lamps have sold principally in Italy.

Metal-filament lamps may be sold in France, Italy, Portugal, Spain and Great Britain, although competition from local and other European factories greatly reduces the opportunity.



DISPLAY OF MOTORS AND MOTOR APPLIANCES IN AN EXPOSITION IN MADRID, SPAIN

Magnetos and spark plugs may be sold in Denmark, France, Italy, Norway, Portugal, Spain and Great Britain.

Meters and measuring instruments may be sold in France, Italy, Norway, Spain and Great Britain.

Motors may be sold in Belgium, France, Denmark, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and Great Britain.

Switches and accessories may be sold in France, Italy, Norway, Portugal, Spain and Great Britain.

Telegraph apparatus, including wireless, may be sold in Denmark, France, Italy and Great Britain.

Telephones may be sold in France, Italy, Netherlands, Spain, Portugal, Switzerland and Great Britain.

Transformers may be sold in France, Italy, Norway, Spain, Switzerland and Great Britain.

EUROPEAN STANDARDS

Naturally a patented American electrical novelty will sell where an article made under competitive conditions would not. In the British Isles and France, for instance, it is obvious that Edison screw sockets cannot be sold because the British people use the bayonet type of lamp base. Articles such as heating devices and portable lamps must therefore be equipped with the bayonet-type plug to fit in the bayonet socket or receptacle, and if merchandise is sent abroad with the Edison screw plug this one detail may kill the sale. In each country will be found such special requirements or special methods of installation, and these must be studied before the sale of American products is attempted.

For an American manufacturer of conduit and fittings to attempt to sell his product in Europe without knowledge of the fact that the German-type Bergman tubing is largely used would be disastrous. The American manufacturer of pull-chain devices must also understand that this is considered a novelty and that lighting devices and fixtures are usually equipped with keyless sockets operated by a switch from the wall. When trying to sell large apparatus or material to be used in connection with electric railways or trolleys, it must be known that engineers of the various countries of Europe have their own ideas as to specifications and needs and that it takes a great deal of educational work to show them where the American methods or the American types of apparatus will perform their work better or perhaps more cheaply.

This educational work cannot be done except by a person who has been trained technically and who is conversant with the articles that he is endeavoring to demonstrate. There is, however, the possibility of making a large sale of electrical apparatus running into a considerable sum of money, and some of the large American electrical manufacturers have obtained very satisfactory business from Europe. In all instances, however, they have given the matter the careful analysis and investigation that is here recommended.

LOCAL AND ECONOMIC CONDITIONS

If we were to turn to countries like Norway and Sweden and endeavor to sell apparatus that has for its chief recommendation the saving of electrical energy, this would not be of great interest in these countries because their energy is generated by water power and is plentiful and cheap. On the other hand, the argument would hold good in Denmark, where energy is scarce and dear.

In Russia it will be impossible to take advantage of the market until a stable government has been established. In the southeastern part of Europe, taking in the old empire of Austria-Hungary, the Balkan States, Turkey and Greece, finances in general are not in a sound condition and extreme caution should be used in accepting orders if they are tendered. Of course, where large railroads or power stations or trolley systems are contemplated, it is quite possible to obtain some form of a government or a semi-government financial guarantee with which the American manufacturer may feel that he is protected. But on shipments of ordinary size it is not considered good judgment under today's conditions to extend the terms of credit usually demanded by the inhabitants of these countries.

It is, of course, difficult in a short article to cover fully the market situation in Europe as it concerns the American manufacturer. Many articles of our production can be sold there. It requires knowledge to discriminate successfully and patient attention to develop profitable business, but the reward through the coming years will fully justify the effort. Thorough investigation is vital, lest costly mistakes be made. Moreover, good service is as essential in the foreign field as elsewhere, and to maintain it the greatest care must be given to the selection of the men who are to represent the exporting manufacturer and build up friendly relations for him in the foreign field.

Textile Mills Lead in Industrial Energy Consumption in Massachusetts

Almost Two-thirds of the 1,606,105,000 Kw.-Hr. Consumed by Industrial Plants in 1920 Was Purchased from Central Generating and Distributing Systems—Of the 117,038 Installed Motors More than Half Are Under 5 Hp.

By **ROBERT M. DAVIS**
Statistical Editor ELECTRICAL WORLD

ALTHOUGH the industrial status of Massachusetts was established many decades before the advent of electrical energy, yet the factories and mills of that state have adopted this new form of motor-power to an extent probably equaled by only a few other states of the Union. More than 62 per cent of the primary horsepower of the state is electrical, and more than 1,600,000,000 kw.-hr. of electrical energy is consumed annually by its industrial establishments.

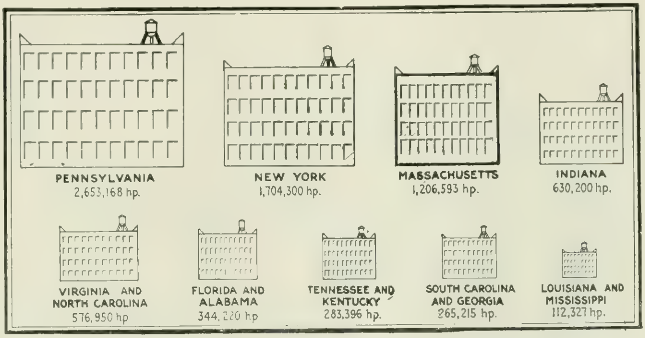


FIG. 1—HOW MASSACHUSETTS COMPARES IN ELECTRICAL POWER WITH OTHER STATES COVERED TO DATE BY THE "ELECTRICAL WORLD" SURVEY

During the past two years the ELECTRICAL WORLD has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. This survey has been undertaken by states, and Massachusetts is the fifteenth in the series. A detailed analysis of the industrial load of California appeared in the ELECTRICAL WORLD for Aug. 28, 1920. A similar analysis of the industrial load of the Southern States appeared in the issue of June 25, 1921, and the industries of New York, Pennsylvania and Indiana were covered in the issues of July 20, 1921; Dec. 31, 1921, and Feb. 18, 1922, respectively. Returns are now being received from Ohio, Illinois, Michigan and New Jersey, and the analyses of these states will appear in early issues of the ELECTRICAL WORLD.

The survey conducted to ascertain the use of electrical energy by the various industries of Massachusetts involved the sending out of about 2,800 questionnaires to the larger manufacturing plants. A summary of the replies received and estimates of the total operations and power equipment are presented in the accompanying tables.

The Census of Manufactures for 1919 indicates that

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF MASSACHUSETTS

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the editorial departments of the ELECTRICAL WORLD and *Power*, and cover plants in all industries employing more than fifty operatives

Industry	Companies Reporting		Electric Generators Direct Current		Electric Generators Alternating Current		Electrical Energy Consumed		Motors Installed			Distribution of Drives		
	Total Number	Number Using Electrical Energy	Number	Total Rating, Kw.	Number	Total Rating, Kw.	Privately Generated, Kw.-hr.	Purchased, Kw.-hr.	Number	Total Rating, Hp	Number Under 5 Hp.	Belt	Chain	Direct or Geared
Chemicals	34	22	16	1,170	7	2,256	[illegible]	[illegible]	1,624	16,423	682	1,226	[illegible]	307
Electrical equipment and machinery	20	10	3	995	4	13,566	22,021,313	3,386,960	9,173	28,832	7,414	6,726	[illegible]	2,360
Food and kindred products	22	12	11	1,100	5	5,930	8,687,200	4,438,848	1,473	12,019	493	1,245	[illegible]	115
Iron and steel and their products	228	161	55	5,739	54	11,061	20,512,709	64,045,025	8,478	102,564	2,376	6,530	243	1,708
Leather and its products	63	45	21	2,007	1	9,195	12,258,705	7,243,746	3,215	17,933	1,982	2,990	13	132
Lumber and its products	61	27	5	288	7	1,154	2,357,176	2,977,714	513	4,689	164	451	3	59
Metals and metal products other than iron and steel	28	18	7	367	1	450	803,000	1,869,047	282	4,965	111	264	5	13
Paper and printing	63	47	31	2,691	52	36,691	118,024,252	31,582,420	3,141	50,734	1,344	2,630	71	440
Railroad repair shops	1	1	0	0	3	1,200	4,070,000	0	213	5,000	31	72	4	137
Stone, clay and glass	17	9	0	0	8	4,225	4,210,615	2,008,410	523	4,137	243	252	179	92
Textiles	336	229	90	5,331	134	100,025	139,123,213	[illegible]	13,547	165,093	6,440	8,400	1,324	823
Vehicles for land transportation	3	3	0	0	0	0	0	3,009,120	110	1,716	66	98	9	12
Miscellaneous	45	29	8	768	8	1,747	2,415,670	5,755,519	916	10,718	366	634	50	32
Rubber	20	14	9	539	11	7,735	13,256,358	60,880,461	2,605	39,740	684	1,242	135	1,238
Totals for all industries of Mass.	941	627	256	20,995	305	[illegible]	352,512,541	317,804,044	45,813	[illegible]	22,396	[illegible]	[illegible]	10,730

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN MASSACHUSETTS IN 1920
(Based on industrial survey federal and state census data)

Industry	Electric Generators: Direct-Current No.	Direct-Current Total Rating, Kw.	Alternating Current No.	Alternating Current Total Rating, Kw.	Electrical Energy Consumed: Generated Private Plants, Kw.-hr.	Purchased from Public Utilities, Kw.-hr.	Total Energy Consumed
Chemicals	21	1,496	9	2,880	6,110,000	19,800,000	25,910,000
Electrical equipment and machinery	7	2,330	9	31,600	51,500,000	8,100,000	59,600,000
Food and kindred products	12	1,178	5	5,930	9,130,000	36,200,000	45,510,000
Iron and steel and their products	73	7,630	72	14,700	27,340,000	103,000,000	130,340,000
Leather and its products	27	2,530	14	11,650	15,500,000	59,250,000	74,750,000
Lumber and its products	11	628	15	2,520	5,125,000	20,200,000	25,325,000
Metals and metal products other than iron and steel	52	4,450	86	61,000	1,330,000	16,700,000	18,030,000
Paper and printing	32	2,740	53	37,350	120,000,000	207,000,000	327,000,000
Railroad repair shops	....	...	4	1,490	5,060,000	5,210,000	10,270,000
Shipbuilding	....	.....	...	..	0	1,310,000	1,310,000
Stone, clay and glass	....	...	8	4,225	4,210,000	29,900,000	34,110,000
Textiles	223	13,220	332	248,000	345,500,000	312,000,000	657,500,000
Vehicles for land transportation	3	258	1	138	1,350,000	16,500,000	17,850,000
Miscellaneous	9	845	9	1,920	26,600,000	38,900,000	65,500,000
Rubber	10	588	12	8,440	14,500,000	98,600,000	113,100,000
Totals for all industries of Massachusetts	480	37,893	629	431,843	633,435,000	972,670,000	1,606,105,000

Massachusetts ranks fifth as an industrial state, with a total capital investment of $2,964,177,000 and manufactured products valued at $4,007,452,000. Industrial growth in this state has been consistent except that the number of establishments, proprietors and firm members decreased during the period from 1914 to 1919. During this period, however, the value of manufactured products increased 144.4 per cent, wages increased 142 per cent, capital 91.4 per cent, number of salaried employees 50.6 per cent, primary horsepower 23.8 per cent and number of wage earners 17.6 per cent.

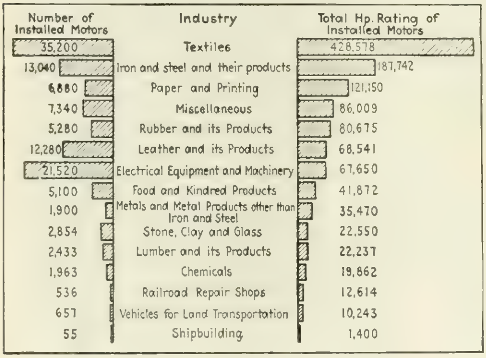


FIG. 2—DISTRIBUTION OF INSTALLED MOTORS AMONG THE VARIOUS INDUSTRIAL GROUPS OF MASSACHUSETTS

The returns received from the survey have been grouped into fifteen general industries, as indicated in Table I. The data are for the year 1920. Complete returns were received from 941 mills and factories employing fifty or more operatives each, and the companies reporting represented every industrial section of the state. Of these plants 627 reported the use of electrical energy as their main source of power. Reports from only a part of the industrial plants of the state such as were received by the ELECTRICAL WORLD are useless, however, for practical purposes except as they are used as a basis for an estimate of the use of electrical energy by all the industrial plants of Massachusetts. The ELECTRICAL WORLD has accordingly made such an estimate for the various items covered in the survey, based upon the information given in the reports received and supplemented by federal census data. These estimates are presented in the accompanying tables.

The total consumption of electrical energy by the mills and factories of Massachusetts during 1920 is

TABLE IV—DIRECT-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN MASSACHUSETTS

Industry	Number of Companies Reporting Various Motor-Operating Voltages: 110	115	120	220	230	250	440	500	550
Chemicals	1	..	1	2	..	..	..	..	1
Electrical equipment and machinery	..	..	..	1	..	..	1	..	..
Food and kindred products	..	..	..	1	..	..	1	..	..
Iron and steel and their products	7	1	1	19	3	4	2	2	9
Leather and its products	..	..	..	3	..	..	..	..	..
Lumber and its products	1	..	1	..	..	..	1	..	2
Metals and metal products other than iron or steel	2	..	..	2	..	..	1	..	..
Paper and printing	2	2	2	3	2	2	1	..	5
Railroad repair shops	..	..	..	..	..	..	..	..	..
Stone, clay and glass	..	..	..	..	..	..	..	..	..
Textiles	8	..	1	9	1	2	1	1	6
Vehicles for land transportation	..	..	..	..	..	..	..	..	..
Miscellaneous	1	1	..	1	..	1	..	..	1
Rubber	2	1	..	4	..	..	..	..	1
Totals for all industries in Mass.	22	5	6	45	6	9	8	3	25

TABLE III—"ELECTRICAL WORLD" ESTIMATE OF NUMBER AND RATING OF MOTORS INSTALLED IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Motors Run by Purchased Energy: Number	Total Rating, Hp.	Motors Run by Energy Generated in Private Plants: Number	Total Rating, Hp	Total Motors in All Plants: Number	Total Rating, Hp.	Motors Under 5 Hp.	Distribution of Drives: Belt, Number	Chain, Number	Directly Connected, Number
Chemicals	1,500	15,180	463	4,682	1,963	19,862	825	1,481	111	371
Electrical equipment and machinery	2,920	9,190	18,600	58,460	21,520	67,650	17,400	15,790	200	5,530
Food and kindred products	4,060	33,300	1,040	8,572	5,100	41,872	1,710	4,310	114	676
Iron and steel and their products	10,300	124,600	2,740	63,142	13,040	187,742	3,650	10,050	376	2,614
Leather and its products	9,730	54,300	2,550	14,241	12,280	68,541	7,580	11,420	355	505
Lumber and its products	1,940	17,730	493	4,507	2,433	22,237	776	2,137	14	282
Metals and metal products other than iron and steel	1,760	31,000	140	4,470	1,900	35,470	748	1,778	34	88
Paper and printing	4,360	70,400	2,520	50,750	6,880	121,150	2,942	5,761	156	963
Railroad repair shops	272	6,400	264	6,214	536	12,614	78	181	10	345
Shipbuilding	55	1,400		0	55	1,400	24	8	1	46
Stone, clay and glass	2,500	19,750	354	2,800	2,854	22,550	1,325	1,376	976	502
Textiles	16,700	203,200	18,500	225,378	35,200	428,578	16,700	21,830	3,440	9,930
Vehicles for land transportation	607	9,470	50	773	657	10,243	394	585	0	72
Miscellaneous	4,360	51,100	2,980	34,909	7,340	86,009	2,930	5,080	400	1,860
Rubber	3,470	52,900	1,810	27,775	5,280	80,675	1,045	1,898	206	1,876
Totals for all industries of Massachusetts	64,534	699,920	52,504	506,673	117,038	1,206,593	58,127	83,685	6,393	25,660

TABLE V—ALTERNATING-CURRENT MOTOR OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN MASSACHUSETTS

Industry	Number of Companies Reporting Various Motor-Operating Voltages — Voltages 110	115	120	220	229	230	240	250	440	500	550	570	600	1,100	2,200	2,300	2,500
Chemicals	2			3					2		5						
Electrical equipment and machinery	1			2					3		3				1		
Food and kindred products	1			3					1		2						
Iron and steel and their products	8		57	26				2	16	1				1			
Leather and its products	2			12				1		1	8					1	1
Lumber and its products	1	1		2					1		8		1				
Metals and metal products other than iron and steel																	
Paper and printing	1			7		2			3		15		4			2	
Railroad repair shops																	
Stone, clay and glass				4							2		1				
Textiles	8	1		47			1		3	2	1	1	5		4	2	
Vehicles for land transportation											1						
Miscellaneous	5			7					2		5						
Rubber			2	3			1		2	1	3				1	1	
Totals for all industries in Massachusetts	29	2	59	123	1	2	2	4	35	5	117	1	11	1	6	7	1

estimated as 1,606,105,000 kw.-hr., of which 633,435,000 kw.-hr., or 39.4 per cent, was generated in private stations. There are 1,109 electric generators installed in the private generating plants, with a total rating of 469,736 kw., of which machines rated at 431,843 kw. are alternating-current generators. By far the largest user of industrial energy in Massachusetts is the textile industry, which in 1920 consumed 657,500,000 kw.-hr., or 40.9 per cent of the total energy consumed for power purposes. Almost 53 per cent of the energy consumed by this industry is generated in private plants. The paper and printing industry is the second largest consumer of industrial energy.

There are 117,038 motors installed in the plants of the state, of which 58,127 are under 5 hp. The total rating of all the installed motors is estmated at 1,206,593 hp. About 72 per cent of the motors are belt-driven, 22 per cent are directly connected and 6 per cent are chain-driven. Over one-third of the total number of motors are installed in the textile mills of the state.

The returns indicate that nine voltages are in use in Massachusetts mills and factories for the operation of direct-current motors and that seventeen voltages are used in the operation of alternating-current motors. These figures indicate that a large field is open to the electrical engineers of the state in the matter of voltage standardization. It appears, however, that voltage standardization has played a much greater part in Massachusetts than in the intensely industrial state of Pennsylvania, where seventeen voltages are used for the operation of direct-current motors and twenty-one voltages are in use for the operation of alternating-current motors. The returns indicate that 35 per cent of the direct-current motors in Massachusetts are operated at 220 volts, but large percentages are also operated at 110 volts and 550 volts respectively. Iron and steel works particularly reported a high percentage of direct-current motors operated at 550 volts. More than 30 per cent of the alternating-current motors are operated at 220 volts, and almost 29 per cent are operated at 550 volts. The details of motor-operating voltages will be found in Tables IV and V.

Only fourteen companies reported the installation of motors with a rating of over 300 hp., and more than 37 per cent of the companies reported the largest motor as under 25 hp. About one-quarter of the companies reported that the smallest motor installed ranged between ¼ hp. and ½ hp. Details on the size of the largest and smallest motors installed in the industrial plants of Massachusetts will be found in Table VI.

Almost 82 per cent of the companies reporting on

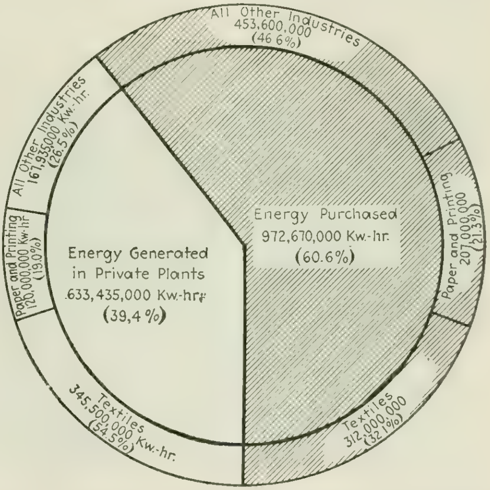


FIG. 3 — ALMOST TWO-THIRDS OF THE ENERGY CONSUMED BY THE INDUSTRIAL PLANTS OF MASSACHUSETTS IS GENERATED IN PUBLIC UTILITY STATIONS

TABLE VI—SIZE OF LARGEST AND SMALLEST MOTORS INSTALLED IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Largest Motor Installed (Number of Plants Reporting) Under 25 Hp.	From 26 to 50 Hp.	From 51 to 100 Hp.	From 101 to 200 Hp.	From 201 to 300 Hp.	Over 300 Hp.	Smallest Motor Installed (Number of Plants Reporting) Under ¼ Hp.	From ¼ to ½ Hp.	From ½ to 1 Hp.	From 1 to 2 Hp.	From 2 to 3 Hp.	Over 3 Hp.
Chemicals	7	7		5			4	4	1	2	3	2
Electrical equipment and machinery	3	2	1		2		4	1	1			2
Food and kindred products	7	3	1	1			2	3	3	2		2
Iron and steel and their products	45	55	23	12	3	2	21	35	33	15	10	22
Leather and its products	22	6	3	3	1		5	10	8	4	2	6
Lumber and its products	6	10	3					8	3	3		5
Metals and metal products other than iron and steel	10	5	1			1	3	3	6	1	3	1
Paper and printing	11	1	8	11	6	5	6	14	6	3	6	4
Railroad repair shops				1			1					
Shipbuilding												
Stone, clay and glass	3		4				1	1	1	2	2	1
Textiles	60	52	31	20	3		19	27	37	16	17	38
Vehicles for land transportation	1	1						1				1
Miscellaneous	13	6	4	2	1		4	6	5	4	3	1
Rubber	1	3	2		1	6	6	1	3	1		1
Total for all industries of Massachusetts	189	151	81	55	17	14	75	125	107	53	46	86

TABLE VII—TYPES OF MOTOR CONTROL USED IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Number of Companies Reporting Various Types of Motor Control: No. of Companies Reporting on Motor Control	Snap Switches	Knife or Safety Switches	Auto-Starters	Magnetic Switches	Remote Control	Circuit Breakers
Chemicals	16	3	9	9	1	4	7
Electrical equipment and machinery	8	5	5	7	2	2	3
Food and kindred products	9	3	8	6	6	2	4
Iron and steel and their products	129	31	125	72	33	20	72
Leather and its products	29	11	25	13	8	6	11
Lumber and its products	17	5	17	8	5	1	8
Metals and metal products other than iron and steel	16	2	13	7	2	0	9
Paper and printing	38	11	31	26	11	15	24
Railroad repair shops	1	1	1	1	0	1	0
Stone, clay and glass	4	1	3	1	2	1	0
Textiles	142	52	92	75	21	16	71
Vehicles for land transportation	2	1	2	0	0	0	1
Miscellaneous	20	6	18	10	7	0	12
Rubber	11	2	10	10	5	6	9
Totals for all industries in Mass	442	134	359	245	103	74	231

TABLE VIII—FREQUENCIES USED IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Total Number of Companies Reporting on Frequency	Number of Companies Reporting Various Frequencies Used (The first figure gives number of phases; the second figure the number of cycles.) 3-40	2-50	1-60	2-60	3-60
Chemicals	13	. .	. .	...	...	13
Electrical equipment and machinery	10	.	.	2	2	6
Food and kindred products	8		...	. .	1	7
Iron and steel and their products	117	. .	.	1	15	101
Leather and its products	23	.	...	...	2	21
Lumber and its products	14	1	...	. .	1	12
Metals and metal products other than iron and steel	13	.	.	...	1	12
Paper and printing	39	1	1	.	3	34
Railroad repair shops	1	.	.	.	.	1
Stone, clay and glass	7		.	.	2	5
Textiles	137	4	.	5	5	123
Vehicles for land transportation	2		.		. .	2
Miscellaneous	23		.	3	2	18
Rubber	15		.	2	1	12
Totals for all industries in Massachusetts	422	6	1	13	35	367

types of motor control use knife or safety switches exclusively or in conjunction with other types of motor control. Figures received from the other fourteen states which have been covered by the industrial survey of the ELECTRICAL WORLD indicate that 82 per cent is very close to the degree to which knife or safety switches are now used by the industrial establishments of the country as a whole. About 75 per cent of the plants use auto-starters and 52 per cent have installed circuit breakers. The detailed figures on types of motor control will be found in Table VII tabulated according to industry.

Standard fuses were reported in use by 173 out of 269 companies reporting on fuses, as against 158 companies using refillable and renewable fuses. These two figures are quite different from those reported by the industrial plants of Pennsylvania, where 477 out of 612 companies reporting use refillable and renewable fuses as against 196 companies using standard fuses. In Indiana 148 out of 169 companies use refillable and renewable fuses, while only 69 reported the use of standard fuses. It is estimated that 55,254 fuses of all types are used per month by all the plants in the aggregate.

Table X is an estimate of the total prime-mover equipment in the industrial plants of Massachusetts, and is based entirely upon the 1919 Census of Manufactures, figures on which have just been made available.

TABLE IX—TYPES OF FUSES USED IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Total Number of Companies Reporting on Fuses	Standard Fuses: Number of Companies Using This Type	Standard Fuses: Fuses Used per Month: Number	Standard Fuses: Fuses Used per Month: Number per Motor	Refillable and Renewable Fuses: Number of Companies Using This Type	Refillable and Renewable Fuses: Fuses Used per Month: Number	Refillable and Renewable Fuses: Fuses Used per Month: Number per Motor	ELECTRICAL WORLD Estimate of Fuses Used per Month by All Industrial Plants in Massachusetts: Standard	ELECTRICAL WORLD Estimate: Renewable and Refillable
Chemicals	6	6	207	1.592	3	112	0.308	821	446
Electrical equipment and machinery	6	4	5,720	0.633	1	50	0.477	13,445	134
Food and kindred products	8	3	160	0.508	6	332	0.454	777	1,621
Iron and steel and their products	89	59	1,724	0.688	54	1,417	0.549	4,414	3,637
Leather and its products	18	10	235	0.417	13	112	0.157	2,258	1,078
Lumber and its products	12	6	69	0.657	10	132	0.583	507	969
Metals and metal products other than iron and steel	10	8	61	0.598	3	151	1.937	643	1,598
Paper and printing	23	17	671	0.362	10	86	0.460	2,261	291
Railroad repair shops	1	1	100	0.935	1	100	0.935	251	251
Stone, clay and glass	1	1	201	0.841	1	512	0.516	466	1,187
Textiles	78	44	598	0.142	42	784	0.238	2,900	3,680
Vehicles for land transportation	2	2	12	0.923	1	12	0.857	293	291
Miscellaneous	8	7	119	0.869	9	361	1.472	2,295	6,920
Rubber	7	5	282	0.255	4	302	0.513	880	940
Totals for all industries in Massachusetts	269	173	10,159	0.504	158	4,363	0.472	32,211	23,043

TABLE X—"ELECTRICAL WORLD" ESTIMATE OF TOTAL PRIME MOVER EQUIPMENT IN INDUSTRIAL PLANTS OF MASSACHUSETTS

Industry	Total Power of All Kinds in Industrial Plants Including Private Electric Generating Stations Hp.	Steam Engines No.	Steam Engines Hp.	Steam Turbines No.	Steam Turbines Hp.	Internal Combustion Engines No.	Internal Combustion Engines Hp.	Waterwheels No.	Waterwheels Hp.	Boilers No.	Boilers Hp.
Chemicals	28,043	65	9,060	16	3,225	20	392	3	186	146	21,200
Electrical equipment and machinery	38,088	8	3,925	6	24,718	1	75	2	180	27	11,650
Food and kindred products	64,030	104	25,902	5	1,718	11	1,047	17	2,063	137	37,050
Iron and steel and their products	207,443	264	62,924	37	10,840	10	2,324	59	6,755	493	98,200
Leather and its products	97,502	165	33,183	3	9,200	2	268	5	551	143	31,150
Lumber and its products	58,332	231	32,772	2	318	9	1,726	79	5,786	248	38,650
Metals and metal products other than iron and steel	42,474	39	10,084	2	260	5	403	8	727	45	7,310
Paper and printing	226,399	157	63,794	28	29,600	3	377	155	62,228	330	98,500
Railroad repair shops	15,159	12	7,753	8	1,000	1	6		.	28	7,220
Shipbuilding	2,304	2	653			2	251			3	750
Stone, clay and glass	40,000	78	13,186	5	5,853	7	431	4	780	82	20,250
Textiles	861,548	1,033	371,092	154	177,513	17	5,453	649	104,290	2,150	515,000
Vehicles for land transportation	12,805	13	2,417	1	275	2	235	4	408	18	5,170
Miscellaneous	124,696	266	41,677	35	15,329	6	1,182	107	15,408	429	78,700
Rubber	81,644	82	16,107	31	11,640	1	57	9	940	97	37,500
Totals for all industries of Massachusetts	1,900,467	2,519	694,529	333	291,489	97	14,227	1,101	200,302	4,376	1,008,300

Oil Qualities Desirable for Transformers and Circuit Breakers

Explosive Limits, Dielectric Strengths and Sludging Properties Are Particularly Important — A Study of the Practical and Theoretical Behavior of Oils Under Service Conditions

By **C. J. RODMAN**
Research Department, Westinghouse Electric & Manufacturing Company

THE busy engineer with a dozen irons in the fire has little time to ask about the important problems of mineral-oil insulation and their solution. Neither can he usually carry on scientific investigations which would reveal the characteristics desirable in such oils when they are applied to his needs. Still, he desires to have an oil which will best suit his electrical application at the lowest cost commensurate with safety in operation, durability in composition and freedom from contamination by contact. The following is intended to meet this need:

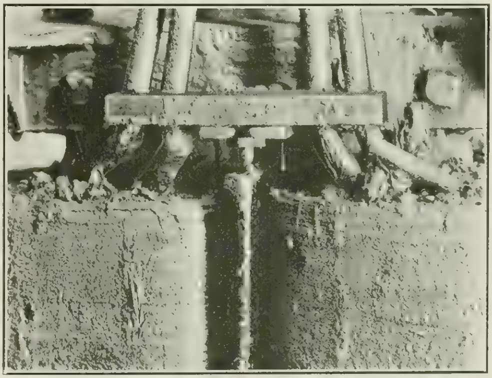
When mineral oils are subjected to the action of an electrical discharge, such as occurs in circuit breakers, even the most stable oils are broken down into decomposition products which consist of some amorphous elemental carbon, a small amount of liquid hydrocarbons, either saturated or unsaturated, and a proportionately large volume of gas, of which hydrogen represents 60 to 70 per cent. If air is added to these combustible constituents in deficient or excessive quantities an explosion cannot occur. Thus each combustible gas or mixture of combustible gases with air or oxygen possesses a lower and an upper explosive limit.

CONDITIONS MOST SEVERE IN CIRCUIT BREAKERS

The fire and explosive hazard of insulating oils connected with circuit breakers is apparently greater than with the transformers and is due primarily to the violent agitation and disruption of the oil during the circuit-breaking period. The gases and vapors which are quickly forced to the surface mix with the atmosphere in the space above the oil. Laboratory tests have shown that similar gas mixtures may be spontaneously ignited at a temperature as low as 270 deg. C. Such cases are exceptional, the general ignition temperature for an average explosive mixture of this character being above 550 deg. C. Hence the ventilating ducts or pressure valves which admit air into the head of the circuit breakers should be removed. An outlet for the disrupted oil gas and vapor should be installed which would prevent fine oil spray from entering the air at more than the flash-point value of the insulating liquid used. The recent successful use of a muffler device for this purpose permits rupturing greater loads in the same oil with greater safety.

It is not within the scope of this paper to discuss the mechanism of discharge rupture of oils, but it may be briefly stated that the amount of gas liberated per kilowatt-second of arc energy decreases with a rise of molecular weight of a homologous series. A research on the high-frequency disruption indicates that rupture of oils per kilowatt-second follows a fairly well defined law.

A great number of vegetable oils when pure possess very good insulating properties. Their initial state of purity is maintained only with extreme care in connection with their use in electrical apparatus. These oils are chemically unstable and have structural formula of unsaturated linkages admitting of drying (oxidation) and formation of saponifiable products, giving rise to the highly undesirable property of formation of adherent sludges, with simultaneous reaction products of a much lower dielectric strength. Granting that the chemically pure vegetable oil would undergo no decomposition while in use, other undesirable properties, such as high viscosity, volatility, drying and comparatively high affinity for water, would make their use somewhat difficult.


SLUDGE FROM POOR TRANSFORMER OIL AFFECTS THE INSULATING PROPERTIES OF THE WINDING AND REDUCES THE HEAT CONDUCTION

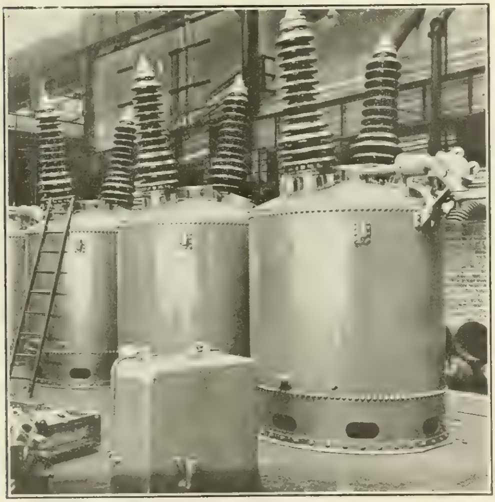
Distillates obtained from the destructive distillation of coal contain substances which are chemically more active than the saturated mineral oils. However, benzol, tuluol, xylol, or the halogenated derivatives, possess a fair insulating value and can be used in some special applications. The action of these compounds limits their use to apparatus built of insoluble metal and insulation. If used within the oil switch or circuit breaker, such compounds are decomposed, resulting in a medium of much lower dielectric strength. Other properties such as volatility, water solubility, fire hazard, etc., limit their use.

A chemical specification which defines a good transformer oil is that it be of pure mineral oil conforming to the formula C_nH_{2n+2} (the paraffines) and $C_nH_{2n} = C_nH_{2n-6} + 6$ (the naphthenes) where *n* equals 12 to 18.

The fluidity, the flash, fire and boiling points, dielectric strength, etc., have a certain value dependent upon the value of *n*. An oil defined by this formula excludes harmful impurities, such as water, sulphur and nitrogen derivatives, unsaturated and oxidizable compounds, acid or alkali and various forms of dirt and suspended or dissolved materials. In general, the flash, fire, freezing and boiling points, viscosity and dielectric strength increase with a rise in molecular weight. Other physical and chemical properties bear a definite relationship to the ascending or descending series.

Applying Knowledge in Selecting Oils

Knowing the dielectric strength of the oil, which varies slightly with a change of *n*, the conducting members of the electrical apparatus are properly spaced by the designer. It is desirable that the operation temperature of the transformer be kept as low as possible. Hence the correct heat capacity for proper cooling will be largely determined by the viscosity and the specific heat of the oil. Since heating takes place within the central parts of active members of the transformer, the rates of convection currents for heat interchange are largely dependent upon the fluidity of the oil. The ambient temperature of the transformer, whether in hot or cool climates, will also govern the selection of a suitable oil. For cold climates the value of *n* should decrease, thus lowering the pour and cloud tests. Under heavy operation the oil may overheat, hence excessive volatile constituents in the oil must be avoided. It is only by a close scrutiny of operating conditions that the best oil available may be selected.



EACH OF THE TANKS FOR THESE BREAKERS CONTAINS OVER 9,000 GAL. OF OIL

The life of a mineral oil is intimately connected with the formation of deposits known as sludge. Oils obtained from the same shipment which have been placed in transformers and have had similar treatment may differ much in their sludging characteristics. Some oils go bad after a year or two, while others with the proper care function well after twenty years of service. Some oils will deposit adherent sludge upon the core, while others deposit sludge upon the cooling coils or at the bottom of the tank. The nature of these sludging phenomena are generally threefold, namely, (1) the formation of sludge due to oxidation, (2) the reaction of liberated characteristic organic acids with certain metals to form soaps, and (3) the actual deposition of carbonaceous material due to electrical breakdown.

The formation of sludge by oxidation of attackable oil with atmospheric oxygen is by far the most general case. This sludge gradually forms within the oil and tends to become deposited upon the warmest parts of the transformer in an adherent honeycombed form. The interstices or pores of this deposit become filled with loosely formed and finely divided precipitated sludge. By breaking off a piece of this adherent sludge and giving it a subsequent extraction with naphtha to free it from oil and loose deposit, a brown, porous, well-defined structure is obtained, which becomes brittle after allowing it to dry. Examination of this form of deposit indicates an asphaltic compound rich in oxygen, which possesses no free carbon, though at times it may appear quite black. Transformer oil dissolves 10 to 18 per cent of oxygen by volume, depending upon the temperature. Thus, when oil is in contact with air, a constant source of oxygen is available to assist in the formation of sludge. Local hot spots, the presence of unsaturated compounds and oxygen are the chief causes of the formation of asphaltic sludge.

A sludge of the second type may be deposited with the asphaltic sludge on the sides of the coils, at the bottom of the tank or upon the cooling coils. The formation of this kind of sludge depends upon the liberation of acids ($C_nH_{2n-2}O_2$ and $C_nH_{2n}O_2$) by slow oil decomposition and their interaction with metals or oxides to form soaps. Such sludge appears dark brown to white in color. Small particles of this sludge aid greatly in raising the moisture content of the oil which is generally condensed from humid air during "breathing." An approximate analysis of this kind of sludge gave 96.6 per cent water and 3.4 per cent dried sediment. The latter consisted of 11.3 per cent Fe_2O_3, 1.4 per cent CaO, 4.1 per cent MgO, 13 per cent of Na salts and 70 per cent of H_2O, and organic material. The asphaltic type of sludge has a much higher insulation value than does soap sludge. In either case the presence of a deposit within the oil should warrant immediate treatment, such as filtration through a filter press containing blotting paper and a leaf or so of finely divided calcium oxide to remove solids, water and acids. Centrifugation in a specially designed centrifuge gives an oil free from many undesirable constituents. Clean, pure mineral oil dissolves less than 0.003 of 1 per cent of water.

TABLE I—EFFECT OF ELECTRICAL DISCHARGE ON GAS CONSTITUENTS

CO^2	Unsaturated Gases	O^2	CO	H^2	CH^4	N^2
0.85	22.38	2.11	80	65.60	2.36	5.60
0.24	19.05	2.38	.24	68.25	3.81	6.18

A third type of sludge which is distinctly characteristic of electrical breakdown may be present in transformer oil. Corona discharge, or arcing within the oil, breaks down the oil to amorphous carbon, to saturated and unsaturated members lower in the series, and to various gases consisting mostly of H_2 (60 per cent), unsaturated gases (20 per cent), CH_4, CO, CO_2 and N_2. High voltage and low current discharge gives very finely divided carbon, whereas low voltage and high current produces comparatively large particles of carbon sludge. The finely divided sludge or precipitate is nearly pure amorphous carbon having a high specific resistance. The coarser precipitate contains much free carbon with small amounts of hydrocarbons low in hydrogen. Its specific resistance is lower than amorphous carbon. No graphite carbon was found as a result of electrical breakdown within the oil. However, if an arc plays near the surface of the oil where atmospheric oxygen is present, "graphitoidal" carbon is formed. This form or these forms of carbon are more conducting than amorphous carbon and lie somewhere in the series between the amorphous and graphitic carbons.

Standard textbooks, government and various companies' specifications, as well as methods prescribed by societies (A. S. T. M.), discuss and designate such tests of oils as boiling point, flash and fire points, cloud and pour tests, evaporation, viscosity, dielectric strength and the determination of sulphur, acid and alkali. Other tests, such as moisture content, volatility and deposit or sludging tendency, need special revision in order that they may be intelligently applied to insulation oils. At the present time considerable activity along this line indicates that ere long complete reliable standard methods covering insulation oil will be forthcoming.

Mineral Oil Vapors Are Not Explosive

Owing to the inflammability of the lower members of the paraffine series, the general impression exists that all mineral oils carry with them some sort of spontaneous ignition hazard. Such a view is unwarranted. It is true that manufacturers of electrical equipment specify as high a flash and fire point as is commensurate with proper fluidity, which insures the oil against any mixture of lighter volatile constituents, but with a flash point above 140 deg. C. the vapor pressure of the oil is so low—namely, less than 2 mm.—at normal operating temperatures, that the possibility of creating an explosive mixture is indeed remote. A great many tests in which the atmosphere above transformer oils was subjected to the effect of corona or spark discharge indicated the existence of a non-explosive mixture.

By subjecting the oil to the action of electrical discharge, either by corona or by high-frequency or low-frequency arcing, the oil is broken up into a number of decomposition products, such as solids, liquids and gases. The solid or sludge products remain in the oil, usually settling to the bottom. The dielectric strength of such products is comparatively high. Much has been said about the alignment of particles within an oil to produce a much lower insulation value under the stress of an electrical field. The following experiment does not substantiate this view. After arcing an oil for some time by means of high-frequency discharge an oil was produced which contained a large quantity of small carbon particles in suspension. The breakdown strength of the altered oil was still well above specification. These decomposition products should not be confused with fibers which do lower the breakdown strength of an oil, chiefly because their chemical nature is such that water is greatly attracted to them instead of being dissolved within the oil, thus forming a bridge for conduction. The liquid breakdown products are either saturated or unsaturated hydrocarbons lower in the series.

With proper design of apparatus and the selection of an oil which is inspected from time to time, no breakdown of the transformer should ever occur under normal operation. Should a breakdown occur, it is of interest to note from the composition of gaseous breakdown products that the explosive limits of a mixture of this disrupted oil gas with air is rather wide, namely, between 2.5 and 72 per cent. Thus if an air space exists above the oil in the top of the tank, this air when mixed with the disrupted oil gas will exist as a serious potential explosive mixture and fire hazard. This fire hazard may be lessened by introducing into the top of the tank an inert dry atmosphere of permanent gases. Atmospheric nitrogen or carbon dioxide may be used. If it becomes necessary to use an impure oil containing some unsaturated constituents, a great reduction in sludging will occur if the atmospheric oxygen is displaced. The fire hazard connected with disrupted mineral oil from circuit breakers should not confuse one concerning the high safety factor that attends transformer operation. By recent installation of the muffler device on circuit breakers not only is the steep pressure wave gradient very materially reduced, but the disrupted gases are so taken care of that explosions following the clearing of the breaker are next to impossible. Thus greater currents are now ruptured with smaller breakers while still using the same insulating oil.

TABLE II—EXPLOSIVE LIMITS OF OIL GAS CONSTITUENTS

	Lower Limit	Upper
CH^4 and air—1876 to 1921—average of twelve investigators	5.4	13.7
Coal, gas and air—1869 to 1921—average of eight investigators	5.9	24.0
H^2 and air—1876 to 1921—average of nine investigators	7.9	69.4
H^2 and O^2—1834 to 1921—average of five investigators	8.3	93.5
C^2H^2—air—1896 to 1921—average of five investigators	2.8	65.9
CO and air—1891 to 1921—average of four investigators	15.3	74.9
Water-gas—air—1894 to 1921—average of two investigators	9.0	60.8
Natural gas—air—1896 to 1921—average of one investigator	5.0	12.0
Ethane-air—1896 to 1921—average of one investigator	2.5	5.0
Ethylene-air—1896 to 1921—average of one investigator	4.0	22.0
Gasoline vapor and air—1896 to 1921—average of one investigator	1.5	6.0
Artificial and illuminating gas-air—1896 to 1921—one investigator	7.0	21.0
Blast-furnace gas and air—1896 to 1921—one investigator	36.0	65.0
Ethene and air—1896 to 1921—one investigator	4.0	22.0
Transformer-oil vapor and air—1920 to 1921—one investigator	2.5	8.0
Disrupted oil gas in air—average of three investigators	2.5	72.0
Atmosphere above oil in operating normal transformer	No explosive limit	

The paraffins and naphthenes of certain fractional cuts from petroleum crudes, when not mixed with impurities which might seriously affect the electrical insulating qualities, should function properly in a transformer for years. It is desirable that the color of the oil should be as light as possible and that it should be free from sulphur, moisture, acid or alkali. The oil should be practically odorless at room temperature and possess a volatility less than 0.003 gram per hour per square centimeter of surface area exposed at 100 deg. C. A good transformer oil should have a viscosity below 50 Saybolt seconds at 40 deg. C. At this viscosity and a specific heat approximately 0.520 good cooling of the transformer is assured. The flash and fire points as recorded by the Cleveland open-cup method should be 140 deg. C. and 156 deg. C. respectively. The insulation value when tested at 0.1-in. (2.5-mm.) gap separation of parallel disk electrodes should be above 25 kv. A well-refined oil sometimes reaches a value over 40 kv., the general average being around 30 kv. A boiling point (A. S. T. M. D-28) of 240 deg. C., a cloud test of 0 deg. C., a pour test of — 3 deg. C. and a deposit test of less than 4 grams as formolit are desirable properties of an insulating oil for transformer purposes.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

An Odd Case of Underground Current Drainage

To the Editors of the Electrical World:

In the Feb. 18 issue of the Electrical World (page 335) there is a communication from Dr. Carl Hering which bears the above caption. It is the writer's belief that the conditions set forth are by no means unusual but that they could be found on nearly every large electric railway system where there are a number of power stations or substations situated fairly close to each other and all feeding into a network of lines so that each station is connected electrically, through its feeders and the trolley wire, with one or more of the other stations. That such conditions have not been noticed and commented upon more frequently is due first to the fact that indicating or recording instruments are very seldom placed in the returns to the busbars, and second to the fact that, although many men have noticed that current sometimes leaves the bus over the cable sheaths or pipes, most of these men have been station attendants or others with little technical training and have therefore not given the matter the same careful, analytical thought that Dr. Hering did—or, at any rate, have never written on the subject.

Dr. Hering's explanation of the cause of the current returning as it does is undoubtedly correct, but could not his statement be simplified by merely considering that both stations fed into the same general territory and that the return path to station B through the rails and ground connections into station A and thence over the drainage cable and pipes to station B was low enough to cause a small portion of the current to come back to the latter station in that way instead of it all following a single path?

It is well understood that the ground potential of large cities will vary by several volts, depending upon the locality where the readings are taken, and pressure wires connecting the negative buses of a number of stations situated in the same area will show similar differences of potential.

The writer does not follow the line of reasoning advanced by Dr. Hering that would call for the current to leave the negative bus of the station having the higher positive voltage and flow to one having a lower voltage, and still make it appear odd when the opposite condition is found. Increasing the voltage on the generators or rotaries will make very little difference in the ground potential of the negative bus, and this is the condition that causes the current to flow, while the increased load which will be picked up by the station having the higher voltage will come from territory normally fed from some other station, and therefore make it more likely that the grounds through the other station will be used as a part of the return to the station supplying most of the current.

Westfield, N. J. G. H. McKelway.

Reply to Mr. McKelway

To the Editors of the Electrical World:

The first part of the last paragraph of Mr. McKelway's comment is without foundation of fact, as it will be seen by reading my little article that there was no such "line of reasoning" anywhere in it. I merely referred to the incident as an "apparent anomaly"; Mr. McKelway sets up a straw man in order to knock him down. That it was "odd" and "unexpected" to find a drainage current flowing to an underground pipe *from* the negative bus has been and will be admitted by many, hence those terms are justified. After explaining that it was caused by an unsuspected second distant power station it is easy to understand.

The "ground potential" is a very convenient "goat" on which to blame all sorts of anomalies that we may not understand. One is generally safe to make a goat of the ground, as it is often difficult to prove the blame misplaced. But that Mr. McKelway's proposed explanation, that the "ground potential" is "the condition that causes the current," is not correct should be shown by the fact that if the whole system, including the pipes, were perfectly insulated from the ground, the result would be the same, the insulation between the nails and the pipes being made a leaky one, as in the actual case, or an actual metallic resistance. Carl Hering.

Philadelphia, Pa.

Invites Operators' Suggestions for Improving Automatic Stations

To the Editors of the Electrical World:

The May 20 issue of the Electrical World contains a research reference to automatic substations which is of interest to us. On page 1039 of that issue the statement is made that "it is desired to develop a control system which will keep revolving machinery in automatic stations running, unless the period of light load is of considerable duration."

Automatic stations with revolving machinery are now being supplied to cover a very wide variety of conditions. These stations are provided with devices which keep the machinery operating for any period up to twenty-five minutes, should the light load last that long. Developments now in progress promise devices which will permit this time to be lengthened materially.

There is another aspect to the matter, however, which indicates that the revolving machinery consumes more energy during its light load running than is desirable. Tests of a number of automatic stations which have been in service several years indicate that the amount of energy consumed in starting rotary converters and the like and placing them in condition to deliver power amounts to the light-load running loss for two minutes.

Another aspect is that after five years' operation there is no appreciable depreciation of apparatus due to frequent starting and stopping in automatic station operation.

There may be, however, a number of features which our studies have not indicated and which have prompted the suggestion for research mentioned. I shall therefore very much appreciate it if those interested will make known such information as they may have tending to indicate the direction in which reasearch should be directed in order to meet the requirements met with in the course of actual operation.

General Electric Company, Chester Lichtenberg.

Schenectady, N. Y.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Jewel Inspection Essential for Proper Meter Operation

THE care and inspection of jewels and pivots, while an important subject to the meter manufacturer, should be equally important to the central-station meter department. No great technical skill is required to determine the condition of a polished surface inside the cup jewel. An ordinary sewing needle is all that is required to make the necessary inspection, although a binocular microscope of a magnifying power from eight to ten diameters is very helpful in determining the exact nature of imperfections. To examine the jewel, the lower bearing should be grasped with the jewel between the fingertips of one hand, while the needle is held between the fingertips of the other hand. The needle point should now be brought in contact with the jewel and receive a very irregular motion in all directions. It requires only a little practice for the fingertips to respond to the slightest friction encountered by the needle. A surface that is satisfactory should be entirely free from irregularities or scratches. The binoculars, however, will serve to determine the nature of the polishing and will detect the presence of striæ coming into the polished surface which are not so readily detected by means of the needle. Small ripples or irregular surfaces may be allowable if they are out of range of the pivot, but only some one skilled in the selection should be trusted in these determinations.

The large number of jewel failures in service is not the fault of the jewels themselves, but arises from the lubrication and action of the lower pivot. Because of these failures lower bearings are often returned for repolishing, which is sometimes done without removing the stone from its setting. This practice is, however, a questionable one, since it involves the chance of particles of sapphire or diamond clinging to the mounting and after a time getting into the cup and causing great damage. In repolishing without actually removing the stone from its setting every precaution must be taken to clean the mounting and stone after the process is completed.

The question as to the right material to be used for the lower pivot is a hard one to answer. Many materials have been tried. Any material that has the property of extreme hardness and homogeneity and is capable of taking a high polish might be satisfactory; but steel, though it has been universally employed, is by no means entirely satisfactory. Stainless steels, unfortunately, cannot be sufficiently hardened, but the semi-stainless steels, such as chrome or tungsten, have great promise.

The inspection of the lower pivots should be carried out under a binocular microscope. The pivot should show a distinctly spherical surface at the point where it comes in contact with the cup, and the polish should be very high. This pivot should have a radius of curvature such that the material will not yield under the enormous pressures that are present. If there is any doubt as to the hardness of the pivot, it may be tested approximately by means of a jeweler's file. The pivot in proper condition should resist filing to a degree which indicates that the file is not taking hold. Such tests, however, will injure the particular pivot tested by this method to such an extent that it cannot be used in a meter.

F. C. HOLTZ,
Chief Engineer.
Sangamo Electric Company,
Springfield, Ill.

Improved Design of Heavy-Duty 6,600-Volt Double Bus

THE design of a modern heavy-duty bus is less an electrical problem than it is a mechanical one. Simplicity of design, reliability in operation, ease of maintenance and safety under short-circuit stresses are to be striven for in every large central station.

Special effort has been made in replacing a single bus with a double bus at the Bennings power station of the Potomac Electric Power Company, Washington, D. C., to design the structure, supports and copper so as to withstand the theoretical stresses that may occur under short-circuit conditions in a station of 93,000-kw. capacity. Limitations caused by existing wall and floor and by restrictions in width of electrical bay have not prevented attaining practically all desirable features of the modern bus.

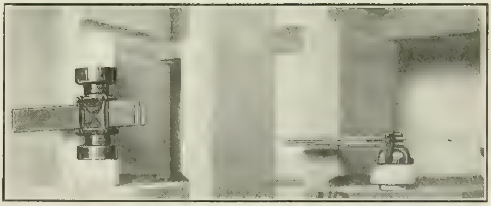


FIG. 1—ADJUSTABLE CAP PERMITS EASY ALIGNMENT AND REPLACEMENT OF INSULATOR

The several features of the bus, as indicated in Fig. 2, where a typical section and elevation are shown at the left, with the details of the bus support at the right, are:

1. Busbars are totally inclosed (except for inspection holes), with isolation barriers between phase leads.
2. There are large clearances between phases and to sides of compartments.
3. Individual copper bars of bus are placed vertically so as to transmit with a minimum deflection short-circuit stresses to the bus supports.
4. Bus supports of all buses are arranged in a single column, instead of being staggered, with short-

circuit stresses transmitted through the supporting slabs to the building structure.

5. Upper bus supports are restrained by a steel clamp, to resist upward short-circuit stresses.

6. Heavy-duty, straight-sided porcelains are cemented into supporting slabs, above and below, resulting in simple installation and in maximum resistance to side stresses upon short circuit.

7. Bus supports are adjustable, to facilitate alignment and replacements of porcelains.

The holes in the precast slabs were made by using clay cores molded to proper shape. In the installation of the bus supports neat cement was allowed to fill completely the central hole of the upper porcelains and to fill the upper porcelain as far as it would squeeze upward.

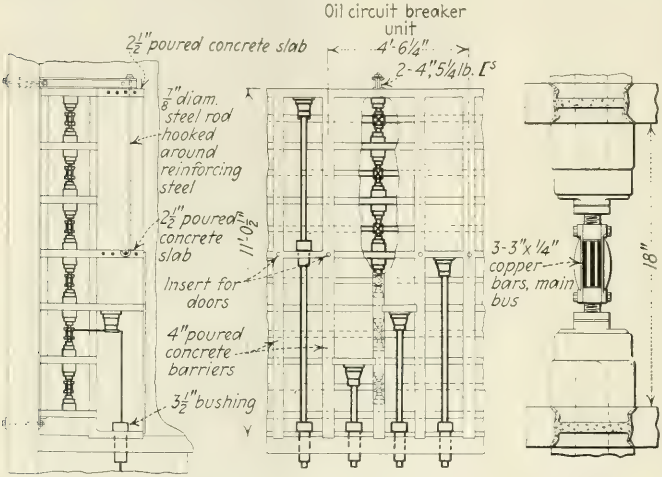

Oil circuit breaker unit
$2\frac{1}{2}$" poured concrete slab
4'-$6\frac{1}{4}$"
2-4",$5\frac{1}{4}$ lb. [s
$\frac{7}{8}$" diam. steel rod hooked around reinforcing steel
$2\frac{1}{2}$" poured concrete slab
Insert for doors
4" poured concrete barriers
$3\frac{1}{2}$" bushing
11'-0$\frac{1}{2}$"
3-3"x ¼" copper bars, main bus
18"

FIG. 2—BUS PORCELAINS CEMENTED TO SUPPORTING SLABS OFFER MAXIMUM RESISTANCE TO SHORT-CIRCUIT STRESSES

Left and Center—Typical section and elevation views of heavy duty bus. Right—Details of bus support showing method of cementing porcelains to concrete slab.

The bus-support unit consists of two straight-side insulators, cemented above and below into horizontal concrete barriers between buses. Supports for all buses line up vertically to form a column of twelve porcelains in the double-bus construction employed. The can of each porcelain, as shown in Fig. 1, is provided with an adjustable head for aligning the copper bars and to facilitate replacement of defective insulators.

The principal dimensions of the bus support are as follows:

Center 3-in. x ¼-in. bus to top or bottom slab, in.	9
Leakage distance on straight sides, in.	$3\frac{1}{8}$
Diameter of porcelain, in.	$5\frac{5}{16}$

The units were required to pass the following tests:

Porcelain, before assembly, volts	45,000
Assembled units, volts	35,000
Compressive or tensile strength of unit on vertical axis, lo.	2,500
Cantilever strength of unit applied at the clamp at right angles to vertical center line, lb.	2,000

The test results showed a proper margin of safety above the requirements of the specification.

Stone & Webster, Inc., W. R. McCann.
Boston, Mass.

Considerations for the Construction of Rural Distribution Lines

The average amount of distribution system equipment per rural customer is from five to ten times the average amount per city customer according to data obtained by the overhead-systems committee and presented in the annual report at the recent N. E. L. A. Convention at Atlantic City. Furthermore, rural lines are usually built along roads which may be in poor condition during certain parts of the year and particularly so immediately after severe storms. It usually requires a considerable amount of time and money to make even a very minor repair to rural line or transformer installation, and it is therefore important to design these lines so that, while the initial cost is kept as low as possible, no construction will be used which will increase maintenance and operating costs.

There are several factors to take into consideration in the construction of rural lines, some of which are given in the following paragraphs:

Poles.—In selecting the size of poles for rural lines consideration should be given to two things: First, the diameter of the pole at the top and ground line. Owing to the fact that poles in rural lines seldom support more than three wires, a pole with a comparatively small diameter may have sufficient strength, when new, to withstand the strains put upon it. Poles with a small diameter, however, have a very limited life, and their strength decreases much more rapidly than that of larger poles. Maintenance costs will consequently increase materially, and it will be cheaper in the end to use a substantial pole in such lines.

The second point to consider is the height of the pole. Rural lines are usually located along a highway and therefore must cross other public highways and cross over numerous driveways into farm yards and fields. In making these crossings it is necessary for the wires to be held at a substantial height above the drives, and therefore poles of a definite minimum height are required. Shorter poles may be used between these drives, but unless proper grading is followed, a very unsightly line is the result. Furthermore, if the line is so built that only minimum clearances above ground are maintained at all points, it will be necessary to increase the height of several poles whenever a new driveway is made or an old location changed. The additional cost of the higher poles will very often be exceeded through such changes. It has been the experience of a number of companies that it is cheaper and better to build a line with comparatively long spans supported on substantial poles than to use short spans and short poles. Careful consideration should be given to the question of poles before selecting a pole less than 30 ft. long or with a top diameter of less than 6 in.

Transformers and Lightning Arresters. — Transformers should be of standard type and make and protected with proper types of fuse blocks and fuses. In all districts affected by lightning the transformers should be further protected with lightning arresters. It has been found that in most farm lines now built the transformers are much larger than necessary. This greatly increases the transformer loss and adds materially to the cost of rural service.

Insulators.—Inasmuch as it costs a considerable amount of money to replace a broken insulator on a rural line, owing largely to transportation costs, it is very desirable that insulator failures should be reduced to a minimum.

It has been found that it is cheaper in the end to equip the line with insulators designed for a somewhat higher voltage than the line voltage. Insulators may be either porcelain or glass, depending on voltage and climatic conditions. Porcelain strain insulators should be used where strain insulators are necessary.

Conductors.—In general the conductors should be either copper, steel, reinforced aluminum or copper-clad steel. There may be instances wherein steel strand or iron wire can be used to advantage; however, owing to low conductivity and comparatively short life, these are not usually recommended for general rural-line construction, particularly where increased loads may later be expected.

MINIMUM VALUES FOR MATERIAL AND CONSTRUCTION FOR RURAL-SUPPLY LINES IN HEAVY LOADING DISTRICTS.*

	Span, Ft				
	125	150	175	200	250
Wire:					
Medium hard-drawn copper (No.)	8	8	6	4	4
Aluminum steel reinforced (No.)....	6	6	4	4	4
Copper-clad steel (No.)	10	10	8	6	6
Pin spacing† (in.)	12	12	15	18	26
Sag for medium hard-drawn copper (in.):					
30 deg. Fahr........................	11	22	28	32	64
60 deg. Fahr	18	27	33	38	71
90 deg. Fahr	22	32	39	45	77

* In each case the cross-arm recommended is 3¼ in. x 4¼ in. Yellow pine or fir.

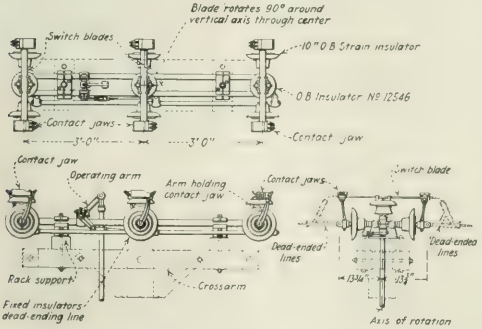
† To the pin space for spans of 125 ft. and 150 ft. add 0.4 in. for each 1,000 volts between phases above 7,500 volts. For the others add 0.2 in. for each 1,000 volts above 7,500 volts.

The accompanying table gives the wire size, pin spacing and sag for various spans for rural lines as recommended by the National Electrical Safety Code.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Rotary Switch Operates Satisfactorily on 17,000-Volt Line

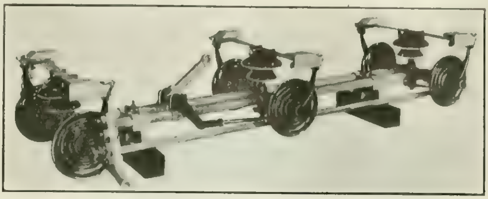
A RUGGED 17,000-volt rotary switch of the strain type for double cross-arm mounting has been employed successfully by this company in order that it might meet the demands of the increased use of outdoor equipment. At first it was thought that trouble would develop on the end insulators owing to the torsional moment of the blade engaging the stationary contacts.



SWITCH BLADES ROTATE ON VERTICAL AXIS TO OPEN 17,000-VOLT LINE

From the fact that more than a hundred switches of this type have been giving satisfactory service for several years it is evident that no destructive stresses are set up in the insulator supports or attachments.

The rotary switch rack is made up of 1¼-in. wrought-iron pipes bolted rigidly to two supports that are in turn fastened to the double cross-arms as shown in the accompanying illustrations. A lever at the foot of the pole operates the blades by turning the center insulators through an angle of 90 deg. on a vertical axis. The line is dead-ended on strain-type insulators which constitute the end insulators of the switch. To these are fastened the jaws into which the rotating blade engages. The entire switching equipment weighs approximately 325 lb.



TYPE OF ROTARY SWITCH SUCCESSFULLY USED ON 17,000-VOLT TRANSMISSION LINE

PAUL P. ASHWORTH,
Distribution Engineer.
Utah Power & Light Company,
Salt Lake City, Utah.

Cost of 33,000-Volt Transmission Line Is $1,757 per Mile

A 33,000-VOLT, three-phase, 60-cycle transmission line was built recently by the Wabash Valley Electric Company of Clinton, Ind., at $1,757 per mile, not including the cost of a 33,000-volt substation with its metering equipment. The overhead expense, including engineering, general office salaries, legal expense, injuries and damages, insurance, taxes and interest, was also excluded. Hitherto the Roachdale (Ind.) Electric Company, which operated 45 miles of transmission line serving some nine communities, has generated its own power at steam plants at Roachdale and Lagoda. Under a contract with the Wabash Valley Electric Company its present Clinton-Greencastle line was extended from Greencastle to Bainbridge, a distance of 11 miles, and a switching, transformer and metering station was established from which the Roachdale Electric Company takes its energy supply. The costs shown in the table on page 1278 are for the 11 miles of line which the Wabash Valley Electric Company placed under construction on Nov. 25, 1921, and finished so that service was furnished to the Roachdale Electric Company on Feb. 8, 1922.

Except for about a mile of line, the entire route is along the highway. The longest tangent is one-half mile, there being many corners owing to the crookedness of the road. Right-of-way was secured from all property owners along the highway. The conductors are No. 6 hard-drawn bare copper, with No. 4 stranded bare copper for road crossings. The line wire joints were made with sleeves without solder. No ground wire is used as experience does not indicate a need for it in this locality. Poles are mostly AA Western red cedar, though a few B poles were used. Triangle steel arms were used and painted with two coats of red lead and oil.

The pin-type insulators on these arms are rated at a nominal line voltage of 45,000. Three 10-in. suspension units were used in each tension insulator assembly. Air-break switches with horn-gap lightning arresters protect the incoming and outgoing 33,000-volt lines and the 37.5-kva., 33,000/2,300-volt single-phase transformer supplying the distribution system for the local consumers.

A 33,000-volt maximum demand and watt-hour outdoor installation is provided to meter the energy. The substation-supporting structure is made up of six wooden poles and 3-in. x 6-in. timbers, and the entire substation is surrounded by a wooden picket fence. The line and substation were designed by C. M. Poor, the general manager of the company, who also supervised the construction. Carrel Moore was the construction foreman.

C. W. OTIS,
Superintendent at Greencastle Station.
Wabash Valley Electric Company,
Greencastle, Ind.

CONSTRUCTION COSTS FOR 11 MILES OF 33,000-VOLT TRANSMISSION LINE

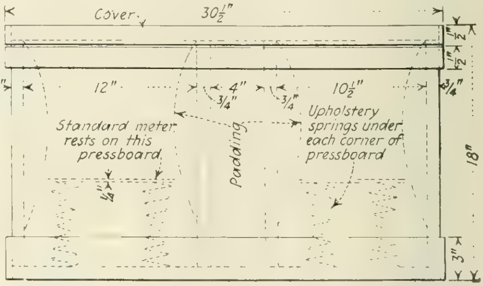
Pole prices given are f.o.b. shipping point. Hauling was done with a 1-ton truck and an army-type trailer. The figures given in the total-cost column are the book figures. Unit costs are calculated from these in a number of cases.

	Quantity	Unit	Unit Cost	Total Costs
Right-of-way	11	Mile	$209.61	$2,305.73
Easements (poles, guys and tree trimming)				830.50
Salaries				210.00
Miscellaneous (recording fees, notary and expense of right-of-way man)				304.19
Clearing right-of-way				880.95
Surveying			...	80.09
Construction equipment	11	Mile	128.49	1,413.42
Operation of trucks				572.51
Truck driver and helper				840.91
Wooden poles, total:	458	Each	11.15	5,108.16
30 ft	335	Each	7.15	2,395.25
35-ft	25	Each	10.20	255.00
35-ft	23	Each	11.25	258.75
40-ft	18	Each	14.35	258.30
40-ft	33	Each	16.70	551.10
45-ft	10	Each	20.30	203.00
50-ft	6	Each	23.20	139.20
55-ft	4	Each	27.30	109.20
60-ft	2	Each	32.65	65.30
65-ft	2	Each	36.10	72.20
Digging holes	458	Each	1.38	640.69
Attaching cross-arms	458	Each	0.35	160.17
Conductors and insulators	32½	Mile	217.00	7,236.95
Copper wire:				
No. 6 hard-drawn, solid	13,424	Lb	0.1525	2,047.16
No. 4 hard-drawn, strand	298	Lb	0.1848	55.07
Insulators:				
10-in. disk	132	Each	2.55	336.60
10-in. disk	402	Each	2.33	936.66
Pin-type	1,194	Each	2.06	2,459.94
Labor	32½	Mile	..	1,401.52
Cross-arms and hardware	11	Mile	227.17	2,498.92
Steel arms:				
36-in. triangle arms	378	Each	2.35	888.30
52-in. triangle arms	7	Each	4.00	28.00
Pins (truss)	1,183	Each	0.60	709.80
Strain insulators	225	Each	0.44	99.00
Angle-iron braces	12	Each	0.955	11.46
Anchors	90	Each	2.55¼	229.74
Pike poles	4	Each	2.80	11.20
$\frac{5}{16}$-in. D. G. steel strand	10.5	1,000 ft.	13.33	139.95
Paint and oil				32.50
Bolts and dead-end clamps			..	348.10
Freight and drayage			.....	353.83
Miscellaneous			......	411.67
Total for entire transmission line	11	Mile	1,757.14	19,328.58
Transformer station for 33,000 volts				3,816.24
37½-kva. transformers	1			577.80
Choke coils	3	Each	79.50	238.50
12-ft. insulated switch stick	1	Each	14.40	14.40
Air-brake switch, D. P. S. T.	1			259.00
Disconnecting switches	9	Each	48.92	440.32
Lightning arresters	6	Each	108.00	648.00
Metering installation	1		..	1,370.00
Freight and drayage				58.81
Switching charges				3.09
Miscellaneous				59.69
Lumber				41.22
Labor				105.41
Line sectionalizing air-brake switch				259.00
Total for entire installation				$23,403.82

Transportation and Handling of Standard Meters

NO FACTOR in the testing of meters in service is more important than the proper care and maintenance of the standards used. The most careful calibration in the laboratory may be rendered useless by rough handling in the field or by jolting.

In order to eliminate the latter cause of trouble, the box shown herewith has been designed by the meter department of the Southern California Edison Company for the transportation of rotating standard meters. It is made to fit the express body of the Ford automobiles used on this class of work, and it contains four compartments for test meters of different sizes. Each compartment, the sides of which are padded with horsehair and canvas, has a removable false bottom, to the under side of which are fastened four small upholstery springs. This box is also very convenient for carrying other delicate instruments, clocks for graphic meters, etc.


Cover
30½"
½"
½"
¾"
12"
4"
¾"
¾"
10½"
¾"
Standard meter rests on this pressboard
Padding
Upholstery springs under each corner of pressboard
¼
18"
3"

PADDED BOXES ARE USED TO PROTECT STANDARD METERS DURING TRANSPORTATION

There are four cells with padding on all four sides of each. The two cells on the left measure 12 in. x 10 in. and the others 10½ in. x 10 in.

Test men are given strict instructions as to the care of standards, and they are particularly cautioned not to deface the cases in any way. At frequent intervals the test meters are brought in and revarnished. While a shabby or battered case may house a perfectly accurate standard, it is felt that the use of apparatus that looks new will have an important psychological effect in increasing the consumer's confidence in the result of the test.

H. R. THOMAS,
Meter Department.
Southern California Edison Company,
Los Angeles, Cal.

Specifications for Welding Wire Issued

THE results obtained from the use of various kinds of welding wire and chemical analyses thereof have been compiled during the past year and a half by the welding wire specification committee of the American Welding Society. Specifications based on this information have been drawn up and are now available.

This information has been found necessary because the notion prevailed several years ago that almost any fence wire was good enough for welding. Although good results are sometimes obtained from the use of such wire, it is now recognized that most careful attention must be given to the physical as well as the chemical characteristics of welding wire if good results are to be assured.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

An Electrical Home Designed and Built by Electrical Men

In Denver the Electrical Industry Combined to Finance and Construct a $22,000 House and Carried Out a Successful Home Electric Exhibition

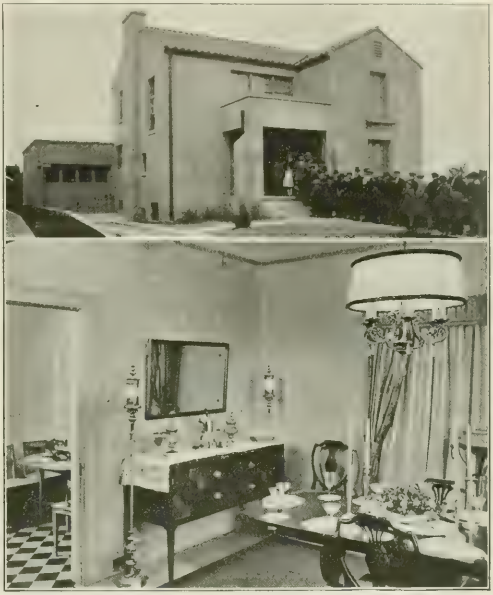
AT AN advertising cost of less than 10 cents per person, 36,992 residents of Colorado inspected the first electrical home in Denver, which was open for four weeks ended June 4 under the auspices of the Electrical Co-operative League of that city. In contrast with the electrical homes in other cities, the Denver home was designed, built and financed entirely by the electrical industry. A stock company, called the Electrical Home Building Company, was incorporated, with the leading electrical men of the city serving as directors. This company was not developed as a part of the league, but rather as an adjunct to it. More than $10,000 was raised by subscription, with shares priced at $10 apiece, and most of this amount came from individuals and not from companies.

Particular attention was given to planning the house with the view to making it as convenient as possible, but all freakish or unusual innovations were carefully omitted. The garage was attached to the house as shown in one of the accompanying cuts and was equipped with an electrical work bench and electrically operated door. The other views give a good idea of the interior and exterior appearance of the home. The cost of the house was close to $22,500, and the value of the interior furnishings was almost an equivalent amount. Daniels & Fisher, one of Denver's leading department stores, co-operated in furnishing the home, turning this work over to their interior decorator, who spared no effort to make the home modern and appropriate in every way.

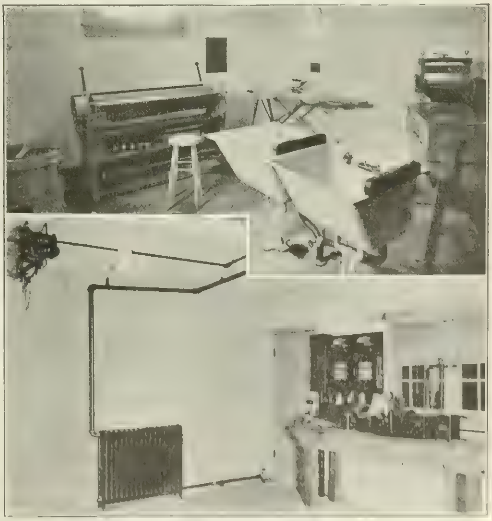
The wiring also provided three outlets for radio-telephone connections, one on each floor, with a special room in the basement for the receiving apparatus. The antenna was placed in the attic, and during the display nightly radio concerts were held.

In order that the display should be systematic, the committee in charge procured the services of twenty-eight attendants for two shifts. They were on duty from 2 p.m. until 10 p.m. daily, the first shift working until 6:30 p.m. and the other one coming on then and remaining until all visitors had passed through the house. To each of the principal rooms in the home was assigned an attendant who gave a three-minute talk to the visitors on the main features in that particular room. Several extra men were provided to relieve these attendants occasionally.

Invitations were furnished to the principal central-station companies in Colorado for attachment to their monthly statements, and the number of out-of-town visitors at the home showed the result of the co-operative publicity. Similar invitations were distributed by



FOUR VIEWS OF DENVER'S FIRST ELECTRICAL HOME, SHOWING EXTERIOR OF HOUSE, DINING ROOM, LAUNDRY AND ELECTRICALLY EQUIPPED GARAGE



the Mountain States Telephone & Telegraph Company to the number of 40,000. The Denver Gas & Electric Light Company prepared and distributed with all its statements an attractive four-color sticker inviting its customers to visit the home. The house-furnishing company issued engraved invitations to a special list of 3,000 names. Announcements also were carried on all cars of the street railway company and similar cards were placed in the windows of all electrical dealers.

Immediately after the home was opened interest developed in improved wiring plans and in many of the appliances displayed at the home. During the first three weeks more than a dozen sets of plans of new homes to be built in Denver were turned over to the league for perfecting the electrical lay-outs and development of a number of ideas featured in the electrical home. The electrical industry of Denver is enthusiastic over the successful exhibition, and the interest developed outside of Denver indicates a keen desire of the industry in this section to get into the movement.

The men responsible for the successful financing of the Denver project through the Electrical Home Building Company were Clare N. Stannard, vice-president and general manager of the Denver Gas & Electric Light Company, and L. M. Cargo and H. D. Randall, territory managers respectively of the Westinghouse and General Electric companies.

Comprehensive Commercial Policy Brings Results in Illinois

CONCRETE evidence of renewed and increasing commercial activity on the part of central-station companies is seen in the comprehensive plans of the Public Service Company of Northern Illinois and in the figures showing the amount of new business taken on during the first quarter of this year. Between Jan. 1 and the end of April this year the total number of contracts made with the company and with contractors for wiring old houses aggregated 526—largely exceeding the record of the same period in 1921 and falling short by roughly 150 of the total marked up in the first three months of the lively year 1920. Of these 526 contracts 123 were made by the company and the remainder by independent contractors.

The prospects of a large addition to the list of wired houses in 1922 are considered very definite. A comfortably large figure has been set as the goal to be attained by the company, and that number has been split into allotments to various districts. A thorough understanding with outside contractors has been reached. In fact, an electric league was organized last year by John G. Learned, assistant to vice-president, and is functioning in a fine spirit of co-operation. In driving for the addition of new customers large advertising will be done in the newspapers and in other ways found effective in the past.

In the first three months of this year 246 new contracts for the furnishing of electric power were made by the company. The capacity of these reached 5,763 hp., to which must be added the demand of electric ranges installed, amounting to 550 hp., bringing the total up to 6,313 hp. These figures are much above the record of January, February and March, 1921, but do not reach the total of that fraction of the big year 1920.

A careful survey of territory has been made with respect to the demand for electric power which will probably develop in 1922. After due consideration of all the facts assembled it has been decided to set a figure of 20,000 hp. as one represented in the additional contracts which it is believed can be secured.

The energy demand of electric ranges connected up in the three months here mentioned is over twice that of the new ranges put in service in the corresponding period of 1921. The Retail Merchandise Sales Department is sanguine that 1922 will be a notable electric range year.

Vancouver, B. C., Has 85 per Cent of Houses Wired for Electric Service

SOME interesting statistics have been compiled by the British Columbia Electric Railway Company showing the number of houses in Vancouver and surrounding districts and the proportionate number of homes wired for electricity. In the district served and accessible to the company's lines there is an average of 85 per cent of the homes wired for electric service. Ioco, a little oil town, holds the perfect percentage for the number of wired houses, having sixty-eight houses and sixty-eight customers. Vancouver comes next with an average of 95 per cent, 20,900 customers out of 22,000 houses. How the various districts shape up is shown in the accompanying table.

	Number of Houses On Lines	Number of Customers	Per Cent Wired
South Vancouver	9,000	7,650	85
Burnaby	3,500	2,980	85
Point Grey	4,400	3,960	90
City of Vancouver	22,000	20,900	95
North Vancouver	1,250	625	50
North Vancouver City	3,000	2,400	80
Fraser Valley	2,000	1,000	50
Chilliwack	900	720	80
Lulu Island	500	250	50
Steveston	800	640	80
Ladner (town)	300	240	80
Ladner (county)	250	125	50
Port Moody	250	190	75
White Rock	330	200	60
Coquitlam (including Port Moody)	1,000	500	50
Ioco	68	68	100
Hammond, Haney and Stave Falls	800	400	50
Totals and average	50,348	42,848	85

What Other Companies Are Doing

Paxton, Ill.—By co-operating with the city officials the Central Illinois Public Service Company has secured a new street lighting contract calling for the removal of the old arc lamps and the installation of a modern incandescent system. Ornamental lighting consisting of thirty-two posts in four blocks of the business district will also be put in. C. W. Amidon, division manager of the company, has been acting as electrical engineer for the city in this work and will supervise the installation, thus saving the city of Paxton a substantial amount of money.

Louisville, Ky.—One week's appliance sales by the Kentucky Utilities Company amounted to $4,107.05 and included thirty-five flatirons, eight electric fans, 18 hp. in motors, three electric ranges, a washing machine and a vacuum cleaner. Fifty-five house-wiring contracts were taken during the same period.

Milwaukee, Wis.—In two days' time 80 per cent of the 600 employees of the Wisconsin Gas & Electric Company purchased $200,000 of the company's issue of $500,000 of its new 7 per cent preferred stock. The Employees' Mutual Benefit Association of the company does not believe that this record has ever been equaled.

Manufacturing and Distributing

Devoted to the Discussion of Production, Distribution and Market Development,
the Business and Economic Problems
of the Manufacturer, Jobber, Agent, Contractor and Dealer

Interpreting the Corporation to the Workers

By C. M. Ripley
General Electric Company

PERHAPS no single thing has contributed more toward misunderstanding between employer and worker than the lack of information on the part of workers regarding the actual business done, profits, payroll and achievements of the particular industry in which they are employed. The experience of the General Electric Company in endeavoring to interpret its business to its employees may not be without benefit to other executives in the electrical industry and in all industries.

Let me illustrate. There was a strike on some years ago. There stood a picket who evidently was an Italian. In response to the question, "What's it all about, Tony?" the picket replied: "Ah, whatta-da-hell? We no getta our $4 a day unless Wall Street first getta their $24 a day." The way the remark was made showed a profound belief that the profits of industry were six times the payroll and that Wall Street owned the company.

Let us compare his contention with the facts. The payroll that year was approximately ten times the dividends, instead of the dividends being six times the payroll. Thus the error was a mere 6,000 per cent as the result of lack of information plus a generous amount of misinformation. And instead of "Wall Street" being the owner, 28,000 different stockholders, scattered all over the country, are the owners.

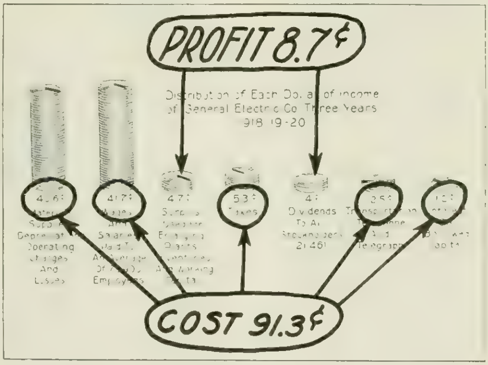
Not long ago an article appeared in the papers regarding the $40,000,000 cash of the General Electric Company. One office man was asked how long he thought that $40,000,000 would last in meeting the cash requirements of the company. He replied that it ought to last a year. Last year several office workers, including engineers and college graduates, were asked how much money the company spent every day in 1920. The answers varied from $10,000 a day to $200,000 a day. Imagine their amazement when they learned that the company's cash requirements that year were over $850,000 a day. Thus the $40,000,000 cash would meet the company's requirements for just forty-seven days.

In many conversations with presumably intelligent clerks, engineers, draftsmen and men in minor executive positions the subject was brought up of the size of the General Electric payroll in 1920. Estimates varied from "about $1,000,000" to as high as $100,000,000 — the latter estimate being made by a highly traveled man in editorial work. As a matter of fact, the payroll for that year was $128,000,000—thus showing a lack of fundamental information regarding the problems of industry.

Sherman Rogers says: "Actual industrial statistics for the rank-and-file employees are as scarce as radium. If a small per cent of the energy spent in suppressing radical literature, in imprisoning the agitators and in stopping their meetings had been spent in publishing actual industrial statistics and in answering the arguments of these individuals, there would have been but little need to worry about the constitution."

In an experimental way an educational lecture was prepared, at the suggestion of various General Electric executives, to show in pictorial form and in simple language the inner workings of the company. The lecture shows that the materials needed for building the company's product come from the four quarters of the world, and are gathered by the workers of white, black, yellow and brown races, who, although in foreign lands, are the unconscious partners of the inventors and engineers.

The sales organization of 6,000 employees is described, together with the fifty or more sales offices in the United States, and some of the problems of the sales department are discussed and illustrated. The corporate organization of the company is described and illustrated by a chart showing relation of stockholders, board of directors, executive committee, general officers, advisory committee, manufacturing committee, etc. It was explained that in 1920 there was an average of 83,000 employees engaged in more than a hundred offices and factories in fifty cities.

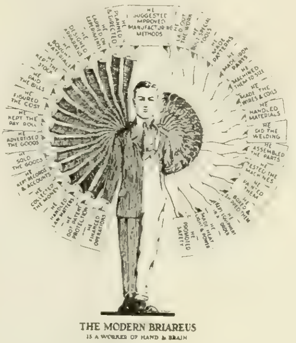


THIS PICTURE HAS BEEN EXTENSIVELY USED TO SHOW THE WORKER WHO GETS THE MONEY HE HELPS MAKE

The distribution of each dollar of the company's income was graphically illustrated, by piles of pennies. In addition to this, the total 1920 payroll of $128,000,000 was featured, from which the average employee is shown to receive $1,538. The average employee, shown as an imaginary composite creature with thirty arms, was illustrated in an artist's drawing. This showed the main functions of the entire organization as condensed into a single human being.

The sales billed in 1920 divided by the number of employees was equal to $3,320, and various photographs were shown of different kinds of apparatus and supplies which the company sells for this sum of money. For instance, a transformer 13 ft. high and with a capacity of 1,250 kw. (over 1,600 hp.) was sold for $3,320, and lantern-slide illustrations pointed out that this transformer sold for 15¼ cents a pound (shipping weight) and contained 1.8 miles of wire, 6½ miles of cotton thread, 7.8 miles of paper tape and 5,300 different pieces of special silicon steel.

It was pointed out that this wonderful device was designed, the materials purchased, the machine built, sold, painted, boxed, shipped, billed, and the money collected, all in one year of 2,400 working hours. The reason why such a machine can be built by one imaginary composite average employee in one year was explained as being due to the division of labor, complete equipment, modern organization and electric drive of factory machinery.



A COMPOSITE OF A GENERAL ELECTRIC EMPLOYEE WITH A HAND FOR EACH JOB THAT HE DOES

As the result of the sale of $3,320 worth of apparatus and supplies in 1920 (neglecting sundry income), the stockholders received dividends of $129 in cash and two-thirds of one share of stock.

These facts give the employee an understanding of the relationship between sales billed, payroll, cash dividends and stock dividends. The numerous requests for this information from all sorts of organizations have almost convinced us that even the labor unions—yes, and the Socialists too—are earnestly, honestly and eagerly searching for the truth regarding industry, and that it will profit every manufacturer to present this kind of information to his own employees.

The Small Manufacturer's Pressing Distribution Problem

By One of Them

SMALL manufacturers are unorganized and have no authorized and recognized spokesman. Yet because in many classes of electrical commodities they represent the majority of the business, they form an important element in this much-argued problem of distribution. Moreover, it is they who are often accused of muddying the waters by selling to the so-called imitation jobbers. Therefore it is well that the viewpoint of this small or "independent" manufacturer be put on record in the general discussion.

It is obvious that there are too many jobbers—too many concerns that call themselves jobbers—in many towns. It sets up an undue duplication of stock and organization, it forces a destructive competition that is largely maintained on a price basis. It embarrasses the true jobbers, reduces everybody's profit and demoralizes the trade. There can be no doubt of it. But there is a reason for it. And the reason is that there are so many manufacturers who cannot gain outlet and distribution through the large jobbing houses. A very large proportion of the latter are owned by or allied with the two large electrical manufacturers, who have built up chains of jobbing houses, operating in reality as glorified manufacturers' agents. They sell little or no competing material so the small manufacturer of a competing line is barred out and forced to sell through smaller distributors.

There are many independent jobbers throughout the land. True. But for a manufacturer seeking national distribution there are a surprising number of the most productive territories where aside from the "kept" jobbers there are too few to go around. The two big companies will have one each—or more—and there will be a few perhaps left over, but not enough. In some cities there will be no first-grade jobbers that are not "owned." In fact, more than half the members of the Electric Supply Jobbers' Association are "kept" jobbers, as well as a goodly proportion of those substantial jobbers who are not members. The result is that there is a relatively small number of large jobbing houses in the free field available to the small manufacturers.

Security in Small Wholesalers

One would naturally say, therefore, that the thing for the small manufacturer to do would be to tie up with as many of these free large jobbers as he can. But even this is a precarious policy. In one case that I know of a certain manufacturer has lost twenty-two large distributors in seven years because these houses were taken into one of the big jobbing systems, and since his was a competing line, he was compelled to look elsewhere for distribution. Therefore, because the policy of increasing the number of houses in these systems continues, it is of doubtful wisdom for a small manufacturer to establish himself with a large jobber in any city. After the territory is well developed and prospering with a good volume of demand, this conspicuously successful house may be gathered in by one of the big fellows and Mr. Small Manufacturer will walk the proverbial plank.

The large jobber who is doing well has become a shining mark. Therefore this particular small manufacturer and many others shun him and develop distribution through small wholesalers only. They would rather have ten little jobbers in a big city than one big one. It is safer, and a burnt child avoids the fire.

Undoubtedly such a policy leads to the setting up of many who are rightly called imitation jobbers, but if there is no recognized qualification to measure a jobber by, the manufacturer must decide for himself. He can only select houses that seem to be performing the economic functions of a jobber, but in the end the best qualification is the size of the orders that he places. If he sells the goods and pays his bills, he is a safe and probably a satisfactory distributor, because, being small, his overhead is so much lower than that of the big jobbers that he can compete with them, just as the small manufacturer cannot be exterminated by the big one because his costs also are lower.

The increasing number of small wholesalers in the electrical industry has undoubtedly complicated the processes of distribution. But there seems to be no way out of it so long as so great a number of the large jobbing houses are subsidized by big manufacturers, thereby barring out competing goods, which must and will have distribution.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Magnetic Flux Distribution in Transformers.—KARL B. MCEACHRON.—Using a simple test core-type transformer, provided with belt exploring coils under both the primary and secondary windings, data concerning the magnitude and phase positions of the fluxes in different sections of the core were secured. The results show that leakage fluxes do not exist as separate fluxes in the core.—*Journal of the A. I. E. E.*, April, 1922.

Methods for Laying Out Coils. — A. C. ROE. — Procedure for laying out new coils when old coils are not available is prescribed for direct-current armatures and alternating-current stators.—*Electrical Review and Industrial Engineer*, April, 1922.

Cascade Group of Asynchronous Motor and Commutator Motor. — R. LANGLOIS. — The author gives an elaborate theoretical analysis of the function of a cascade group consisting of an asynchronous motor and a commutator motor. Such a group is being used in several rolling-mill drives with three-phase current and also for the improvement of the power factor of asynchronous motors.—*Revue Générale de l'Electricité*, April 15, 1922.

Lamps and Lighting

Electric Farm-Lighting Plants.—The author presents a number of interesting arguments for and against automatic, semi-automatic and manually operated isolated farm-lighting outfits. He claims that all factors are in favor of the low-speed kerosene-motor plant with a large storage battery on account of the not quite reliable operation of the fully automatic or even the semi-automatic gasoline sets. A manually operated station requires very little attention and will last for ten years or more, while automatic stations will be good for only two or three years, the author asserts. A tabulation of twenty-five different plants is given, comprising all three systems, with their main data, including cost.—*L'Industrie Electrique*, May 10, 1922.

Generation, Transmission and Distribution

Winnipeg City's Hydro-Electric System.—E. V. CATON.—The power house of this system is situated at Point du Bois on the Winnipeg River, 78 miles northeast of Winnipeg, Manitoba. A detailed summary of the generating and distributing equipment and of the plant is given. Eleven units are now installed with a total capacity of 49,500 kva. Energy is generated at 6,600 volts, three-phase, 60-cycle, and is transmitted on four lines built on two sets of steel towers at 56,000 volts.—*Electrical News*, April 15, 1922.

Expectation of Efficiency of Steam-Boiler Operation.—H. R. CARR.—Empirical curves are developed enabling the expected efficiency of a boiler installation to be determined with a fair degree of accuracy. The method of using these curves and the conclusions that can be drawn are explained.—*Power Plant Engineering*, April 1, 1922.

Grounds on a Transmission Line and the Principle of Superposition.—H. HO.—The convenience of applying the principle of superposition of currents and electromotive forces in investigating the phenomena resulting from an accidental ground and its opening on a transmission line is pointed out.—*Journal of Institute of Electrical Engineers of Japan*, March, 1922.

Large Water-Turbine Installations.—W. HAHN.—A general description, with numerous photographs and drawings, of the turbines and power stations given in the accompanying table.—*Elektrotechnik und Maschinenbau*, March 19 and 26, 1922.

Location	Year	Head, Meters	Size, Hp.	Turbines, Installed	Type of Turbine
Niagara Falls	1913	54	16,000	12	Twin-spiral
Lienfos, Sweden	1912	17	5,100	3	Twin-drum
Svaelfos, Sweden	1913	47	12,000	..	Twin-drum
Tokio, Japan	....	104	11,400	6	Twin-spiral
Rjukanfos, Norway	1915	276	16,000	10	Twin-Pelton
Glomfjord, Norway	....	442	27,500	3	Twin-Pelton
Ottawa & Hull Power & Manufacturing Company	....	11.6	10,000	..	Double-twin
Whylen, Germany	1913	7.5	3,000	10	Double-twin
Meitingen, Germany	....	15	7,000	3	Twin-drum
Raanaasfos, Norway	1921	13	14,000	..	Twin-drum
Leitzach, Germany	1914	115	4,400	5	Single-spiral
Walchensee, Germany	1921	200	18,000	4	Twin-Pelton
Walchensee, Germany	1921	200	24,000	4	Twin-spiral
Sorocoba, Brazil	1914	..	17,500	3	Twin-spiral
Meran, Austria	1914	300	8,000	..	Twin-Pelton
Ruetz works, Austria	1913	170	4,000	2	Pelton
Ruetz works, Austria	1921	170	8,000	1	Pelton

Installations, Systems and Appliances

Three-Phase Arc Furnace for Copper and Brass.—E. RUSS.—An arc furnace is described which can be connected directly to any three-phase line. Rocking the furnace during its operation gives a very uniform distribution of the heat and prevents excessive burning of the melted metal. An average power factor of 0.90 per cent is maintained. The lining will hold for 500 to 800 charges. The consumption of the furnace varies between 250 kw.-hr. and 400 kw.-hr. per metric ton of metal. Standard sizes of 500 kg. to 2,000 kg. are manufactured. — *Elektrotechnische Zeitschrift*, April 13, 1922.

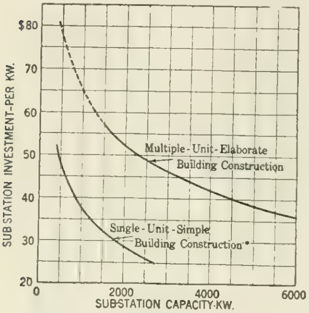
Central Control of Motors.—ORVILLE F. LONG.—From a single dispatching board 135 motors ranging in size from 1 hp. to 225 hp. are started and controlled. Any circuit may be easily tested when troubles develop. The layout of the system and the use of special connectors make it easy to replace equipment in this plant of the Kelsey Wheel Company, Inc., Memphis, Tenn. On the small motors circuit breakers and relays are used. For large motors oil switches are used.—*Electrical Review and Industrial Engineer*, April, 1922.

Synthetic Cast Iron.—J. L. CAWTHON, JR.—The author discusses in detail manipulation of the heat in the production of synthetic cast iron in the electric furnace with respect to its five principal alloys—carbon, silicon, manganese, sulphur and phosphorus.—*Paper presented before the American Electrochemical Society, Baltimore*, April 27, 1922.

Traction

Operation of an Electrified Terminal.—L. E. LYNDE.—Comparison of the conditions at the Broad Street (Philadelphia) station of the Pennsylvania System before and after electrification.—*Electric Traction,* May, 1922.

Economics of Direct-Current Railway Distribution.—L. P. CRECELIUS and V. B. PHILLIPS.—The purpose of this paper is to determine, first, the relations that govern the size of feeders and the correct feeder layouts for any given arrangement of substations and, second, the principles underlying the correct location, size and type of substations, assuming the fullest development of automatic and semiautomatic control. The limit of substation investment, without land, is shown in the accompanying illustration. The upper curve is based largely upon Cleveland substation costs, while the lower curve, on the other hand, is based on the smallest and simplest buildings possible.—*Journal of the A. I. E. E.,* May, 1922.



AUTOMATIC SUBSTATION COSTS FOR 60-CYCLE CONVERTERS

Electrophysics and Magnetism

The Disappearance of Gas in the Electric Discharge.—N. R. CAMPBELL and H. WARD.—The experiments described were concerned primarily with the disappearance of gas in the presence of phosphorous vapor. In the main they were directed to the determination of how the quantity of gas absorbed in the discharge in the presence of phosphorus varies. The experiments take up the nature of the gas and discharge, the form of the vessel, the pressure of the gas, the relation between the amount of gas absorbed and the amount of phosphorus present and the effect on the walls of the tube.—*Philosophical Magazine* (*London*), May, 1922.

The Inner Structure of the Pearlite Grain.—COL. N. T. BELAIEW.—Investigations made by the author on the crystallization of steel, using a series of alloys specially prepared under conditions of extremely slow cooling.—*Engineering,* May 19, 1922.

Electrochemistry and Batteries

The Corrosion of Lead-Covered Wiring by Oak.—P. DUNSHEATH.—An unusual case of corrosion of lead where a lead-covered cable ran through timbers of oak is described, with a partial analysis of the causes.—*Electrical Review,* May 19, 1922.

Conductivity of Copper-Refining Electrolytes.—E. F. KERN and M. Y. CHANG.—The specific conductivities of solutions of sulphuric acid and copper sulphate and of mixtures of sulphuric acid and copper sulphate were determined at 25 deg. C., 40 deg. C. and 55 deg. C. Tables and curves are given for the several solutions of varying concentrations and for different temperatures. The effects of the impurities were also investigated, the most important discovery being that the presence of nickel sulphate and ferrous sulphate depresses the conductivity very much.—*Paper presented before the American Electrochemical Society, Baltimore,* April 27, 1922.

Units, Measurements and Instruments

Direct-Reading Henry (Inductance) Meter.—R. BARTHÉLEMY.—The author has devised and described in this paper an instrument consisting of a magneto which generates an alternating current that is made to pass through a fixed self-inductance in series with the unknown exterior inductance. In parallel with the external inductance is a direct-current voltmeter, which receives current from the magneto over a mechanical rectifying commutator on the shaft of the magneto. Depressing a push-button disconnects the magneto from the unknown inductance and makes connection with a comparison inductance. From the resulting two readings of the voltmeter the unknown inductance may be determined. Several examples for the use of this new instrument are explained.—*Revue Générale de l'Electricité,* March 25, 1922.

Telegraphy, Telephony and Signals

Practical Application of the Telephone Repeater.—H. S. OSBORNE.—Attention is called to some of the fundamental conditions of telephony which make the telephone repeater of such importance. Several examples are given of the use of this repeater in special telephone service.—*Journal of Western Society of Engineers,* May, 1922.

Radio Transmission Over Long Distances.—G. MALGORN.—The formulas of different investigators as to the amount of energy transmitted between sending and receiving stations in relation to the height of the antenna, wave length and antenna resistance give very different results. The author compares such formulas, as, for example, those of Austin, Sommerfeld, Howe, Cohen and others, and shows their relative differences. A special expedition on board the ship *Aldebaran* was recently authorized the aim of which was to measure the signals emitted by Nantes, Lyon and other high-power stations. The results have been tabulated, and from these values an alignment chart was constructed, which gives direct readings of such dimensions as height of antenna, wave length, distance between stations.—*Revue Générale de l'Electricité,* April 8, 1922.

Miscellaneous

Water-Power Resources of Canada.—J. T. JOHNSTON.—A general review of the water-power developments, tabulating the available power with that developed. In the accompanying table the power utilized in central stations and in the pulp and paper industries is given for each province. The water power now developed represents an investment of $530,000,000.—*Canadian Engineer,* March 28, 1922.

DEVELOPED WATER POWER IN CANADA

Province	—Turbine Installation in Horsepower— In Central Stations	In Pulp and Paper Mills	In Other Industries	Total
British Columbia	207,656	48,800	48,859	305,315
Alberta	32,380		807	33,187
Saskatchewan				
Manitoba	93,355		10,792	104,147
Ontario	948,372	170,624	93,654	1,212,650
Quebec	696,593	224,412	94,380	1,015,385
New Brunswick	8,978	14,668	6,534	30,180
Nova Scotia	14,992	17,999	13,957	46,948
Prince Edward Island.........	245		1,624	1,869
Yukon	10,000		3,199	13,199
Total for Canada	2,012,571	476,503	273,806	2,762,880

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Marconi Shows Results with Short Waves in Radio Experiments

POINT-TO-POINT radio sending with a one-meter wave was demonstrated by Guglielmo Marconi before a joint meeting of the Institute of Radio Engineers and the American Institute of Electrical Engineers in New York on June 20.

Mr. Marconi said that his present investigations were with short waves and that this new and promising field of radio offered superior possibilities of development. At the same time he reviewed the long-wave radio development and showed how it had progressed by leaps and bounds.

In England they now use sixty bulbs and 100 kw. in the antenna, with a radiating efficiency of about 50 per cent, on 20,000-m. waves. Aside from the protection from interference given by directional reception, a close filtering and an element of saturation, no particular methods have been developed for eliminating static, Mr. Marconi said. However, the effective speed has increased eight to ten times since 1912 owing to many small improvements.

A new air-core type of transformer as invented by G. Mathieu was described by Mr. Marconi. This transformer increases the amplification factor of a tube from 5 to 15 per cent and is a noteworthy development in the art of amplification.

Investigations on a world-wide basis are now being carried on to determine the strength of signals that can be relied on over given distances and to find the ratio of the strength of signals to that of static and other interferences acting on receiving stations. These investigations seem to bear out the prediction of Mr. Marconi that at the Antipodes radio waves reunite and become in phase so that signals can be received with ease. The signals do not follow the great circles, but follow well-defined paths independent of distance to a large degree.

CONCLUSIONS CONCERNING STATIC

On his trip across from Europe, Mr. Marconi found that static came from Europe until the halfway point was reached and then seemed to originate in America. All static seems to be greatest and to originate over land areas and to behave very irregularly in the different parts of the earth. Transmission from west to east is far easier than from east to west in all parts of the world.

The new lines of investigation pursued by Mr. Marconi are in the use of continuous short-wave lengths. In the words of Dr. Pupin, he has "returned to his first love." Every experiment with the short waves shows that wonderful possibilities are opened up. No static interference occurs, very sharp directional sending and receiving may be accomplished, and one antenna may be used to send and receive at the same time. By means of tubes it is possible to produce 12-m. waves which utilize a power of several kilowatts.

Using a revolving reflector for these short waves and signals for each half point on the compass, ships off Scotland have been able to locate the sending station within one-quarter point of the compass, or 2.8 deg.

A duplexing radio-telephone system of 20 miles is in operation in England between London and Birmingham which uses the short waves and reflectors with astonishing results. Communication is kept up at all times without distortion. The same type of system has also been used between England and Ireland. The attenuation of these short waves is so very regular over the sea that distances can be accurately measured by the strength of the signals.

The Institute of Radio Engineers conferred its medal of honor on Mr. Marconi, the presentation being made by A. I. Cutting.

Dr. M. I. Pupin of Columbia University and E. H. Armstrong of the General Electric Company paid tribute to Mr. Marconi in enthusiastic terms.

New Minority Report on Muscle Shoals Assails Ford Offer

EIGHT members of the House military affairs committee opposed to the Muscle Shoals project of Henry Ford have united in a new minority report prepared by Representative Kearns of Ohio. These members include Messrs. Parker of New Jersey and Frothingham of Massachusetts, who had previously made a report in opposition to the Ford bills. In this new report Mr. Ford's proposal is attacked without gloves.

The properties for which Mr. Ford offers the government $5,000,000, the report says, already have cost the government $85,487,900. It declares the amount offered "seems wholly inadequate when it is remembered that Mr. Ford could immediately dispose of the Gorgas plant to the Alabama Power Company for $2,500,000." Additional appropriations totaling $50,000,000 would have to be made if the Ford offer were accepted, the report says, with the result that the government would suffer a further loss of $13,350,000 in interest, "returning to Mr. Ford in this one item of interest his $5,000,000 and $8,350,000 besides."

Under the head of "frenzied finance," the report goes on to say that Mr. Ford would repay the government in a hundred years only $4,674,000 of the $50,000,000 to be expended by it on the dams "Men everywhere who understand this proposition condemn it in unmistakable terms," the report continues. "The entire people will some time know what fraud is being attempted, and then the condemnation will be universal."

The report favors concurring in the Senate appropriation of $7,500,000 to continue work on the Wilson Dam, the leasing of the government nitrate plants, the abandonment of the proposed Dam No. 3, and the authorization of the Secretary of War to entertain new Muscle Shoals proposals.

A dispatch from the ELECTRICAL WORLD'S Washington correspondent received as it goes to press says that no rule to permit consideration of the Mackenzie, or majority, Muscle Shoals bill will be brought into the House prior to the recess and that the House will probably vote to concur in the Senate appropriation. The Kearns report, he says, has intensified the opposition to the Ford proposals. Representatives of consumers who get their power from the Alabama Power Company have been in Washington urging that that company be allowed to retain the Gorgas plant.

Muscle Shoals became the subject of a running debate in the Senate last Saturday when Senator McKinley of Illinois read a letter from James E. Smith of St. Louis, the president of the Mississippi Valley Association, in which the acceptance of Mr. Ford's offer with the Gorgas steam plant included was urged. Senator McNary of Washington said the proposed contract would "fall under the control of Wall Street within three days after Mr. Ford's funeral." Senator Underwood said that the Ford proposal should be either accepted or rejected before Congress adjourns. Senator Norris replied that the legislative situation was such that no reasonable hope could be entertained for the disposal of the matter at this session. Senator Underwood expressed the opinion that there would be time to take it up while the tariff bill is being considered by the conferees of the two houses.

Senator Heflin of Alabama warmly advocated the Ford proposal, quoting one of Mr. Ford's representatives as saying that most of the power developed at Muscle Shoals will be used in the making of fertilizer. Senator Norris expressed the opinion that the bulk of the power would be used for manufacturing purposes He attacked the Ford offer vigorously, saying that it was a proposal to sell a birthright for a mess of porridge.

Senator Norris concluded by introducing a resolution proposing that the Federal Trade Commission report to the Senate whether or not the production or sale of fertilizers is controlled by any monopoly or whether any conspiracy exists under which the price of fertilizers is enhanced.

New Officers Chosen for the Canadian Electrical Association

AT THE executive session of the Canadian Electrical Association held in connection with its convention at Ottawa, Ont., last Saturday the following officers were elected: President, P. T. Davies, Southern Canada Power Company, Montreal; vice-presidents, R. J. Beaumont, Shawinigan Water & Power Company, Montreal; A. P. Doddridge, Quebec Railway, Light, Heat & Power Company, and L. W. Pratt, Hamilton (Ont.) Cataract Light & Traction Company. Eugene Vinet resigned as secretary-treasurer, having accepted a position with a large electric public utility organization in Chicago, and J. Coffey of the Southern Canada Power Company was appointed secretary-treasurer pro tem. Regret was expressed over Mr. Vinet's resignation and his loss to the Canadian association, for which he has done such excellent work during the last three years.

President Smith Impressed with Association Work in the West

FRANK W. SMITH, president of the National Electric Light Association, has just returned from a tour of the Pacific Coast and is most enthusiastic over the outlook. When seen by a representative of the ELECTRICAL WORLD soon after his return, Mr. Smith said:

"In an endeavor to become thoroughly conversant with electrical conditions throughout the country, I made a trip to the Pacific Coast, attending the convention of the Pacific Coast Electrical Association at Los Angeles and that of the Northwest Electric Light and Power Association at Boise, Idaho. The thing which impressed me at both conventions was the solidarity of the electric light and power business and the great enthusiasm which managers and operators alike show in the business.

"In California, of course, chief interest centers in the water and power act to be voted on this fall, and I was greatly heartened by the confidence shown by the leaders of the industry on the Pacific Coast in the ultimate defeat of the proposed measure. To an outsider viewing the enormous development that has taken place in California and realizing to what extent this development is due to electricity and to the privately owned electric public utilities providing it, it is unthinkable that so revolutionary and socialistic a change as that proposed in California can be brought about.

"Naturally the companies on the Pacific Coast are warm in their praise of the work done by the national association, particularly in the preparation of the Murray and Flood report on the Hydro-Electric Power Commission of Ontario and in the work of the water-power committee in its dealings with the Federal Power Commission at Washington.

"I was informed that the attendance at the convention held in Los Angeles was unprecedented and that executives who were never before known to attend a convention were present. This to my mind is indicative of the great interest which has lately been shown in association affairs, and, needless to say, it will be the aim of the staff at headquarters to maintain and even deepen this interest.

"California is certainly showing a wonderful growth. Depression, as we know it in the East, apparently does not affect it. Her crops are constantly increasing in size and in value, and it is significant of the excellent work done by the public utilities of the state that almost every business interest and public-spirited citizen recognize to what extent this growth and expansion has been made possible through electrical development.

"At the convention at Boise the same keen interest in association affairs was manifest. As in Los Angeles, one whole session was given over to an industrial conference. That at Boise was held in a theater and was open to the public. I am confident that meetings of this kind cannot help but be of great benefit to the public as well as to the utilities.

"We are engaged in one of the most progressive of industries, one that has attracted engineering and executive talent of a high order and one which has contributed in some instances more than the railroads themselves to the upbuilding of the country. For example, I was amazed in looking out of the train window to see so many small communities with no paved streets, no water or fire protection system, and apparently no sewers, and yet possessing electric service. The roads were well lighted and apparently the homes also. Of course, with vast interconnected networks it becomes possible for such communities to obtain almost as good electric service as large cities do, and at reasonable cost.

"An Easterner is always impressed with the great distances of the Far West, and an electric light and power man is also struck with the daring and magnitude of the electrical undertakings, the faith in the industry felt by the men engaged in it, and the great investment necessary to reach sparsely settled communities. Certainly, electricity is used more per capita on the Pacific Coast than elsewhere, and considering the great outlays made for generating and distributing it, the cost is remarkably small. Just to see the industry at work in the West is an inspiration, and the enthusiasm they show in it is certainly catching. The work done in customer ownership of securities is nothing short of marvelous.

"It is my purpose to bring the N. E. L. A. into more intimate contact with the various sections of the country and thus weld the organization as a whole into a more compact and efficient body. The chairmen of the various committees have all been appointed so that work for the next administrative year may begin at once, and the first meeting of the executive committee will be called at New York on July 20.

"In addition to addressing the conventions of the Pacific Coast Electrical Association and the Northwest Electric Light and Power Association, I transmitted a speech to the Canadian Electrical Association and spoke to the New York Bankers' Association, in convention at Lake Placid, by radio from Schenectady. Naturally, my heart and soul are in this work, and if the enthusiasm that they have on the Pacific Coast can be spread over other sections of the country, the industry will enjoy not only well-deserved popularity but great expansion as well."

Iowa Men Discuss Inductive Interference and Rural Lines

INDUSTRIAL interference, rural lines, group insurance, sales of securities to customers and electric cooking were prominent among the topics that came before the Iowa Section of the National Electric Light Association when it met at Lake Okoboji, Iowa, on Tuesday to Friday of this week. The president, S. C. Dows, also dwelt in his opening address on the desirability of a uniform accounting system for municipal utilities and on the steps being taken to revise the rules governing overhead wire crossings in the interests of safety.

Pleasure at the way in which the telephone and power interests have got together in work on the inductive-interference problem was expressed by Dwight N. Lewis, chairman of the Iowa Board of Railroad Commissioners, in his address on Tuesday. Both telephone and light and power lines must occupy the highways, he said, and the commission intended to see that cheap and flimsy construction is prohibited on rural lines, for which the commission has recently issued specifications.

Mr. Lewis criticised a few men who have made it a practice to construct cheap lines and then unload them on the farmer, promising trouble for these individuals and protection to the men who are promoting adequate construction.

A fuller report of the convention proceedings will be printed in the ELECTRICAL WORLD next week.

Study of Cost Factors in Rates Urged at St. Paul Convention

A PLEA for consistent analysis of the costs of operation to aid in determining whether business being handled is profitable and whether additional business that can be taken on is likely to prove profitable was made by W. S. Heald of Duluth before the North Central Electric Association at its second day's sessions at St. Paul last Thursday. He showed how it is possible for any one familar with the conditions on any given property to separate the costs into the principal factors, such as customer expense, capacity, street lighting and like factors, in a way that will give a practical basis for checking the accuracy of rates.

Martin J. Insull said that one of the principal faults of utility men in handling relations with the public is the failure to understand that the things which seem simple and obvious from the utility viewpoint are not so to the public. Many misunderstandings arise from this failure. He also said that it was not generally appreciated that while in some phases of their business the central stations are necessarily monopolies, they are in active competition with other forms of energy supply for favorable public opinion and in the money markets, where the competition is far keener than it is anywhere else. Because the public has invested in wiring, appliances and other means of utilizing electric service about two dollars for every dollar of utility investment, he said that public interest in the maintenance of successful utilities is greater than the interest of the utilities themselves.

That newspapers cannot be bought by the use of advertising space and that their advertising space has a real value that can be utilized by the preparation of proper copy and intelligently directed advertising campaigns was the message George F. Oxley, director of publicity of the National Electric Light Association, brought the convention in discussing "National Good-Will Advertising."

Inductive interference was discussed by R. F. Pack, who presented the report of the joint general committee representing the N. E. L. A. and the Bell Telephone System. S. B. Hood of Minneapolis reported for the geographic division committee on this subject. A careful study of the report was urged, as was the need of backing the work of the committee through effective local co-operation with the telephone systems. A representative of the Bell companies said that telephone engineers who have the duty of carrying out their part of the co-operative work were stationed at the companies, division offices in Omaha, Des Moines, Minneapolis and Fargo.

The officers elected for the ensuing year are: President, W. S. Heald, Duluth; vice-president, R. M. Howard, Winona, Minn.; treasurer, A. L. Kippels, St. Paul. The executive committee will be composed of H. L. Thomas, St. Paul; J. W. Peterson, Fergus Falls, Minn.; W. C. Blanchard, Aberdeen, S. D., and W. L. Hibbard, Fargo, N. D. Interest in the association was shown by the fact that the registration this year was 380, as compared with 237 last year.

Reserve Stocks of Coal Shrinking Toward "Danger Mark"

WITH reserve stocks of bituminous coal depleted to approximately 26,000,000 tons, or within less than one week's consumption of the "danger mark," which has been officially placed at between 20,000,000 and 25,000,000 tons, reports reaching the Geological Survey this week indicated a reduction in the output for the eleventh week of the strike. Production of soft coal in the tenth week was 5,078,000 tons, while the returns forecast less than 5,000,000 tons for the week that followed this.

After a conference between retailers and operators Secretary Hoover announced that it had been settled with the representatives of the retail association that they will co-operate to insure that all coal be sold at cost plus a reasonable selling charge and that in localities where bituminous coal is sold for household purposes existing stocks, as of June 1, of unsold pre-strike and contract coal be reserved for the smaller household trade and such coal be sold at prices based upon cost plus usual handling charges. Except for the above coal, the retail prices are to be based upon average purchase prices with usual handling charges. Retailers are to co-operate to prevent rising mine prices by calling the attention of the administration to price demands out of line with the established bases and they are to handle coal on straight lines, from operator and wholesaler without speculative resales in the trade.

Following the meeting emphasis was placed on the fact that larger consumers should buy coal at this time when unsold surpluses exist at Virginia tidewater points and in Alabama. If that type of consumer would make his purchases now, it would make for a better situation later in the season when the demand from small consumers will enlarge.

In a further statement Secretary Hoover said: "In the field where a price basis has not yet been established (only 15 to 20 per cent of the total tonnage now being produced), I earnestly request that each operator immediately reduce his selling basis for spot coal to the Garfield price, including the standard selling expense, plus such additions for increased costs as can be justified in his individual case. Owing to the persistent misstatement or misunderstanding of elements inside and outside of the industry, the impression has been given in some quarters that the maximums constitute minimum prices and offer reason for some occasional taking of advantage of such price basis. It is in the interests of the good repute of the industry, as well as that of the public, that the formula for computing prices in relation to the Garfield scale should be conscientiously applied by all operators."

There have been few violations of the spirit of this arrangement in Virginia, West Virginia, eastern Kentucky and Tennessee, where prices for spot coal vary from $2.50 to $3.25, with an occasional price at the maximum, but with an average of about $3. At the same time more than half the tonnage is moving as contract coal at averages below $2.25. Alabama coal is being offered at from $1.82 to $2.10. The refusal of the operators in western Kentucky to accept the maximum which Secretary Hoover prescribed is generally held to be a very short-sighted policy.

Pressure already is being brought on the administration to arrange for the arbitration of the strike. Most of this pressure has its origin in the Northwest. That seems to be the only section of the country in which any nervousness is developing. New England is getting all the bituminous coal it is willing to buy.

S. P. E. E. Champions Engineering Leadership in Production

PROF. CHARLES F. SCOTT of Yale University in a stirring address as president of the Society for the Promotion of Engineering Education, at its annual convention this week at the University of Illinois, pictured the position of the engineer as something more than a master of engineering details of design and construction. The engineer must show leadership in production and in the elimination of waste of human effort in manufacturing processes and in the management of these processes. If he is to show this leadership, Professor Scott said, the engineering universities must know how to provide instruction that will make it possible to know more about the fitness of the students they graduate and how effective that instruction is during the period it is being given. The building up of efficient teaching staffs, he declared, must be one of the prime functions of the Society for the Promotion of Engineering Education, if that organization and the educators who compose its membership are to lead and not follow the requirements of industry and to develop men who are prepared to deal with the new and changing problems in engineering that involve economic and management phases. In line with this expression of opinion, the council of the society adopted the following resolutions:

> Whereas the president of this society, visioning the future, has, after a careful study of the possibilities of greatly enlarging the scope of its activities, made certain recommendations, and whereas in his opinion there is a reasonable possibility of securing funds for the society for the promotion of engineering education if an adequate plan is developed and indorsed by this society, and whereas in the opinion of the council this society stands challenged by the conditions thus presented, now be it resolved that the president of this society appoint a committee of five members, including himself, to study the development of the Society for the Promotion of Engineering Education and to formulate an answer to the question "what can the society do in a comprehensive way to develop, broaden and enrich engineering education?" and further, that this committee shall report as early as feasible its formulation of an answer back to the council for action on the committee's recommendations.

The keynote of all the discussions at the sessions of the society was the development of teachers who can train engineers, with an analysis of the plans that are now being studied to make university training more effective. The plan of instruction for freshmen now being followed at Purdue University, as inaugurated and explained by Dean A. A. Potter, created much discussion. This plan aims to stimulate the interest of the student early in his course by introducing engineering problems that appeal to his instincts and deal with actual situations calling for solutions designed to train the student to "think clearly, act quickly, equalize carefully and calculate accurately." It is also a rough measure of his fitness to pursue engineering work. The instruction includes general lectures, inspection trips and simple engineering problems. The discussion showed that similar work is being conducted in several other colleges.

Important Interconnection Expected in Massachusetts

FALL RIVER and New Bedford, Mass., will be interconnected electrically in the near future, if plans now being completed mature as expected. The New Bedford Gas & Edison Light Company is enlarging its Cannon Street station to a total generating capacity of 92,000 kw. in anticipation of the purchase of energy by the Fall River Electric Light Company. The turbine room and switchboard galleries are being extended 40 ft. and the boiler house 80 ft., the latter to afford a total boiler capacity of 72,000 kw. Four new 1,608-hp. boilers, a 55,000-cu.ft. air washer, two concrete stacks, coal-handling machinery and other auxiliary apparatus are being installed. Engineering details of the proposed tie line are not yet finally determined, but when this is completed all the leading central-station and transmission systems from southeastern Cape Cod to the northwestern Berkshires will be electrically connected, roughly including nearly 750,000 kw. in steam and hydro-electric generating capacity. Some of the ties are not of the trunk-line type, but already 66,000-volt trunks run from Fall River to the upper Connecticut and Deerfield valleys and contribute to the efficient handling of interconnected plants.

Candidate for Governor of New Jersey Proclaims Utility Plank

A DECLARATION has been made by State Senator Runyon, Republican candidate for Governor of New Jersey, that, in accordance with his interpretation of the meaning of the United States Supreme Court's decision in the recent Galveston Electric Company case, he favors strict adherence to "actual values" of public utilities as a basis for rate making.

"I believe," said Mr. Runyon, "that the values on which rates are based should be actual values, excluding good will, franchise value, past deficits, development cost, hypothetical brokerage fees, deferred maintenance, federal taxes and other similar items. The public utilities act should state explicitly what items the commissioners shall take into consideration and what items they cannot take into consideration in valuing the property of the public service companies."

Rate Dispute at Springfield, Ohio, Is Not Settled, After All

ALTHOUGH an agreement had been reached between members of the Springfield (Ohio) City Commission and the Springfield Light, Heat & Power Company for a domestic light scale of 9, 6 and 3 cents and the agreement had been ratified by the company directors, as related in the ELECTRICAL WORLD for May 27, page 1085, the City Commission rejected the schedule when the matter formally came before it in ordinance form, and as the result the future rate for Springfield remains in doubt. The City Commission not only threw out the proposed new rate but also repealed the ordinance now in effect, which provides a rate of 11 cents for the first 15 kw. and 7 cents for all additional energy. An ordinance providing for a rate for one year of 8 cents for the first 15 kw.-hr., 6 cents for the next 45 kw.-hr. and 3 cents for all additional energy seems certain of adoption by the City Commission, but its definite rejection has been announced by C. I. Weaver, general manager and vice-president of the company, who said, however, that the company would take no action toward appealing the case to the Public Utilities Commission until the ordinance had actually been adopted by the City Commission, which is expected to consume about six weeks. The proposed rate, Mr. Weaver said, is far below the cost of service.

If the Public Utilities Commission follows its usual custom when the case reaches it and orders the present rate to be charged pending the fixing of a proper rate, the city, it is thought, will attack the jurisdiction of the commission in the courts, pointing out that Springfield operates under the charter form of government.

Carrier-Current Relay Control Opens Door to System Simplification

SIGNIFICANT tests of carrier-current relay control by radio engineers of the General Electric Company at Lynn, Mass., were referred to in the ELECTRICAL WORLD of June 17, page 1238. To a representative of this journal Prof. Elihu Thomson, consulting engineer of the company, said last week that the success which attended the demonstration on the Nahant feeder of the Lynn Gas & Electric Company marks an era of new possibilities in the field of remote control through the adoption of selectively tuned relay equipment to switch operation. While the company is not ready to publish the details of the equipment used, it may be said that the use of carrier current on the test circuits was accomplished by the employment of condensers between the service line and the apparatus at the transmitting and receiving points, and the frequency used was in the vicinity of 10,000 cycles. No vacuum tube was required at the receiving point, and this eliminates the necessity for continuous excitation. The receiving equipment embodied the major principles of radio relay design as developed by the General Electric Company for use in connection with the recent remote-control tests on the battleship Iowa. No antennas were used at Lynn. Professor Thomson pointed out that by the use of a large number of different frequencies the remote control of apparatus at numerous points could be commercially applied, with the advantage of localizing action at desired places, combining multiple and individual switch operations as required.

F. E. Chase, superintendent of the electrical department of the Lynn Gas & Electric Company, said that the success of these tests indicates the possibility of substantial future savings in the way of labor and of cable construction for central stations. There are many cases where the operation of street lamps from multiple circuits can be economically handled if the switching of these units is accomplished by carrier currents, as compared with the use of series circuits controlled from one point only.

Another Unit for Niagara Falls

IT IS reported that the Niagara Falls Power Company has placed an order for a 70,000-hp. turbine and a 65,000-kva. generator with the Allis-Chalmers Company. The turbine runs at 107.14 r.p.m. and is designed to operate on a 213-ft. head. The generator is rated at 12,000 volts, 25-cycle, three-phase.

Blackstone Valley Common Stock Offered on 7 per Cent Basis

LOW-PRICED bond issues of electric light and power companies have become a frequent occurrence, but stock issues, of course, to be made attractive have had to pay a higher rate. That the downward tendency in the price of money for public utility investment has reached stock issues too is shown in the recent offer of common stock of the Blackstone Valley Gas & Electric Company, which serves industrial communities in Rhode Island. This stock has a par value of $50, and the company has paid a dividend of 8 per cent on it since 1912, this dividend being increased to 10 per cent with the Dec. 1, 1921, payment. It is now offered at 71½. In other words, the purchaser will pay a premium of $21.50 per share and be content with a return of 7 per cent per annum.

T. H. Tutwiler May Head Reorganized Memphis Company

REPRESENTATIVES of the Electric Bond & Share Company of New York, which is soon to take over the control of the Memphis Gas & Electric Light Company, for many months in the hands of receivers, have been in the Tennessee city completing the arrangements. It is intimated that T. H. Tutwiler, formerly president and now one of the receivers of the local street railway, will head the reorganized utility.

Society for Electrical Development Elects New Directors

AT THE semi-annual meeting of the board of directors of the Society for Electrical Development, Inc., held on May 20, these directors were elected:

Representing Manufacturers—R. C. Lanphier, vice-president and general manager Sangamo Electric Company, Springfield, Ill., for one year to fill the unexpired term of W. D. Steele, resigned.

Representing Contractors—Walter H. Morton, secretary Sanborn Electric Company, Indianapolis, for four years, to fill the unexpired term of A. Penn Denton, resigned.

Representative-at-Large — Howard Ehrlich, president Electrical Trade Publishing Company, Chicago, for one year, to fill the unexpired term of Charles W. Price, who resigned as a director in the "at large" group.

Representing Affiliated Group — Charles W. Price, for four years, as the first director in the newly created affiliated group.

The board also ratified the previous action of the executive committee in accepting the resignation of L. A. Osborne as a director in the manufacturers' group and the election of Calvert Townley, assistant to the president Westinghouse Electric & Manufacturing Company, to fill the unexpired term, two years.

W. W. Freeman was re-elected president of the society and the same five vice-presidents were elected for the coming year, seniority being decided by lot, as follows: First vice-president, J. E. Montague; second vice-president, J. R. Strong; third vice-president, A. W. Burchard; fourth vice-president, Fred Bissell; fifth vice-president, J. R. Crouse. The present executive committee was re-elected with the substitution of Calvert Townley for Mr. Steele and Walter H. Morton for Fred B. Adam.

On May 9 the annual meeting of the society was held, at which the directors whose terms of office had expired were re-elected for four years, as follows: J. E. Montague, central-station group; L. P. Sawyer, manufacturers' group; Fred Bissell, jobbers' group; James H. McGraw, "at large" group, and A. Penn Denton, contractor-dealer group. Mr. Denton later resigned.

Ohio Men to Hold Varied Discussions at July Meeting

THE twenty-eighth annual convention of the Ohio Electric Light Association will, as already announced, be held at the Breakers Hotel, Cedar Point, Ohio, from July 11 to 14. The Tuesday morning session will be devoted to the presentation of committee reports. The entertainment features have been prepared in conjunction with the Ohio Electrical Contractor-Dealers' Association. An informal ball is scheduled for Thursday evening. The tentative program is as follows:

TUESDAY, JULY 11

Afternoon.—Report of transmission and distribution committee, by A. M. Wilson; "Co-operation," by Ward H. Snook, inspector for the Public Utilities Commission of Ohio.

WEDNESDAY, JULY 12

Morning.—Report of meter committee, by S. C. Henton; address by M. G. Lloyd, United States Bureau of Standards.

Afternoon.—Report of station-operating committee, by William Long; address by United States Senator Pomerene, Ohio.

THURSDAY, JULY 13

Morning.—Address by A. K. Baylor, member joint committee for business development, Schenectady, N. Y.; "Relation of the Manufacturer to the Merchandising Group of Business Men," by John J. Gibson, Pittsburgh.

Afternoon.—Address by Capt. Lawrence Davis, special representative National Contractor-Dealers' Association; address by Kenneth McIntire, special representative Society for Electrical Development.

FRIDAY, JULY 14

Morning.—Report of rural-service extension committee, by G. E. Miller; report on underground farm-line extensions; election of officers.

Tufts College Has Wireless College Faculty

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THIRTEEN of the leading members of the faculty of Tufts College have volunteered to give lectures on their subjects by wireless for the American Radio & Research Corporation plant. Four of them are, left to right, Dr. Arthur I. Andrews, who will speak on "Changes in Europe"; Prof. Edward H. Rockwell, "The Story of the Bridge Builders"; Dean Gardner C. Anthony, "The Story of Engineering," and Prof. Albert H. Gilmer, "The Modern Drama."

Seattle's Cedar Falls Plant Has Narrow Escape from Destruction.—In a recent fire that swept Cedar Falls, Wash., the quarter-million-dollar hydro-electric plant of the city of Seattle had a narrow escape from destruction, being saved only by the determined work of the Seattle firemen.

Squirrels Short-Circuit Power Line.—Manager Thomas M. Cougevan of the Canandaigua branch of the Rochester Gas & Electric Corporation has recommended the installation of large tin collars on poles in the new power line between Rochester and Canandaigua to prevent gray squirrels from causing damage to the wires. Mr. Cougevan's recommendation followed the discovery that a recent short circuit on this line had been caused by an adventurous squirrel which had investigated the aërial system with fatal results to itself.

Work on New Plant of Counties Gas & Electric Company Begun.—Work on the erection of the first unit of a steam-power plant on Barbadoes Island, in the Schuylkill River, opposite Norristown, Pa., to supply power for the fast-growing load of the Counties Gas & Electric Company, has been begun by the United Gas Improvement Contracting Company of Philadelphia. The immediate installation will consist of one turbo-generator of 25,000 kva. rating, with condensers, boilers and all other necessary apparatus. Ultimately the plant is to have a capacity of 125,000 kva.

Eastern Wisconsin Electric Company Purchased by Middle West Utilities.—The Middle West Utilities Company announces that it has acquired the Eastern Wisconsin Electric Company of Sheboygan. The total population served by this company is estimated at 110,000 and its gross annual revenue is in excess of $1,500,000. Announcement also has been made that the Wisconsin Power, Light & Heat Company of Madison will immediately construct a 66,000-volt high-tension transmission line extending from Dane through Columbus and Beaver Dam to Fond du Lac, a distance of 75 miles.

French and American Engineers Fraternize at Washington.—Ambassador Jusserand recently gave a dinner at Washington to a group of leading American engineers at which the harmony existing between French and American engineers was praised and plans for future co-operation and mutual furtherance of world peace were discussed. Secretary Hoover was the toastmaster at the dinner, at which the speakers were Ambassador Jusserand, M. Aimé Dumaine, representative of the Creusot Works in America and president of the American section of the Society of Civil Engineers of France, and Ambrose Swasey of Cleveland, founder of the Engineering Foundation, who is an officer of the Legion of Honor. Dr. William McClellan, president, and F. L. Hutchinson, secretary of the A. I. E. E. were guests.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Indiana & Michigan Electric Company Expands.—The Indiana & Michigan Electric Company has started work on an expansion of its South Bend (Ind.) power plants and has awarded contracts for $1,250,000, which will result in the generation of 15,000 hp. in addition to that now supplied.

People to Decide When Engineers Disagree.—Directly contradictory reports have been rendered by two engineers employed respectively by the Modesto and the Turlock irrigation district in Stanislaus County, central California, the former recommending that the districts sell the electrical energy generated by them at the Don Pedro dam wholesale to the Pacific Gas & Electric Company, and the latter that the districts build a power house and distribution system and retail the energy themselves. It is probable that the voters will be called upon to decide between the two propositions.

Employees at Hawthorne Listen to Speeches Made in New York and San Francisco.—Speaking from New York to the employees of the Western Electric Company's Hawthorne plant at Chicago last week by means of loud-speaking apparatus, Dr. Frank B. Jewett remarked that it was the first time he had been able to talk with all his co-workers simultaneously. Addresses were also given by Charles G. Du Bois, president of the Western Electric Company, and Harry B. Thayer, president American Telephone & Telegraph Company, both speaking from New York. J. C. Nowell, vice-president Pacific Telephone & Telegraph Company, addressed the gathering from San Francisco. The radio set used has a possible amplification of eighteen and three-quarter billions. Six loud-speaking receivers were used.

Mississippi Valley Power Company Takes Over Transmission System in Arkansas.—The Mississippi Valley Power Company, recently organized, is now operating approximately 60 miles of 33,000-volt and 13,200-volt transmission lines from Alma to Clarksville and Paris, Ark., formerly owned by the Commonwealth Public Service Company, and will assume ownership of these properties on July 1. It will also acquire distributing systems at eleven other towns in Arkansas and will serve the customers in these towns at retail. The company purchases energy under a twenty-five-year contract from the Fort Smith Light & Traction Company. The transmission lines operated by the Mississippi Valley Power Company will form part of the transmission system connecting Fort Smith with the proposed plant of the Oklahoma General Power Company at Muskogee, Okla. Construction work on this station will be started at an early date, and its initial capacity will be 10,000 hp.

Pacific Power & Light Company to Build Plant.—The Pacific Power & Light Company, with headquarters at Portland, Ore., has announced that a contract has been awarded to the Phoenix Construction Company of Portland to build the Pacific company's hydro-electric plant at Hood River, Ore., at a cost of about $1,250,000. This plant will have a total capacity of 7,500 kw. Water will be diverted from Hood River by a dam and conducted to the power plant through a pipe line 2½ miles in length. Work is to begin at once, and it is expected that the plant will be completed by February, 1923. The Northwestern Electric Company of Portland will, it is stated, purchase a 3,000-kw. block of the power to be generated.

Associations and Societies

Empire State Gas and Electric Association.—A meeting of the Commercial Section of this association will be held at the Fort William Henry Hotel, Lake George, on Thursday and Friday, June 29 and 30.

Geographic Division Meetings, N. E. L. A.—The Rocky Mountain Division of the N. E. L. A. is to hold its annual convention at Glenwood Springs, Col., beginning Sept. 18. The second annual convention of the Great Lakes Division will be held at French Lick Springs, Ind., on Sept. 28-30.

Radio Club of America.—A special meeting of the Radio Club of America will be held on Wednesday, June 28, at 8:15 p.m., in Room 306, Havemeyer Hall, Columbia University, New York City. Major E. H. Armstrong will read a paper on "The Super-Regenerative Circuit," his latest invention, and actual demonstrations of the new circuit will be given, with lantern slides.

Coming Meetings of Electrical and Other Technical Societies

A. I. E. E. Annual Convention — Niagara Falls, Ontario, June 26-30. (For program see issue of June 17, page 1240.)

American Society for Testing Materials—Atlantic City, N. J., June 26-July 1.

National Council Lighting Fixture Manufacturers—Cleveland, June 28-29.

Ohio Electric Light Association — Cedar Point, Ohio, July 11-14. (For program see "News of the Industry.")

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11.

International Association of Municipal Electricians — New Bedford, Mass., Aug. 22-25.

N. E. L. A. Geographic Divisions—New England, New London, Conn., Sept 5-7; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Springs, Ind., Sept. 28-30.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15.

American Electrochemical Society — Montreal, Sept. 21-23.

Illuminating Engineering Society—Boston, Sept. 25-28.

National Association of Railway and Utilities Commissioners—Detroit, Sept. 26.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Contributory Negligence a Question of Law When There Is No Dispute About Facts.—Instructions to the jury favoring the defendant in a damage suit involving the question of contributory negligence where there was no dispute over the facts have been sustained by the Court of Appeals of Kentucky (McMurtry's Administratrix vs. Kentucky Utilities Company). In this case a telephone lineman was killed while reaching over high-voltage wires which, by mutual arrangement between a power company and the telephone company, occupied the same poles on which the lineman had to work. Although the court found that the power company was bound to exercise the highest degree of care to keep its lines safe for workmen, the undisputed facts that the lineman was aware of the uninsulated condition of the wires by contact with which he was killed, and that he took the course he did against the protest of other members of the crew, and that there were other and safe methods by which he might have proceeded to perform his task, prevented any recovery for his death. (239 S. W. 62.)*

Why a Service Charge Is Not Rent.—In its decision declaring a service charge to be legal (City of Rochester vs. Rochester Gas & Electric Corporation; see issues of March 11, page 500, and March 18, page 552) the Court of Appeals of New York thus discriminated between such a charge and the rent of meters forbidden by the law: "Rent is the periodic return for the privilege of use. The rental value of a machine when capitalized for a term which varies with durability of use is equal to the capital value of the price. There may, of course, be rents that will not yield a profit. None the less, profit within the limit of capacity is typically and normally the end and aim of the exaction. . . . We do not say that a charge, however small, may not be rent within the statute if imposed with that intention and under an agreement that it shall be so regarded. The measure of the charge and the mode of computation are none the less relevant considerations when the question is whether a burden imposed under another name and ostensibly for a different purpose is merely rent in disguise. The Legislature in forbidding rents must be presumed to have had in view the typical and normal. Here the burden of the consumer, so far as affected by the meters, is limited to the cost of installation and repair. The charge is not intended as an equivalent for the value of the use. It is compensation for expenses that must be incurred to put the meters in such a condition that the use may be enjoyed. True it is that the individual must pay his monthly quota though his own meter has been neither changed nor repaired during the month, just as he must pay his quota for the maintenance of service pipes and their accessories though his own may have remained intact. In the long run, however, and on the average, what he pays is counterbalanced by what he receives." (134 N. E. 834.)

United States Supreme Court Again Rules on Confiscation.—Findings of the United States District Court for southern Texas and of a special master in a suit brought by the city of Houston against the Southwestern Bell Telephone Company to the effect that the rates to which the city strove to hold the company were confiscatory have been affirmed in a decision just handed down by the United States Supreme Court. In this case the district court and the master, while agreeing on the point of confiscation, disagreed over a merger ordinance of 1915 which contained the provision that the company "agrees that it will not increase rates as at present charged by it for service in the city of Houston unless it appears upon a satisfactory showing . . . that there exists a necessity for an increase of charges, in order that the said company may earn a fair return upon its capital actually invested in the Houston plant." The master sustained the contention of the company that this clause controverted the Constitution of Texas, which provides that "no irrevocable or uncontrollable grant of special privileges or immunities shall be made, but all privileges and franchises granted by the Legislature or created under its authority shall be subject to the control thereof." The district court disagreed and held that the company, having accepted the clause, was obliged by it to accept the cost of its physical plant as the basis for rate making, instead of the value of the property used and useful in operating the plant at the time of the inquiry. The Supreme Court declares that the lower court was in error in so ruling and that the provision of the ordinance in question was invalid. On the question of "going concern" value, which was also involved, the Supreme Court referred to its recent decision in Galveston Electric Company vs. City of Galveston (see Electrical World for April 29, page 852), reiterating that whether going concern value should be considered and allowed at all in determining the base for rate making, and if allowed what the amount of it should be, depends upon the financial history of the company, but declining in this case to make a specific ruling because briefs had not been prepared to save the court from reading a transcript of more than 1,600 pages.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Why Street Lighting Is Entitled to Lower Rate than Other Lighting Business.—The fact that a village pays in one check for electricity used for street lighting, thereby obviating the necessity for reading a large number of meters, making out and collecting numerous bills and the occasional losses through inability to collect, is, the North Dakota Board of Railroad Commissioners pointed out in passing upon an application for increased rates made by the Gackle Light & Power Company, the reason street lighting should pay a lower rate than general lighting.

Capitalization and Depreciation Reserve.—Granting conditional permission to the Ojai Power Company to issue additional securities, the California Railroad Commission declared that it cannot authorize issues to reimburse the treasury of a public utility company for moneys expended for additions and betterments when such moneys were obtained from the sale of other property and when no reduction was made in the capitalization of the company at the time the property was sold. A public utility company, it further observed, should not be allowed to use the proceeds from the sale of its stock to provide an adequate depreciation reserve with which to make additional extensions from time to time, since the primary function of a depreciation reserve is to take care of replacements and such reserve should be built up from earnings.

Service Rates for Mine-Hoist Motors.—The Public Utilities Commission of Utah has authorized amendments to the rules of the Utah Power & Light Company to determine the power consumed in the operation of mine hoists. Under these changes, which have been agreed to by the mining interests, it is provided that where hoist motors are used the maximum demand shall be the highest average five-minute load taken by the consumer, no additional charge being made for motors hoisting on inclines where an average gradient of less than 45 deg. exists. Where motors hoisting on inclines having an angle of 45 deg. or more are used the maximum demand shall be the highest of the combined continuous load ratings of all hoist motors multiplied by the fraction obtained by dividing the said average gradient by 90 plus the highest average five-minute load. The contract horsepower under other charges shall be the monthly maximum demand, but shall not be less than that now contracted for.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Don C. Shafer, advertising manager of the International General Electric Company and well known in advertising and literary circles, has resigned his position and will devote himself to literary work. Mr. Shafer left newspaper editorial work in 1906 to take up advertising and publicity work, joining the advertising department of the General Electric Company in that year. When the International General Electric Company was organized he was appointed advertising manager. In the electrical field Mr. Shafer has been an active factor in the work of educating the public to the value and desirability of electricity and electrical devices in the home. Through magazine and newspaper articles he has helped popularize the use of electricity.

D. C. SHAFER

D. H. Braymer, who has served successively as engineering editor, managing editor and coeditor of the ELECTRICAL WORLD, is now devoting all of his time to the *Electrical Review and Industrial Engineer*, formerly the *Electrical Review*, which was purchased by the McGraw-Hill Company last winter. He has been made publishing director as well as editorial director of the new paper, with headquarters in Chicago at 1570 Old Colony Building. This present activity of Mr. Braymer is the direct outcome of his interest and work in connection with the industrial side of electrical engineering. He is the author of a book on armature winding which has proved very popular in the industrial field and he has done much to make the ELECTRICAL WORLD serve the industrial electrical engineer.

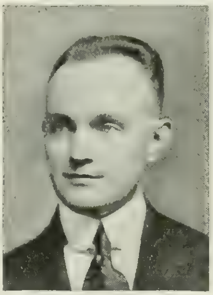
On account of the fact that his entire attention is now devoted to the *Electrical Review and Industrial Engineer* he is discontinuing his official position as editor of ELECTRICAL WORLD, effective July 1.

Harold V. Bozell, who has been for the past two years coeditor of the *Electric Railway Journal* and more recently editor of the new McGraw-Hill publication *Bus Transportation*, has been appointed an editor of the ELECTRICAL WORLD in executive charge of the paper. He has been acting as the managing editor of the ELECTRICAL WORLD for the past few months. He will retain a connection with the *Electric Railway Journal* and *Bus Transportation* as consulting editor. Mr. Bozell by this move returns actively to the electrical field. From 1908 to 1916 he was head of the department of electrical engineering at the University of Oklahoma, during which time he was also active in the field of consulting engineering in that state. He organized and served as secretary of the Gas, Electric and Street Railway Association of Oklahoma, now the Public Utilities Association of Oklahoma. From 1916 to 1921 he was assistant professor of electrical engineering at Yale University and during the war was quite active both in supervising the training of technical signal personnel for the army in various colleges and in conducting engineering developments on special problems for the Naval Consulting Board. At Yale he specialized in courses in public utility engineering and management. In 1920, while retaining a part-time connection with Yale, he joined the *Electric Railway Journal*. He is a native of Kansas, a graduate of the University of Kansas, a member of the A.I.E.E., the I.E.S. and the S.P.E.E.

Frank W. Smith, vice-president and general manager of the United Electric Light & Power Company of New York City, and newly elected president of the National Electric Light Association, was one of the prominent guests at the recent convention of the Pacific Coast Electrical Association at Los Angeles, as well as one of the speakers on the convention program. He brought a message of confidence and support from the national association to the Pacific Coast organization. The gentleman with Mr. Smith is **Herbert Dewes**, assistant to the vice-president and general manager of the Southern Sierras Power Company, general chairman of the convention. Much of the success of the gathering was due to the tireless efforts of Mr. Dewes in directing the many committees charged with the arrangements and the entertainment of guests and delegates.

F. W. SMITH AND H. DEWES

J. Elmer Housley has been appointed sales engineer of the Aluminum Company of America, with headquarters in Kansas City, Mo. Mr. Housley will specialize in the sale of aluminum electrical conductors. He was born in Knoxville, Tenn., Jan. 9, 1893, and was graduated from the University of Tennessee in 1915 as electrical engineer. After graduation he entered the engineering apprentice course of the Aluminum Ore Company and in 1915 he was placed in charge of motor testing, metering and record systems for that company. In 1917 he was in turn construction foreman and shop foreman in the electrical department of the same company and in 1918 entered the engineering department to handle its electrical problems. In 1919 he was appointed electrical engineer, having complete charge of construction and maintenance in the electrical work. During 1921 he also took over the complete power-house operation in connection with the electrical work. Mr. Housley has contributed extensively to the technical press.


J. E. HOUSLEY

James M. Wakeman, formerly general manager of the Society for Electrical Development, Inc., and well known in the electrical industry, has just returned to his home in East Orange, N. J., from an eight months' trip in Europe. Shortly after he resigned from the S. E. D. Mr. Wakeman, accompanied by Mrs. Wakeman, sailed for England in search of rest and recreation. That he found both is evident from his appearance. Questioned as to his future plans, Mr. Wakeman would give no inkling other than that they would be announced when completed.

J. G. Barry, sales manager of the General Electric Company since 1917 and manager of its railway department for many years, was recently elected a vice-president of the company. Mr. Barry has been connected with the General Electric and Thomson-Houston companies for thirty-two years. He is fifty-two years old. He was first employed in the production department of the Thomson-Houston company in Lynn, Mass., in 1890. A year later he was transferred to the construction department of the Boston office and in 1894 entered the railway department at Schenectady, following the organization of the General Electric Company. Mr. Barry worked up to the position of assistant manager of this department in three years, and in 1907 was appointed manager, in which position he exerted a marked influence on many aspects of the company's sales problems and policies. His success as manager of the railway department led to his appointment in 1917 as general sales manager and his present promotion to vice-president.

J. G. BARRY

Randolph M. Mann has become connected with the Betts & Betts Corporation as assistant sales manager and will make his headquarters in New York City. He comes to this position after about twenty-seven years in the electrical construction and manufacturing industry. Mr. Mann began his career with the General Electric Company in 1895 and continued with this company for the following ten years. He then became connected with the Metropolitan Engineering Company as general manager, and when this concern ceased the manufacture of electric signs he went with the Federal Sign System at New York and was later transferred to its Minneapolis office, where he became district manager. In May, 1918, he entered the government service as industrial expert for the United States Ordnance Department in the safety and sanitation branch, ranking as first lieutenant. After discharge from the army in 1919 he entered the employ of the Electric Service Supplies Company of Philadelphia as manager of the New York branch, which position he held until his present connection with the Betts & Betts Corporation.

George P. Prichett has been appointed resident engineer in Philadelphia for the National X-Ray Reflector Company, Chicago.

Henry Joseph has been elected president of the Joart Electric Company, which has been recently incorporated in Los Angeles for the purpose of manufacturing and merchandising Joart electric washing machines. Mr. Joseph is the owner of the patent of the machines to be manufactured.

Otis L. Thompson has been elected president of the Casper Electric Supply Company, which has been recently organized at Casper, Wyo., to carry on a wholesale and retail general electrical contracting and construction business and to handle electrical supplies and appliances of all kinds.

A. A. Brown, assistant to the sales manager of the Westinghouse Electric & Manufacturing Company, has been appointed manager of syndicate operations for that company. Mr. Brown entered the employ of the Westinghouse Machine Company as a salesman in its Pittsburgh office in 1904, and later was transferred to and placed in charge of the Cincinnati office. In 1907 he became Pittsburgh representative of the Westinghouse, Church, Kerr Company, and in 1909 he took a position in the sales department of the Westinghouse Electric & Manufacturing Company. In 1911 he was made assistant to the sales manager.

H. W. Kilkenny of the Tubular Woven Fabric Company has taken over the districts of Detroit and Michigan in addition to his present supervision of the districts of northern Ohio, northern Indiana and western New York.

Edgar Switzer is the vice-president and general manager of the recently incorporated Manufacturers' Electrical Corporation, Chicago, which will act as manufacturers' representative throughout the Middle West. After attending the electrical engineering course at Lewis Institute Mr. Switzer joined the Commonwealth Edison Company in 1900. Several years later he was connected with the engineering department of the North Shore Electric Company, which was later absorbed by the Public Service Company of Northern Illinois. In 1905 he went with the J. Lang Company as sales engineer and remained there until it was absorbed by the George Cutter Company. Then he became connected with the Stare Electrical Company as sales manager and supervised the importation of various lines of electrical specialties of European manufacture. In 1912 he joined the Westinghouse company, where he remained as syndicate representative until the formation of this new distributing company.

C. F. McGilvray has resigned as president of the Robbins & Myers Company, Springfield, Ohio, to become chairman of the board of directors, his place as president being filled by F. S. Hunting. Mr. McGilvray has been with the Robbins & Myers Company for many years and as president built the company up to a point of eminence in the production of fans and small motors.

C. F. McGILVRAY

Obituary

George G. Ward, vice-president and general manager of the Commercial Cable Company, who was regarded as the dean of the submarine cable engineers, died on June 15 in New York City. Mr. Ward was an Englishman, born Dec. 30, 1844, at Great Hadham, Hertfordshire. Upon leaving school he entered the employ of the Electric Telegraph Company, and in 1865 was sent to Alexandria on telegraph service for the Egyptian government. In 1869 he joined the French Atlantic Cable Company and was assigned to the steamship Great Eastern as a member of the electrical staff during the laying of the company's cable. Later he was superintendent of the Direct United States Cable Company and in 1884 became the general manager of the Commercial Cable Company. He was elected vice-president of that company in 1890 and continued in this position until his death. Mr. Ward was a director of the Commercial Company of Cuba, the Commercial Pacific Cable Company, the Mackay companies, the National Surety Company, the Postal Telegraph Cable Company, the United State & Haiti Telegraph & Cable Company and the United States Mortgage & Trust Company.

Trade and Market Conditions

Business Reviews, Together with Market Letters
from Important Trade Centers, on the Supply, Demand and Prevailing Prices of
Electrical Apparatus and Supplies

Sales of Hollow-Ware Are Reported Increasing

SALES of hollow-ware in Southern districts are, in general, on the increase, electric flatirons and percolators being the principal sellers. Chafing dishes are slower than for some time past, with water heaters also rather sluggish. Curling irons and grills continue to grow in popularity. It is hard to put a percentage increase on these sales as the movement has been somewhat spasmodic.

In the Western district a special flurry of trade has been in evidence for several weeks past, gifts for the June bride occasioning the demand. Aside from this seasonal sale, the hollow-ware market is sluggish. Stocks are in good condition.

Non-English-Speaking Countries Sent 70 per Cent of Canada's Lamp Imports

THAT 70 per cent of the lamps imported into Canada for nine months ended Dec. 31, 1921, were imported from non-English-speaking countries is the outstanding feature of a table on lamp importations into Canada for consumption as supplied by the external-trade branch of the Dominion Bureau of Statistics. The largest number of lamps imported from any one country was from the Netherlands, with the United States coming second. The importations from Japan were apparently on the decline as shown in the following table:

IMPORTS OF ELECTRIC LAMPS INTO CANADA FOR CONSUMPTION

	—Nine Months Ended Dec. 31— 1920		1921	
	No.	Value	No.	Value
Lamps, electric, arc:				
United States	.	$20,403		$17,301
Lamps, electric, incandescent:				
United Kingdom	18,111	6,249	112,216	19,355
United States	2,972,228	867,707	551,049	121,275
Austria	864	195	7,379	882
Belgium	......	......	138,830	60,321
Czecho-Slovakia	...		18,022	1,733
France	303	277	5,871	1,014
Germany		......	50	119
Hong Kong	10	4	204	75
Japan	735,057	54,793	386,676	27,909
Netherlands	527,619	88,577	1,039,552	192,875
Switzerland	......	......	6,707	1,607
Total	4,254,192	1,017,802	2,266,556	427,165

Freight Traffic for Four Months of 1922 Gained 5.7 per Cent

IN SPITE of the coal strike, the railroads during the first four months of this year have carried 5.7 per cent more freight traffic than they did during the corresponding period last year. In April of this year, the month in which the strike began, the net ton-miles totaled 24,709,000,000, which is a decrease of 857,000,000 miles, or 3.4 per cent, compared with April, 1921. But in the first four months of this year the net ton-miles have amounted to 113,252,000,000, which is an increase of 6,125,000,000 miles over the same period last year.

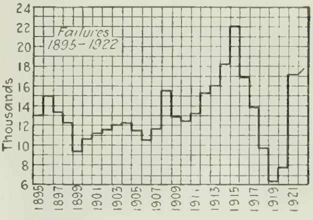
The passenger reports of the Interstate Commerce Commission show a decrease of 15.5 per cent in passenger travel in March, compared with the same month last year. On the basis of revenue passenger miles, the total in March was 2,592,731,000, compared with the 3,069,779,000 in the same month last year.

For the three-month period ended March 31, this year, revenue passenger miles totaled 7,693,255,000. This is a decrease of 1,328,610,000, or 17.8 per cent, compared with last year.

Business Failures Show Decided Decrease from Previous Week's Figures

FAILURES reported in the United States for last week number 407, showing a decided decrease from the figure for the previous week, when 440 defaults were reported to R. G. Dun & Company. Last week's number is nearer the record for the corresponding week a year ago, when 329 defaults were reported.

Of last week's insolvencies 231 involved $5,000 or over in each instance, that number being 56.7 per cent of the total defaults. In the previous week, although the number of failures with liabilities of $5,000 or more in each instance was greater, being 243, the percentage was slightly lower, or 55.2, while a year ago similar defaults numbered 171, being 51.9 per cent of that week's total.



BANKRUPTCIES FROM 1895 TO JUNE, 1922

Canada's failures, however, show an increase from fifty-five week before last to sixty-one last week. In the corresponding week a year ago they were only thirty-seven. Of the current Canadian defaults, thirty had liabilities of $5,000 or more in each case, compared with twenty-nine a week ago.

New York City Has Shortest Factory Week in United States

THE number of manufacturing establishments in New York City increased 10 per cent from 1914 to 1919 and 13 per cent in the number of persons employed, according to a report to the industrial bureau of the Merchants' Association.

Factory workers in New York City work fewer hours a week than those employed in up-state factories or in manufacturing establishments throughout the country, the same report shows. The figures were obtained from data furnished by the New York State Department of Labor and are based upon 593 reports, covering a total of 98,032 factory employees.

The working week of 26.5 per cent of New York City factory workers is forty-four hours or less, while in New York State only 3½ per cent of the employees work the short week. Taking the country as a whole, more than 25 per cent of the factory workers work more than fifty-four hours a week and about an equal number work forty-nine to fifty-four hours. Only 12.2 per cent are employed for a work week of forty-four hours or less.

Bank Clearings Gain 9 per Cent Over Same Week in 1921

THE more favorable exhibits of weekly bank clearings continue, an aggregate of $6,900,365,000 at twenty cities in the United States, as reported to *Dun's Review*, representing an increase of 9 per cent over the $6,332,502,817 of a year ago. There is a reduction, however, of 11.9 per cent from the total for this week of 1920. Comparing with last year, decreases appear at Philadelphia, Atlanta, Cincinnati, Cleveland, Minneapolis and Kansas City, the losses ranging from 0.8 per cent at Atlanta to 7.4 per cent at Kansas City; but these changes are more than offset by gains at other cities, which range from 3.2 per cent at Dallas to 27 per cent at Boston.

Average daily bank clearings for June to date and for preceding months are compared herewith for three years:

	1922	1921	1920
June	$1,158,439,000	$1,030,496,000	$1,284,749,000
May	1,143,911,000	982,676,000	1,331,217,000
April	1,115,478,000	957,996,000	1,321,113,000
March	1,042,360,000	975,088,000	1,321,007,000
February	1 052,112,000	1,060,726,000	1,322,870,000
January	1,087,235,000	1,190,774,000	1,374,249,000
	1921	1920	1919
December	$1,095,600,000	$1,255,276,000	$1,409,930,000
November	1,091,856,000	1,291,574,000	1,444,048,000
October	1,070,232,000	1,343,698,000	1,392,663,000
September	969,200,000	1,214,388,000	1,351,396,000
August	877,464,000	1,135,201,000	1,192,969,000
July	981,185,000	1,264,155,000	1,278,856,000

Wiring Devices Are Reported in Steady Demand

CONTINUED improvement, slow though it may be in some factories, is reported in the wiring-device field. Building activities in various parts of the country are beginning to pull upon accumulated stocks in the hands of jobbers, and while nothing like a boom is being felt by manufacturers of sockets, switches and related supplies, the tone of business is far better than a few months ago. In some quarters a lull in demand has been experienced during the past two or three weeks, but this is not believed to be any serious curtailment of the general upward trend.

Orders have been coming in well for heavy-duty switches such as are used in electric range service and for small-motor operation in machine-shop work. Some of these orders have come from France and Norway. Wages in most plants are still above pre-war levels, but in some cases adjustments have brought the average down to 10 to 25 per cent over the figures of 1913.

Manufacturers are now able to buy brass on terms much more acceptable than prevailed during the war period, and pretty much all of the high-priced raw material of that time has been worked into finished product now and in general moved out of the factory. Wide differences exist still among manufacturers as to the maintenance of factory stocks of wiring devices, but more or less production for stock will undoubtedly occupy manufacturers this summer in anticipation of still larger sales next fall. One plant has taken on over 200 employees within the past three weeks.

Cost of Living for May Higher in Most Groups of Commodities

FIGURES compiled by the Bureau of Labor Statistics of the Department of Labor indicate that the cost of living continues to rise. In all groups of commodities except chemicals and drugs the level of wholesale prices in May averaged higher than those in April. Farm products, food, clothing, fuel and lighting, metal products, building materials and most commodities reached higher price levels in May than during the previous months, and in a number of groups the prices were higher than during the corresponding month in 1921.

The department endeavors to show the relative difference between wholesale prices from month to month by a series of index numbers. These are being continually revised to show the fluctuating changes in price levels. The revised index numbers for the several commodity groups for May, 1921, as compared with those for April and May, 1922, are as follows:

	May, 1921	April, 1922	May, 1922
Farm products	118	129	132
Foods	138	137	138
Clothes and clothing	173	171	175
Fuel and lighting	200	194	216
Metals and metal products	138	113	119
Building materials	165	156	160
Chemicals and drugs	134	124	122
House furnishing goods	209	175	176
Miscellaneous	128	126	116
All commodities	145	143	148

Copper Consumption in 1922 May Reach 1,900,000,000 Lb.

WORLD'S consumption in 1922 of new copper will probably approximate 1,900,000,000 lb. and may equal 2,000,000,000 lb., government statistics indicate. This is at an average of 160,000,000 lb. a month, compared with an indicated 1921 world consumption of approximately 1,750,000,000 lb., or 145,000,000 lb. a month.

Including orders for future delivery, sales of copper metal for May will exceed the total of any month in the last two years, according to trade estimates. The greater part of the orders placed for future delivery call for shipments during the current month and in July, and some for August delivery. The Copper & Brass Research Association some time ago discontinued furnishing statistics on sales even to its members, consequently no official figures are now obtainable.

Weekly Metal Market Situation

FOREIGN and domestic buying of copper remains small, as is to be expected between domestic buying movements when foreign buyers are uncertain regarding developments in European politics. Prices remain firm, with no disposition on the part of any producers to press the market.

As sales during recent weeks have been large enough to keep shipments from all companies at a good rate, it is believed that money coming in will be ample to meet all requirements, no matter if consumers stay out of the market for some time. It is therefore thought that prices will hold at present level with possibly ⅛-cent recession until the next buying movement begins.

Price of electrolytic copper for domestic shipment is 14 cents a pound delivered for June, July and August, with a small amount of second-hand metal available at around 13⅞ cents. Price of lake copper is 14 cents for the same months. Price alongside ship New York is 13⅞ cents for June, July and August, with price at 13.90 cents to 14 cents at Tacoma for the same months.

NEW YORK METAL MARKET PRICES

Copper:	June 14, 1922	June 21, 1922
London, standard spot	£ s. d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14.00	14.00
Electrolytic	13.75	13.62½
Casting	13.37½	13.37½
Lead, Am. S. & R. price	5 75	5.55
Antimony	5.12	5.05
Nickel, ingot	36.00	36.00
Zinc, spot	5.75	5.70
Tin, straits	31.25	31.37½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	June 14, 1922	June 21, 1922
Heavy copper and wire	11.00 -11.50	11.00 -11.50
Brass, heavy	5.50 - 6.00	5.50 - 5.75
Brass, light	5.00 - 5.25	5.00 - 5 12½
Lead, heavy	4.70 - 4.75	4.62½- 4.70
Zinc, old scrap	3.00 - 3.12½	3.00 - 3.12½

THE WEEK

IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

HEAVY demand for fans, the hot weather having given the necessary stimulus, is one of the principal features of this week's electrical market. Steady prices prevail and few attempts at underselling are reported.

High-tension equipment manufacturers report good business with steady orders.

Lamp demand is holding up its curve started during the winter months. Dealers attribute this to the entrance of buyers from the railroad and industrial field.

Jobbers report a good market for automobile battery sales. Prices are reported steady, although one leading manufacturer is scheduled to reduce his quotations about 10 per cent on July 1.

Building activity, as previously noted, has created a steady call for wiring materials, and jobbers generally are realizing on this business. Orders from industrial customers continue to come through, and although most of the material is for renewal and maintenance work and minor extensions to plants, it is a good indication of the confidence of industry in the general business situation.

Motor sales are considered spotty with prices firm. Considerable manufacturing in this line is now in progress to build up agency stocks.

NEW YORK

The demand for electrical material and supplies has been steady for the past week without any particularly noteworthy features. Some jobbers report a slight increase in sales, while others report that a few items have fallen off. There have been no important price changes, and the market has the appearance of having settled down for the summer.

Rigid Conduit.—No change in prices or demand for this material was noted. Jobbers report that sales are only moderate, and prices still show quite a variation. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.88 per 1,000 ft.

Rubber-Covered Wire.—Prices have stiffened somewhat, although the demand for the smaller sizes is rather sluggish. The larger sizes are being bought in increasing quantities by industrial users and seem to be intended for maintenance and renewal work. No. 14, rubber-covered, single-braid, is quoted from $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—Armored conductor continues to move steadily without any indication of a change in price. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft., and double-strip at $45 per 1,000 ft. for that quantity.

Sockets.—In line with other wiring supplies, sockets are in fairly steady demand. In standard-package lots full sockets sell for 33 cents, key sockets for 18 cents and keyless for 16 cents each.

Loom.—Demand is usually light and only small stocks are carried. In coil lots the $\frac{7}{32}$-in. size sells for $16.50 per 1,000 ft. and the ¼-in. size for $18 per 1,000 ft.

Dry Cells.—In barrel lots No. 6 regulars are quoted at $29 per 100 and igniters at $30 per 100. Demand is fair and stocks are good.

Tape.—In 25-lb. lots friction and rubber tape are quoted at 36 cents per pound.

Fans.—Jobbers are well satisfied with the volume of fan business thus far and expect a fairly active demand for the next month or six weeks.

Appliances.—Heating devices are moving slowly, but there has been some increase in the sales of electric washers and ironing machines. Active demonstrations by manufacturers have helped to stimulate this business.

CHICAGO

Conditions in the electrical market have changed but slightly during the week. The previous activity on wiring materials has been maintained, although prices have varied according to the rating of the purchaser. Manufacturers of high-tension equipment found the week to hold some good business, since sales were steady. The lamp demand has practically held up its curve started during the winter months. Dealers attribute this to the entrance of buyers from the railroad and industrial field. While the radio demand has fallen off somewhat, well-established jobbers are not worrying but are studying the future in anticipation of a brisk fall business.

During the week the Chicago Mail Order Company announced plans for the erection of a four-million-dollar factory on the corner of Jackson Boulevard and Rockwell Street, which will measure 275 ft. x 465 ft. This project will be built in units—the first calling for an eight-story building costing about $1,000,000.

Conduit.—Sales on conduit are steady and prices vary from $43 to $45 per 1,000 ft. for the ½-in. black pipe. Although stocks on this size have been lowered by the demand for building, jobbers report that shipments during the week from manufacturers have again brought their supplies up to normal.

Wire.—The call for rubber-covered wire is still good and prices are quoted between $6.10 and $6.20 per 1,000 ft. for No. 14 in 5,000-ft. lots. The supply is quite uniformly distributed among jobbers. Quotations on the bare and weatherproof wire range from 16½ cents to 17 cents per pound and the demand is fair.

Flexible Armored Conductor.—Dealers state that this material is again going steadily at prices around $43 per 1,000 ft. for the No. 14 two-wire single-strip. Stocks are sufficient to supply local demands.

High-Tension Equipment.—Another week of steady activity in this line was reported by the majority of manufacturers. One firm received orders for one 1,200-kva., 33,000-volt steel-tower outdoor substation for the Middle West and two 600-kva., 13,200-volt substations for the Northwest.

Lamps.—Although a slight slump has been felt in this market, the majority of dealers report that the level of buying established during the winter has been fairly well sustained to date. Most of them attribute this to the fact that the industrials are gradually getting back into operation again and are requiring new lamps to replace the old carbon bulbs. The railroads are also in the market for lamps. The popularity of the "golden glow" lamp for home lighting is increasing, making it evident to designers that the idea of "painting with light" is spreading.

Dry Cells.—The demand for No. 6 dry cells is steady and they are quoted at $30.55 per 100 in barrel lots.

Outlet Boxes.—In standard packages the average discount on the black boxes averages around 60 per cent off list, while the galvanized has a percentage discount of 55. The call for this material has been good because of the activity in the building industry.

Radio.—The present slump in the demand for radio equipment is producing a sobering effect upon many dealers who expected the demand would keep up. This, according to far-seeing jobbers and dealers, will result in a more stable plane of buying and demand next fall. Equipment is now available which has been on order for three months. Well-established houses are looking the ground over carefully and are laying plans for fall demands.

BOSTON

Trade is somewhat spotty this week, although the tendency is toward greater sales in most lines of ordinarily active material. A gradual return of textile operatives to work in New Hampshire and Rhode Island marks the prospective failure of the long-continued strikes in these districts. Building and engineering contracts let in New England are exceeding those of a year ago by 75 to 100 per cent, the latest week totaling about $8,000,000 and covering structures of varied sorts from mercantile to residential types. Occasional enlargements of industrial plants of smaller size and better business in many of the smaller cities of New England encourage the belief that this summer's business will be better than usual. Central-station outputs continue to reflect good gains. Prices of electrical material are fairly steady and stocks are meeting requirements in the main. Conditions in New England electrical manufacturing plants are improving on the whole, the demand for larger apparatus being a feature.

Motors.—Local sales are rather spotty, with small orders dominant. Prices are firm. Considerable manufacturing is now in progress to build up agency stocks. Jobbers are meeting the market requirements easily. Expansion of output is proceeding along conservative lines, the motor business as a whole lagging some months behind the demand for heavier equipment.

Storage Batteries.—In some quarters local stocks have been reduced by the curtailment of manufacturing during the period of depression. Jobbers report a good season in automobile battery sales, and interest in batteries for road trucks and industrial electric trucks is apparent from increased inquiries. Prices are steady on most makes, although one of the well-known manufacturers is scheduled to reduce his prices about 10 per cent July 1.

Wire.—Demand for rubber-covered wire continues more active than for weatherproof and bare copper. In 5,000-ft. lots the first-named sells at $6.25 per 1,000 ft. Weatherproof and bare bases are 17½ and 16 cents. A moderate amount of central-station buying for line extensions is evident. The demand for copper aërials has fallen off heavily.

Flexible Armored Conductor.—Competition is very sharp, and some price cutting is reported. No. 14 single-strip moves on the basis of $44.20 per 1,000 ft. in 1,000 ft. lots. Building operations continue to absorb much of this material, and some of it is in demand for wiring motor and control equipment in individual machine-tool drive betterment work.

Radio Apparatus.—The sharp drop in demand has left many dealers overstocked in spots, and jobbers are buying very little equipment of this kind at the moment. During the summer, however, it is expected that many gaps in dealers' stocks will be rounded out and prepared for a renewed active demand in the fall.

Fans.—Jobbers and dealers alike find this business very responsive to weather conditions. The recent spurt has given way to sluggish trade, pending another hot wave. Stocks are spotty.

Pole-Line Hardware.—Buying continues better, though nothing striking in orders is reported. Prices are steady. The demand is greater than was expected in many quarters at this season.

Appliances.—Sales of the lighter socket devices are picking up, and the response to lower-priced apparatus offered is encouraging. Trade is healthier also in the heavier equipment.

ATLANTA

Spot cotton in Atlanta has reached 22.25 cents per pound, and predictions are that turpentine will shortly sell for $1 per gallon. This, combined with the prospects of the biggest peach and melon crops in the state's history, is lending an excellent tone to business conditions throughout the agricultural district, and prospects are for business to be on an active and aggressive plane by early fall. The Federal Reserve ratio reached 84.3 per cent on May 29, the highest mark in the history of the Sixth Federal Reserve Bank, this being a rise of 42 per cent since early in January. Automobile dealers report a very heavy demand for the more inexpensive makes of cars, and the Atlanta branch of the Ford Motor Company has increased its daily production 50 per cent in view of the 3,500 unfilled orders which had accumulated up to June 1.

Electric jobbers report a general improvement throughout the entire line, with radio equipment and accessories playing a very prominent part in the business done. Practically all of the textile mills which have been shut down during the depression have resumed operations, the latest one to reopen being one of the Western Reserve mills in middle Georgia, while a great many of the mills are even considering double-shift operation. A general activity is to be noted among the larger central stations, and a number of large line extensions which will open up virgin territory are projected and will be under construction within the next sixty days.

Fans.—The arrival of summer in full force has brought fans into the foreground, retail dealers reporting sales as very satisfactory, and jobbers are in receipt of a reasonable volume of refill orders. Stocks are in good shape in all sizes.

Wire.—Weatherproof and rubber-covered are active, particularly in the popular sizes, with a reasonable demand for large cables and bare stranded. Inquiries for the latter type, however, by the more important central stations are for large quantities.

Bell-Ringing Transformers.—Building construction is continuing to furnish a fair demand for this specialty. Local stocks are in fair to good shape, with retail price $1.50 each.

Safety Switches.—All sizes are in brisk demand, the 30-amp. to 400-amp. types at present being the best sellers. Good stocks and shipments are reported by all jobbers, with prices steady.

Lighting Fixtures.—The movement is satisfactory in all lines of fixtures, with the commercial type particularly good. There is a marked tendency for commercial purchases to drift toward the better class of material. Stocks are in good shape with shipments satisfactory.

Distributing Transformers.—This line has not responded to the general activity and to the movement of pole-line materials, though it is expected that orders for it will improve in the next sixty days. Stocks are good to heavy throughout the section.

Vacuum Cleaners.—Except in isolated instances, this line continues very slow, little or no interest being apparent on the part of the consumer. Stocks are heavy, despite efforts to move them.

Electric Churns.—Conditions in the rural districts have not been rectified sufficiently to permit of any large volume of purchases in this line, though conditions should improve as the rural population accumulates surplus funds. Jobbers are stocked heavily and prices are steady.

ST. LOUIS

That smile of happiness that comes when business is booming was apparent in the St. Louis jobbing houses last week. It was the biggest week experienced for almost two years. Some feel that the improvement was of permanent character, and others look at it askance. At the present rate June business will be about 50 per cent better than that of May, which was in itself a comparatively very good month. One of the principal features was the heavy demand for fans, hot weather having given the necessary stimulus. Residential construction is growing rapidly, and many of the houses are reaching the wiring stage.

Fundamentally general business is much improved, the industrials again being active, and the morale of the buying public is stronger than it has been since the beginning of the recent business depression. The wheat outlook remains good, and in some sections the crop is virtually made. The corn crop is generally good, though some portions of Iowa report insufficient rain. Cotton has been materially helped by the recent dry weather, and the government reports show splendid conditions in northern and northeastern Arkansas.

Missouri reports show oats to be slightly off. The farmers on the whole are much encouraged over the prospects for this year.

St. Louis is planning extensive municipal improvements, and a bond issue will probably be voted on to supply funds for about $75,000,000 of work. This will provide for new hospitals and institutions, sewer reconstruction, playgrounds, major street widening, grade crossings, a new civics building, additional fire department equipment, sites and buildings as memorials, additional waterworks, and a municipal heat, light and mechanical building. The amount allotted for the additional water works is $12,000,000, and for the heat, light and mechanical building $1,000,000 is provided.

Fans.—The first hot weather of the season came this week, and a dull fan market has suddenly become extremely active. Dealers' stocks have moved with exceptional rapidity, and jobbers have consequently been able substantially to lower their stocks, which were becoming heavy. Local dealers report that the 12-in. six-blade oscillator is the best seller this season. Ceiling-type fans are moving comparatively well, and an improved call for exhaust fans is also reported.

Battery-Charging Sets.—A gratifying improvement in demand for electric trucks and battery-charging sets is found. In preparation for business when the strike is terminated the coal-mining companies are making inquiries and purchases of charging sets for the operation of mine locomotives. Delivery in about thirty days can be given.

Porcelain.—The demand continues steady and stocks remain conservative. Larger individual orders are being placed, as is indicated by one comparatively small contractor buying ten barrels last week. The following prices are representative: "Nail-it" knobs, $16.50 per 1,000 in barrel lots and $15 per 1,000 for one to five barrels; split knobs, $12 per 1,000 in barrel lots; $\frac{5}{16}$-in. x 2½-in. tubes, $5.40 per 1,000 in barrel lots and $3.73 per 1,000 in larger orders.

SAN FRANCISCO

Building is still increasing, the larger number of permits indicating a disproportionate amount of residence construction. Retail store business was dislocated not only in San Francisco but in all the surrounding country by the Mystic Shrine convention, culminating in a final display that was witnessed by nearly a million people.

Schedule Material.—Nearly all shipping in this line is by way of steamship, averaging about forty days, compared with twenty days by rail. Several schedule manufacturers maintaining local offices have changed over from rail to boat on account of competition. The steamship carload rates are about $2.25 per 100 lb., and the rail rate is about $3.50 per 100 lb. In some instances this change of route produced stock shortages, but these gaps are now filled up so that excellent stocks are on hand and the demand is very good although rather scattered.

The low package price on fuse plugs has produced a shortage, nearly all dealers loading up in expectation of a raise. Dealers are getting only a small proportion of business from residence construction in the outlying city districts. It is evident that still greater publicity of the socket convenience outlet idea is needed. Such houses are nearly all built ready made by tract owners, and only a wider public knowledge and demand can correct the skimping of electrical fittings. Some excellent corrective measures are now being worked out by the California Electrical Co-Operative Campaign.

Poles.—Sales have been excellent this spring and excess stocks have become subnormal. There is only a limited stock of seasoned poles, but there is a big demand for them because of the ease of handling and freighting. Treated poles are being increasingly specified. Big consumers are being warned to prepare for the railroad strike that is threatened for July first.

Appliances.—Washer sales are greatly improved. Vacuum cleaner sales are decreasing in volume though better distributed among all the dealers. Ironer sales are quiet, but the volume of electrically heated ironers has greatly increased. Dishwashers and sewing machines are moving rather slowly. Excellent publicity was secured for "June bride" week despite the counter publicity of Shrine week, which immediately followed it. No reliable data of actual and comparative sales will be available until the end of June, but all dealers co-operated loyally and most of them believe that the idea was successfully put across.

Rubber-Covered Wire.—No. 14 single-braid, solid, in 5,000-ft. lots, has now advanced to $6.75 per 1,000 ft., with a 10 per cent advance in coil lots. No. 14 duplex solid is being quoted for about $17.75 per 1,000 ft. in 5,000-ft. quantities. These prices may be considered a good indication of the market.

PORTLAND—SEATTLE

Non-employment showed a marked decrease in Oregon and Washington during the month of May, increased building activity and road construction having absorbed virtually all surplus labor. Alaska is coming back strong, cargo movements from Seattle to Alaska for the first five months of the year showing a gain of 126 per cent as compared with the corresponding period of a year ago. Tourist travel to Alaska is also heavier. The lumber business continues to book new business in excess of production. Production for the week ended June 10 was 9 per cent above normal. Increases in wages are reported from various quarters in the lumber industry.

In the electrical field extensions to distribution lines are being made more generally than a year ago. Power companies are apparently realizing that the bottom of the market in many materials has about been reached and are buying more freely. A 25 per cent reduction in the charge for off-peak power recently put into effect by the city of Seattle lighting plant is stimulating the use of power in considerable blocks in a number of industries. Contracts for energy to supply electric furnaces as well as forty bake ovens have recently been signed, it is reported.

Jobbers report business improving and are well pleased with the continued increase. Estimates of increased business vary, it being said to be from 10 to 25 per cent better than a year ago. Quotations are very active for new construction work. Demands are reported good on wire, conduit and wiring supplies for out-of-town shipments. Collections are improving slightly in the Portland district. The average date of outstanding bills for May was a little over forty days as against a little over forty days for April. Jobbers are still watching credits very closely because of the very narrow margin at which contracting work is being taken. Stocks are in good shape, most of them for the past year coming by water. Freight-rate reductions effective July 1 will probably not alter this situation. Shipments come through in an average of about four weeks from Eastern factories.

Porcelain.—Knobs and tubes are in very good demand owing to extensive building. Prices, which have been near the bottom for months, remain unchanged. Stocks are ample to meet the demand. Insulators are moving better as a result of extensions and some new construction now going on. Prices likewise are well down and have remained unchanged for some months.

SALT LAKE CITY—DENVER

Collections are reported better than they have been in months. Easier credit and a better movement of stocks are given as chief reasons for the improvement. Banks are in a much better position to extend credit where good security is offered. The investment market shows an active tendency, stocks and bonds with a good rate of interest being eagerly sought by large and small investors. In the electrical field retail dealers are stocking much better than formerly, some buying in volumes that suggest the return of the old-time stability of the market. Jobbers' stocks in practically all lines are more than ample, no recent shortages having developed.

Hollow ware is moving in better shape, after a long period of being consigned to the "luxury" list. Percolators have been in special favor as gifts to June brides. Flatirons also have sold pretty well.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

San Francisco Radio Concern Expands

W. A. Layman, president of the Wagner Electric Manufacturing Company of St. Louis, and C. B. Kennedy, president of the Colin B. Kennedy Company of San Francisco, announce that the two companies have joined in an arrangement to increase the facilities of the Kennedy company in serving the radio field.

Both companies involved in the transaction are recognized as leaders in their respective fields. Mr. Layman states that the joint plan was possible largely because both organizations have built their reputations on the quality ideal.

The engineering personnel includes radio men of national reputation and is of such character as will insure the company keeping abreast of progress in the radio art. The engineering department is under the direction of Dr. Leonard F. Fuller, who is largely responsible for the development of the Poulsen arc transmitter as now used for world-wide communication in practically all the high power stations in the United States Navy.

The Kennedy company will continue to operate at full capacity the manufacturing plant established at San Francisco, the output of which will be used to meet the requirements of the Western trade and supplement production at St. Louis.

Oregon Holds Third Electrical Home Exhibit

The third electrical home exhibition to be held in Oregon was given in Silverton on May 4, 5 and 6. During the three-day exhibit 589 adult persons signed the register, which is more than 20 per cent of the population of the town of Silverton. The affair as a whole was a credit to the electrical industry and much lasting good is expected to result.

Rome Wire Company Takes Over Toledo Concern

The Rome Wire Company has purchased all equipment of the Toledo Enameled Wire Products Company of Toledo, Ohio, and intends to install this equipment in its main plant at Rome, N. Y., as soon as possible.

The Toledo Enameled Wire Products Company during its period of operation earned a high reputation for the quality of its product, which consisted mostly of large and intermediate sizes of enameled and cotton-covered wire. The purchase of this equipment by the Rome Wire Company will considerably increase the latter's production.

The company reports that the volume of magnet wire business has materially increased and that prices are firmer than they were a few weeks ago.

Bakelite Corporation Merger Details Announced

That the Bakelite Corporation has taken over the General Bakelite Company, the Condensite Company of America and the Redmanol Chemical Products Company is announced by officials of the first-named concern.

The merger is the result of a suit for infringement of the Bakelite patents brought against one of the customers of the Redmanol Company, the General Insulate Company of Brooklyn. This suit resulted in an unqualified victory for the Bakelite company and the entry of a decree in the United States District Court for the Eastern District of New York on May 11.

The Bakelite patents which are thus broadly sustained cover the molding in general of phenolic condensation products by heat and pressure and the use in such products of fibrous bodies such as wood flour, asbestos, etc. In a previous suit against George J. Nicholas & Company the Bakelite patents covering the manufacture of varnishes and solutions had been broadly sustained.

The decision against the General Insulate Company and the bringing of other suits against Redmanol customers made it impracticable for the Redmanol Company to continue its business, and in order that the value of the good will, plant, and organization might not be lost, it was decided to consolidate its business, including the personnel, with that of the General Bakelite Company.

The Redmanol Company in the meantime having purchased a controlling interest in the Condensite Company, the inclusion of that company in the merger was made possible. The Condensite Company had been operating under the Bakelite patents for several years, paying royalties as the result of suit against it in 1913.

Dr. L. H. Baekeland is the president of the new Bakelite Corporation, with Philip Schleussner, A. Karpen and Kirk Brown vice-presidents.

Dr. Baekeland remains also president of the General Bakelite Company, Kirk Brown president of the Condensite Company of America, and Dr. L. V. Redman president of the Redmanol Chemical Products Company.

Dubilier Condenser & Radio Corporation Plans Expansion

Announcement has been made that the Dubilier Condenser & Radio Corporation, which markets the "Ducon," has been receiving orders at the rate of 150,000 a month and that the company plans immediate expansion to bring production up to the rate of 5,000 daily.

The "Ducon" is a small instrument to be attached to an ordinary electric light socket, obviating the necessity of aërial installation. A great many wireless enthusiasts, particularly those who live in apartments and others living in houses but subject to the restraint of landlords, have found the installation of aërials an impediment to their individual ownership and use of the wireless. For such, the "Ducon," says the manufacturer, opens wide the door, for by attaching it to an ordinary electric light socket enthusiasts may now get better results than would be possible with an aërial constructed by individual enterprise.

Dingle-Clark Company Opens Cincinnati Office

The Dingle-Clark Company, contracting engineers, Cleveland, Ohio, specializing in the sale of power-plant equipment, announces the opening of a Cincinnati office at 605 Mercantile Library Building, in charge of C. G. Tarkington. On completion of his electrical engineering course at Purdue University, Mr. Tarkington spent some time in the testing department of the General Electric Company and after some operating experience was associated with the Cutler-Hammer Company of Milwaukee and Kohler Brothers of Chicago as a designing engineer. For the last eleven years he has been sales engineer with the Westinghouse Electric & Manufacturing Company and the Mechanical Appliance Company.

Creosoted Fir Poles Excel in Southern France

Creosoted poles have been found, after protracted experimentation, to be the best for carrying electric power wires in southern France. Investigations carried on by the leading electric companies have determined that, as regards both longer life and conductibility, the creosoted fir poles excel. In the course of experiments at Marseilles it was found, according to Consul Wesley Frost, that iron poles, in spite of any system of repairing, are subject to destruction by oxidation, while reinforced-concrete poles are difficult to manufacture locally or to transport if manufactured at central points. Furthermore, the average life of reinforced-concrete poles is uncertain, says the report.

From the standpoint of long life, it has been found that creosoted fir poles are most economical. These last from twelve to fourteen years, creosoted pine coming second with a life of nine to ten years.

Westinghouse Makes Record Equipment Shipment

Largest Single Consignment of Apparatus for Chilean Railroads Called Important Event in History of Electrical Industry

An important event in the history of the electrical industry was marked when the largest single consignment of electrical apparatus for railroad electrification ever made was shipped recently from the works of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

This shipment represented the first consignment of electrical equipment for the electrification of the Chilean State Railways. The contract for the initial installation amounting to $7,000,000, which was considered by industrial leaders as one of the first indications of a business revival, was awarded by the South American Republic to the Westinghouse Electric International Company last October after the severest competition from manufacturing concerns in the United States and other countries.

This train load of apparatus, shown in the picture, consisted of thirty-two cars and was about 1,300 feet, or almost a quarter of a mile, long. It was one of the longest trains that ever left the Westinghouse plant with a consignment of material covered by one contract. The shipment included two complete substation equipments for supplying power at 3,000 volts direct current to the Chilean State Railways, which is now being electrified. Each substation includes motor-generator sets, transformers and switching equipment. The remaining substation equipment will be shipped from the Westinghouse plant to the Republic of Chile within the next thirty days, and the shipment of the locomotives for the electrification, thirty-nine of which are included in the order, will, according to the officials of the Westinghouse Company, commence in July.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY'S RECORD SHIPMENT OF ELECTRICAL APPARATUS, FILLING THIRTY-TWO CARS, LEAVING THE EAST PITTSBURGH PLANT FOR SOUTH AMERICA

The awarding of the contract to the Westinghouse Company assured the electrification of the Chilean State Railways in accordance with the American standards and constituted a tribute to American leadership in the electrical industry, as this electrification is by far the most important one undertaken in 1921 and 1922 and is the largest and most comprehensive single order for electrification equipment ever received in the United States.

The initial electrification of the Chilean State Railways will include 144 miles, 116 miles from Valparaiso to Santiago and 28 miles from Las Vegas to Los Andes. The maximum grade in this zone, 2¼ per cent, was encountered in approaching La Cumbre from the west. The main line of this railroad has six tunnels, the longest being 1,600 ft. in length.

The waters of the Rio Colorado will be utilized in the generation of the power to be furnished the railroad. The station which will generate this power for the electrification will have three 8,125 kva. Westinghouse generators. The 110,000-volt power will be transmitted 37 miles to Santiago, where it will be connected with the system fed by the Florida hydro-electric station and the Mapocho steam station, both of which have been operating for some years.

The construction of the electrical equipment has been under the direction of the officials of the power and railway departments of the Westinghouse company and representatives of the Chilean State Railway who are in this country. The latter include Carlos Schneider, managing director for activities in the United States of the Chilean State Railways; Enrique Palma, Domingo Santa Maria and A. Gomes.

The Westinghouse company is building in its shops at East Pittsburgh at this time locomotives or motor equipments for shipment to Japan, England, Colombia, Manchuria and other countries. It also has on order a large amount of power equipment for nearly all of the foreign countries, this consisting of turbines, rotary converters, transformers, switching equipment, etc.

Chicago Distributor Obtains Better Quarters

The James E. Gleason Company is now located at 650-652 West Monroe Street, Chicago. The Burlington fire on March 15 destroyed its old quarters at 515 West Jackson Boulevard. For a short time the company had its headquarters at 9 South Clinton Street, but since April 15 it has been at the new location.

According to Mr. Gleason an increase of about 25 per cent in floor space was obtained by this changeover. He stated that he had transacted about ten times as much business since the fire as he had done during the same period last year. He also reported that the building industry was as active outside of Chicago as it was in the city. This company acts as distributor for manufacturers of conduit fittings, armored cable and porcelain.

The Nunn Electric Company of Amarillo, Tex., has been organized to conduct a retail business in electrical fixtures and goods, with stores in Amarillo, Dallas and several other Texas cities as well as several stores in Oklahoma and New Mexico. The company is capitalized at $30,000, and the incorporators are: J. L. Nunn, F. B. Spencer and P. R. Underwood.

The Electric Maid Shop of Portland, Ore., has moved to new and more spacious quarters on Alder Street between Fourth and Fifth Streets. This shop specializes in household conveniences and appliances.

The Connecticut Instrument Company, Stamford, Conn., recently organized to succeed the Allen-Hogan Company, Brooklyn, N. Y., has leased the former local plant of the Lounsbury-Soule Company and will establish a factory for the manufacture of radio equipment and devices. The equipment from the Brooklyn works will be removed to this location and other machinery acquired for installation. It is planned to inaugurate production at an early date. The company is capitalized at $100,000. R. E. Gillmore, formerly general manager Sperry Gyroscope Company, Brooklyn, is president.

The Acme Wire Company, Hamden, Conn., will develop an increased line of production at its plant, to include static electric condensers of special type and other electrical equipment.

The Shaw Insulator Company, Newark, N. J., has recently purchased a two-story concrete and steel-reinforced building, 50 ft. x 100 ft., together with a two-story building, 30 ft. x 50 ft., which will be used for power-house purposes.

The Western Electric Company's Portland (Ore.) branch will have a new home upon completion of a three-story brick building to be erected immediately for its exclusive use at the corner of Park and Flanders Streets. It will cost $35,000 and be ready for occupancy the latter part of August.

The Formica Manufacturing Company, Cincinnati, is enlarging its factory space, adding about 120,000 sq.ft., and will increase production approximately 100 per cent, officials of that company have announced.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An inquiry has been received from Norway (No. 2,460) for the purchase of heater bricks, made of porcelain or clay, to be used as heating elements for electric hot plates, the annual purchase to be 8,000 to 10,000 bricks.

A merchant in India (No. 2,538) desires to purchase and secure an agency for electric goods and accessories, such as electric fans, lamps, and electric engine accessories for crude-oil engine and sewing machines.

EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, 673 Bourke Street, Melbourne, Australia, until Sept. 1, the *Electrical Times* states, for furnishing the following equipment: Specification 226, item 1—five surface-feed water heaters, two of 2,250 sq.ft. surface, three of 1,450 sq.ft. surface; item 2—six surface vapor condensers, each 105 sq.ft. surface; Specification No. 227, item 1—twelve feed-water evaporators, to operate in groups and multiple effect, four effects producing 12,500 lb. per hour. R. Liddlelow, secretary of the commission.

Foreign Trade Notes

GREAT INCREASE IN USE OF WATER AND LIGNITE FOR POWER PURPOSES IN GERMANY.—The use of water and lignite for power requirements in Germany, according to the *Electrician*, has greatly increased in the last few years. In 1913 about 75 per cent of the whole of the electricity supply was produced by ordinary coal, water power and brown coal (lignite) accounting for about 15 per cent of the remainder. Only about 50 per cent of black coal, it is stated, is now used, the proportion of lignite having increased to nearly 35 per cent. In eight or ten years it is estimated that by an extension of existing hydro-electric plants, together with new water-power developments, it will be possible to generate by water power alone 50 per cent of all the power required for industrial and private uses and for traction. In Bavaria and the South German states hydo-electric developments will permit the discontinuance almost entirely of the use of ordinary coal for industrial work, and make possible the electrification of all the railways in south Germany.

ELECTRIC PLANT FOR MACEDONIA, GREECE.—By direction of the Greek Minister of Public Works, according to *Commerce Reports*, a committee has been appointed to make investigations regarding the plan for the construction of an electric plant at Vodena, Macedonia, using the falls of the Voda River, which it is estimated will develop about 20,000 hp. The cost is estimated at 20,000,000 drachmas ($900,000).

LARGE POWER PROJECT FOR HOLLAND.—A commission, according to the *Electrician*, has been appointed by the Holland government to look into a project for erecting five large power stations, which are to be connected by a 50,000-volt cable. One station is to be in Amsterdam, one in Rotterdam, one in Dutch Brabant and another in the Dutch coal-mine district. The location of the fifth power house has not yet been decided upon.

ELECTRIFICATION OF RAILROADS IN HOLLAND.—In connection with a scheme for erecting power stations in various cities in Holland, according to the *Electrical Review*, it is proposed to equip the Izeren Spoorweg Maatschappij railway for electrical operation, plans having been drawn up in 1918. Next in order are the secondary lines which, with the state railways, are now being surveyed. Overhead transmission, it is said, will be preferred, owing to the characteristics of the ground. The power station, which will have a capacity of 30,000 kw., will be at Leidchen Dam, to the east of The Hague. The existing steam tramway lines are also to be electrified. The concession for the conversion of the Gooische tramway will, it is expected, be granted this year. The conversion of the line has been completed and work has been started on the construction of the power station. The Zeeuwsch Vlaamsche Tramweg Maatschappiji of Axel, Zeeland, it is said, proposes to establish in this province a new line of tramways with stations, depots, etc., the work to be started this year.

PROPOSED EXTENSIONS TO THE TELEPHONE AND ELECTRIC SYSTEMS IN ROTTERDAM.—Proposals have been submitted to the Town Council of Rotterdam, Holland, according to the *Electrician*, for an extension to the telephone exchange building, to have a capacity of 20,000 telephones, to cost about 450,000 guilders. It is also proposed to erect an additional power station, which will probably be equipped with three generating units of 1,500 kw. each, to cost approximately 600,000 guilders.

PROPOSED STREET-CAR SYSTEM FOR VALDIVIA, CHILE.—Permission has been granted by the city government of Valdivia, Chile, *Commerce Reports* states, to a Chilean engineer to establish a street-car system in that city. The part of the petition requesting a grant of certain waterfalls and of city property as a site for the power house was denied. The plans provide for a number of lines, including one from the market to the railroad station. The name of the engineer holding the above concession may be obtained from the Latin-American Division by referring to "Street Car System at Valdivia," No. 53,448.

New Apparatus and Publications

RADIO MOTOR-GENERATOR SET.—The Emerson Electric Manufacturing Company, St. Louis, is distributing bulletin No. 3,603, covering its new motor-generator set, designed especially for radio service.

POLE TREATMENT.—The Naugle Pole & Tie Company, 5 South Wabash Avenue, Chicago, has issued a catalog describing the butt treatment of cedar poles.

STATIC CONDENSERS.—The National Electric Condenser Company, New Haven, Conn., is distributing bulletin No 1, describing and illustrating its static condensers for the correction of low power factor.

ALTERNATING-CURRENT GENERATORS.—Bulletin No. 1,099-B issued by the Allis-Chalmers Manufacturing Company, Milwaukee, covers its alternating-current generators for belt drive and also for direct coupling.

BATTERY CHARGES.—The Valley Electric Company, 3,157 South Kingshighway, St. Louis, has developed two new types of battery chargers, known as "Valley" type "W" for the radio battery and "Valley" type "MC" for automobiles. Both have been approved by the National Board of Fire Underwriters.

VALVES.—The English Electric Company, Ltd., Queens House, Kingsway, London, W. C. 2, is distributing publication Nos. 330 and 331, describing its cylindrical balanced valve and relief valve respectively. Publication No. 332 issued by the company covers its bucket attachment for impulse wheels.

OIL ENGINE.—"The Fullagar Oil Engine for Land Purposes" is the title of publication No. 366 issued by the English Electric Company, Queen's House, Kingsway, London, W. C. 2, in which it describes the Fullagar oil engine.

DISTRIBUTION TRANSFORMERS.—The Allis-Chalmers Company, Milwaukee, is distributing bulletin No. 1,109, covering its various types of distribution transformers.

BATTERY CHARGING OUTFIT.—The Hobart Brothers Company, Troy, Ohio, is distributing a leaflet covering its new "HB" constant-potential charging outfit for battery stations.

NEW ATTACHMENTS FOR SUCTION CLEANER.—The Hoover Suction Sweeper Company, Canton, Ohio, has developed several improved and simplified new attachments designed for used with Hoover suction sweeper.

THEATER DIMMERS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing an eight-page pamphlet covering its "Vitrohm" (vitreous enameled) theater dimmers.

FUEL ECONOMY.—"Keeping Down Furnaces Losses" is the title of the leading article in the May edition of "Power Notes," published by the Diamond Power Specialty Corporation, Detroit.

FLEXIBLE GRINDER.—A new "Stow" radial flexible grinder has recently been developed by the Stow Manufacturing Company, Binghamton, N. Y.

ELECTRIC COFFEE URN HEATER.—An electric coffee urn heater designed for use in hotels, restaurants, etc., has been brought out by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC METERS AND INDICATORS.—Bulletin No. 820, issued by the Roller-Smith Company, 233 Broadway, New York City, describes its "PV" ammeters and voltmeters and "COD" indicators.

CIRCUIT BREAKERS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing Bulletin No. 560, covering its types "E" and "P" inclosed circuit breakers.

MERCURY-ARC LAMP.—Engineering Department bulletin No. 104, issued by the Cooper Hewitt Electric Company, Hoboken, N. J., describes its "Lab-Arc" monochromatic light. This is a quartz mercury-arc lamp designed specifically to combine all the advantages of these lamps with special provisions for laboratory use.

New Companies

THE FRIENDSHIP (TENN.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $3,000 by J. T. Carman, W. C. James, L. L. Dunagan, C. E. Sweatt and William H. Stallings.

MURTAUGH (IDAHO) LIGHT & POWER COMPANY has been incorporated by Harvey and M. S. Ball and Harry Winterburn. The company is capitalized at $15,000.

THE MIDLAND ELECTRIC MANUFACTURING COMPANY, 4,224 West Harrison Street, Chicago, has been incorporated with a capital stock of $50,000 by Elmer R. Talbot, Leo E. Dolan and James F. Cramek. The company proposes to manufacture and also to deal in electrical equipment and specialties.

THE STATES RADIO CORPORATION, 501 South Jefferson Street, Chicago, has been incorporated by George Carlson, Anstol Golles, Thomas J. Hickey and others. The company is capitalized at $100,000 and proposes to manufacture and deal in radio apparatus and equipment.

Record of Electrical Patents

Notes on United States Patents

(Issued May 30, 1922)

1,417,806. Method and Apparatus for Forming Headed Articles; O. H. de Lapotterie, Kent, Ohio. App. filed March 1, 1918. Machine for heating and upsetting nails, rivets, etc.

1,417,896. Electrodeposition of Metals Upon Iron and Alloys of Iron; R. J. Fletcher, London, England. App. filed Jan. 17, 1921. Iron electrolytically cleansed before deposition.

1,417,912. Vacuum Electric Apparatus; P. C. Hewitt, Ringwood Manor, N. J. App. filed June 24, 1916. Voice transmitter connected directly to vacuum tube.

1,417,913. Apparatus for Generating High-Frequency Electric Currents; Alexander Heyland, Brussels, Belgium. App. filed July 28, 1914. Frequency controlled by oscillations of field circuit.

1,417,945. Trolley-Pole Head; Vincenzo Saccone, Johntown, Pa. App. filed Jan. 10, 1922. Guard prevents disengagement of wire.

1,417,953. Electric Furnace; Filip Tharaldsen, Trondhjem, Norway. App. filed March 1, 1915. Zinc produced by condensing vapor.

1,417,957. Electric Switch; Max Vogelsang, Frankfort-on-the-Main, Germany. App. filed June 5, 1915. Time lag relay operated by voltage drop.

1,418,000. Telegraph Apparatus; Edward L. Klingel, St. Paul, Minn. App. filed Feb. 6, 1918. Open-circuit telegraph circuit.

1,418,007. Motive-Power Appliance for Sewing Machines and the Like; David Lustig, Paris, France. App. filed June 29, 1920. Small motor attachment.

1,418,011. Electrical Water Heater; Hermann Mehn, Berlin-Tempelhof, Germany. App. filed Oct. 12, 1921. Water-tubes surrounded by the element.

1,418,022. Discharge-Tube Relay for Undulatory Currents; Eugen Reisz, Treptow, Germany. App. filed June 5, 1915. For reinforcing weak current undulations.

1,418,023. Apparatus for Converting Direct Currents of Low Voltage into Direct Currents of High Voltage; Eugen Reisz, Treptow, Germany. App. filed June 25, 1915. By self-induction coil and condensers.

1,418,030. Electrically Heated Furnace; C. W. Speirs, London, England. App. filed March 9, 1920. Resistance type for melting metals.

1,418,051. Lighting System for Automobiles; Edwin C. Ballman, St. Louis, Mo. App. filed Sept. 13, 1915. Lights from magneto automatically controlled.

1,418,066. Radio-Transmitting System; T. R. Bunting, Norfolk, Va. App. filed June 2, 1920. Two messages transmitted simultaneously.

1,418,132. Writing-Lighting Devices; J. J. Devine, Middletown, Conn. App. filed April 24, 1920. Pen and pencil combined in tube with electric light.

1,418,139. Appliance for Regulating the Hardness of Roentgen-Ray Tubes; H. F. Eiken, Skorping, Denmark. App. filed Jan. 15, 1920. Means for regulating vacuum.

1,418,171. Plug and Socket Contact; Bruno Raettig, Colongne-Lindenthal, Germany. App. filed Sept. 17, 1921. For power circuits.

1,418,183. Graphic Recorder; Charles B. Thwing, Philadelphia, Pa. App. filed March 11, 1921. Inking device.

1,418,187. Automatic Telephone System; D. S. Hulfish, Toronto, Ont., Can. App. filed May 27, 1918. Automatic switch having busy-testing and speaking positions.

(Issued June 6, 1922)

15,370 (reissue). Volt-Ampere Meter; Donald J. Angus, Indianapolis, Ind. App. filed Nov. 12, 1921. Measures volts times amperes regardless of power factor.

15,378 (reissue). Electric Furnace; H. G. Weidenthal, Cleveland, Ohio. App. filed March 25, 1920. Adapted to brass, bronze and aluminum founders.

1,418,285. Translating Circuit; J. R. Carson, New York, N. Y. App. filed Oct. 10, 1918. Carrier-current elephone system.

1,418,302. Lighting Fixture; E. F. Guth, St. Louis, Mo. App. filed April 25, 1919. Maintains proper light center with different lamps.

1,418,322. Electric Signal Apparatus for Elevators; R. A. Newe, Houston, Tex. App. filed Jan. 12, 1920. Combination of outside and car indicator.

1,418,362. Electrical Resistance; W. W. Coblentz, Washington, D. C. App. filed Sept. 22, 1920. Resistance sensitive to certain light waves.

1,418,367. Electrical Measuring Instrument; H. L. Decker, Toledo, Ohio. App. filed Jan. 14, 1919. Magnet vane-type ammeter.

1,418,369. Method of Filling the Insulation of Hollow Cables and Product Thereof; H. W. Fisher and R. W. Atkinson, Perth Amboy, N. J. App. filed Aug. 28, 1920. High-voltage cables.

1,418,370. Conduit Fastener; J. M. FitzGerald, Chicago, Ill. App. filed Aug. 15, 1917. Fastener for conduit caps.

1,418,390. Dynamo-Electric Machine; A. H. Neuland, Glensdale, Cal. App. filed Jan. 23, 1918. Magnetic gear for ship propulsion.

1,418,398. Rectifier System; A. C. Reid, Genoa, Ill. App. filed June 24, 1920. For charging storage batteries.

1,418,449. Electric Starter for Automobile Engines; H. L. Meeder, Denver, Col. App. filed April 12, 1919.

1,418,460. Heat-Storing and Water-Evaporating Plant; H. Pfenninger, Wadenswil, Switzerland. App. filed March 21, 1919. By electricity.

1,418,468. Electrical Connector; John Raus, Cleveland, Ohio. App. filed Aug. 27, 1919. For connecting small wires.

1,418,477. Transformation of Direct Current; M. Schenkel, Charlottenburg, Germany. App. filed March 29, 1917. Direct current changed to polyphase by rectifiers.

1,418,487. Keyless Clock; A. L. Sohm, Chicago, Ill. App. filed Sept. 18, 1919. Electrically wound.

1,418,496. Electric Heater; F. G. Van Dyke, Detroit, Mich. App. filed Nov. 15, 1920. For attaching to cups, bowls, etc.

1,418,518. Quench Rotary Spark Gap; E. F. Bell, Indianapolis, Ind. App. filed Sept. 20, 1920. Gap inclosed by airtight casing.

1,418,633. Heating-Bar Terminal; G. Egly, Berlin-Treptow, Germany. App. filed Oct. 21, 1920. Means for attaching conductors to heating bars.

1,418,650. Pipe Clamp; F. I. Johnson, Warren, R. I. App. filed July 3, 1920. For grounding conduits.

1,418,667. Combination Electric and Gas Heater; Carrie A. Muir, Los Angeles, Cal. App. filed Jan. 30, 1922. For household use.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has issued $2,059,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEW IPSWICH, N. H.—The installation of a municipal electric light plant in New Ipswich is under consideration.

BRANDON, VT. — The Public Service Commission has granted the Hortonia Power Company permission to increase its capital stock from $500,000 to $1,000,000.

BOSTON, MASS.—The Boston Elevated Railway Company has taken out a permit for the erection of a new generating plant at the rear of 696 East First Street, to cost about $350,000.

LEXINGTON, MASS.—The citizens have voted to install electric lamps on Albemarle, Arcadia and Ridge Avenues, and also on Webb Street.

THOMPSONVILLE, CONN.—At a special town meeting held recently the proposal to install an ornamental lighting system was carried. The cost is estimated at about $15,000.

WALLINGFORD, CONN.—The committee appointed to investigate the electric lighting situation has decided to recommend to the Board of Electric Light Commissioners that steps be taken to purchase power for distribution by the municipal electric plant. The cost is estimated at about $30,000.

WESTPORT, CONN. — The Westport Water Company will erect a transmission line to Lyons Plains and Upper Weston, a distance of 2 miles.

Middle Atlantic States

AMSTERDAM, N. Y.—Arrangements are being made by the Adirondack Power & Light Company to erect a large switching station at the Inghams Mills power station.

AMSTERDAM, N. Y.—The Adirondack Power & Light Company has applied to the Public Service Commission for permission to operate in the village of Munnsville and in the town of Stockbridge, and for approval of franchise granted the company by these municipalities.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates improvements to its system, including the installation of a 600-hp. boiler and switchboard at the Willow Point plant and a new switchboard at Noyes Island.

BROOKLYN, N. Y.—The Brooklyn Edison Company has acquired a site, bounded by Third and Fourth Streets and Fourth and Fifth Avenues, for a new generating plant.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, board of education of school district of city of New York, Flatbush Avenue Extension and Concord Street, Brooklyn, until June 26 for installing electric wiring and fittings in new Public School 67; for installing gas and electric fixtures in new Public School 54, both in Brooklyn; for installing electric equipment in new Public School 54 on Hillside Avenue and 127th Street, Richmond Hill, and for installing electric equipment in new Public School 102 on Van Horn Street, borough of Queens. Plans and specifications may be obtained at the Brooklyn branch of board of education, 131 Livingston Street, and at branch office 69 Broadway, Flushing.

BUFFALO, N. Y.—The Inland Lakes & River Transit Company contemplates building several electric, steel and self-propelling barges for operation on the barge canal between Buffalo and New York City, to cost $150,000 each. C. A. Swigent, Marine Trust Building, is manager.

BUFFALO, N. Y.—The Buffalo General Electric Company has awarded contracts to Huntley & Derdenger, Electric Building, for the erection of a substation at Main and Hertel Streets and for an outdoor switching station, 200 ft. x 400 ft., at its Tonawanda power plant.

LA SALLE, N. Y.—The Walmore Electric Light Company, Sanborn, has applied to the Niagara Town Board for a franchise to furnish electricity in the township.

NEW YORK, N. Y.—The New York Edison Company has awarded a contract to the Louis Weber Building Company, 342 Madison Avenue, for the erection of an addition to its substation at 100 Water Street.

OLEAN, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, has received permission from the Public Service Commission to purchase the property of the Olean Electric Light & Power Company. A transmission line will be erected from a point near Buffalo to Olean, to cost about $600,000.

POTSDAM, N. Y. — The St. Lawrence Transmission Company will erect a transmission line from the power plant at Hannawa Falls to Parishville to furnish electricity in that village.

WATKINS, N. Y.—Steps have been taken by the Commissioners of Watkins Glen for the installation of an electric lighting system in the Glen.

CAPE MAY, N. J.—The plant and holdings of the Stone Harbor (N. J.) Electric Light & Power Company will be offered for sale on July 7 by Edgar W. Hunt, special master in bankruptcy.

CHAMBERSBURG, PA. — The Council has awarded a contract to Quigley Hofer, Chambersburg, for the erection of a municipal power plant to cost $123,000. A. C. Wood, Stock Exchange Building, Philadelphia, is engineer.

McKEE'S ROCKS, PA. — A one-story power house will be erected in connection with the new local vaseline plant of the Chesbrough Manufacturing Company, 17 State Street, New York City, to cost about $500,000. The Hunting-Davis Company, Century Building, Pittsburgh, is architect.

NORRISTOWN, PA. — The Worcester Electric Transmission Company and the Lower Providence Electric Transmission Company, recently organized, are planning to erect and operate electric transmission systems in Montgomery County.

PHILADELPHIA, PA.—The R. B. Dutt Company, 1726 Mascher Street, will build a one-story power house at its dye works.

PHILADELPHIA, PA. — The Philadelphia Suburban Gas & Electric Company has issued $700,000 in bonds, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Philadelphia Electric Company has awarded a contract to Irwin & Leighton, 126 North Twelfth Street, for the erection of a one-story and two-story substation at Fifth and Federal Streets, 25 ft. x 65 ft. and 29 ft x 63 ft. respectively. Bids have been asked for the construction of a similar substation at Fifty-sixth and Race Streets.

PITTSBURGH, PA. — The West Penn Power Company contemplates the erection of three 22,000-volt transmission lines and two telephone lines across the Allegheny River.

PITTSBURGH, PA.—A number of electric companies are being organized by C. P. Morrison, E. P. Griffiths and J. R. McNary, 435 Sixth Avenue, to construct and operate power and light systems in different townships, as indicated by the name, as follows: The Kilbuck Township Light Company, the Stowe Township Light Company, the Kennedy Township Light Company, the Robinson Township Light Company, and the Neville Township Light Company.

RIDGWAY, PA.—The Keystone Power Corporation contemplates building an addition, 100 ft. x 100 ft., to its local plant.

YORK HAVEN, PA.—Work will soon begin on extensions to the local plant of the York Haven Water & Power Company. The plans provide for doubling the capacity of the plant, to cost about $1,000,000.

WOMELSDORF, PA.—The Womelsdorf Electric Company, recently organized, has acquired the local municipal power plant. Extensions and improvements will be made to the system, including the erection of new lines.

ILCHESTER, MD.—The Thistle Cotton Mills, Inc., will build an electric power plant at its textile mills. Charles M. Sears is secretary.

BOYDTON, VA.—The erection of a transmission line to connect Halifax and Charlotte, to cost about $50,000, is under consideration by the Staunton Power Company. E. L. Baptist is secretary.

HAMPTON ROADS, VA.—The purchase of coal and ash handling equipment for the local naval base (Specification 4,663) is under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until July 5 for 54,300 flashlights and batteries for Eastern and Western navy yards. (Schedule 13.)

North Central States

FLAT ROCK, MICH.—A power plant will be erected in connection with the new glass-manufacturing plant to be erected here by the Ford Motor Company, Detroit, to cost with machinery about $1,000,000. Albert Kahn, Marquette Building, Detroit, is architect.

CLEVELAND, OHIO. — The Cleveland Illuminating Company contemplates extensions and improvements during the year, to cost about $4,000,000.

CLEVELAND, OHIO.—Preliminary plans are being prepared by H. L. Porter, architect, 1900 Euclid Avenue, Cleveland, for a widows and orphans' home for the Army and Navy Union, consisting of a one, two and three-story hospital administration building, officers' quarters, gymnasium, academic school, library, church, twenty-four cottages, power house, workshop, etc., to cost about $5,000,000. E. McGeorge and A. G. Simon, 1900 Euclid Avenue, are engineers. E. Jeffrey, national commander Army and Navy Union, 1403 West Third Street, Cleveland, is in charge.

PAINESVILLE, OHIO.—Plans are being prepared for an addition to the municipal electric plant, to cost about $50,000. Hadlow & Hick, Finance Building, Cleveland, are engineers.

EVANSVILLE, IND.—The Southern Indiana Gas & Electric Company will build an addition to its local power plant, and make extensions to the system to cost about $700,000. A new 8,500 kw. generator will be installed at the local power house.

CHICAGO, ILL. — Hetzel & Company, 1739 Larabee Street, will build a power house at their meat-packing plant on Mohawk Avenue, 70 ft. x 120 ft., to cost about $60,000.

KEWANEE, ILL.—Bonds to the amount of $125,000 have been voted for the installation of a municipal electric light plant.

EAU CLAIRE, WIS.—The Chippewa Power Company has issued $1,800,000 in bonds, part of the proceeds to be useed for the construcion of a hydro-electric plant on the Chippewa River, to be operated by Wisconsin-Minnesota company under a thirty-year lease. The plans call for an initial installation of 15,000 hp., with an ultimate capacity of 20,000 hp.

FOND DU LAC, WIS.—The Middle West Utilities Company, Chicago, has acquired the Eastern Wisconsin Electric Company and will make extensions and improvements to the system.

GREEN BAY, WIS.—The Wisconsin Public Service Company contemplates extending its transmission line to Duck Creek.

LODI, WIS.—The Lodi Utilities Company contemplates the erection of an electric transmission line in Columbus County to connect adjacent towns, to cost from $40,000 to $50,000. W. F. Groves is interested in the company.

MARINETTE, WIS.—The Menomonie & Marinette Light & Traction Company is planning to extend its power and light service on the shore drive south of Marinette.

PINE CITY, MINN.—The Eastern Minnesota Light & Power Company contemplates the erection of a new local power plant. Extensions and improvements will also be made to the power plant at Milaca, Minn.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company is preparing plans for the erection of a 5,000-kw. power plant, to cost about $600,000. The plans provide for the installation of a second unit in the future.

WATERLOO, IOWA.—The Rath Packing Company will build a one-story power house at its local factory.

KANSAS CITY, MO.—A power house will be erected at the Unity School of Christianity at Tracy and Tenth Streets. Elmer E. Boillot, Scarritt Building, is architect.

ST. LOUIS, MO.—A power house will be erected in connection with the proposed new pottery on a site near St. Louis, to cost about $300,000, to be established by a company now being organized by W. S. Hooper, president of the Ozark Iron Ore & Manufacturing Company, Poplar Bluff, Mo., and associates.

ELLINWOOD, KAN.—Contract for the installation of a municipal ornamental street-lighting system has been awarded to the Ellinwood Electric Company.

KANSAS CITY, KAN. — Contract has been awarded to the E. A. Brown Electric Company, 715 Minnesota Avenue, for the installation of an ornamental street-lighting system in the district north of Eighteenth and State Streets, to cost $42,500.

Southern States

HOBGOOD, N. C.—The Council is considering an issue of $10,000 in bonds for the construction of a municipal electric light plant.

WILSON, N. C.—Plans are under consideration by the Municipal Electric Light Department to extend the transmission lines of the municipal electric light plant to the towns of Middlesex and Bailey to furnish electrical service.

SUMTER, S. C.—The City Council has decided to install an ornamental lighting system on Main and Liberty Streets in the business section.

ATHENS, GA.—The Council is considering the installation of an ornamental lighting system in the business district.

COLUMBUS, GA.—The Columbus Electric & Power Company has issued $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

COCOANUT GROVE, FLA.—Bonds to the amount of $10,000 have been voted for improvements to the electric lighting system.

JACKSONVILLE, FLA.—The City Commission has engaged the Scofield Engineering Company, Philadelphia, as consulting engineer in connection with the proposed extensions to the municipal electric plant, including the installation of a 10,000-kw. generator. The cost is estimated at $280,000.

PUNTA GORDA, FLA. — Preliminary plans are being considered for the erection of a new municipal light and power plant.

QUINCY, FLA.—Bids will be received by the City Council until July 18 for extensions and improvements in the municipal power plant, including one 210-kva. electric generator direct-connected to "Unaflow" engine; three-panel switchboard; two centrifugal pumps, motor-driven; one 500-hp. feed pump and heater; one air compressor, motor-driven; one condenser, and one 200-hp. return tubular boiler. The J. B. McCrary Engineering Corporation, Atlanta, Ga., is engineer. J. P. Smith is clerk of Council.

ST. PETERSBURG, FLA. — Bonds for $300,000 have been approved for the construction of a municipal power plant and system.

CHATTANOOGA, TENN. — The Dixie Spinning Company will build a power house in connection with its proposed local textile mill, to cost about $500,000.

DUCKTOWN, TENN.—The Ocoee Copper Company, Volunteer Life Building, Chattanooga, Tenn., will build a power house in connection with its new flotation plant, to cost about $200,000. J. I. Carter is president.

GRAYSVILLE, TENN.—The Dixie Coal, Lime & Clay Products Company will build a power house in connection with its proposed local brick plant. O. E. Thomas is president.

ALICEVILLE, ALA. — J. V. Park is organizing a company to construct and operate a hydro-electric power plant on the Sipsey River, with local distributing system, to cost about $75,000.

ANNISTON, ALA.—The installation of an ornamental lighting system in the business section is under consideration.

ARTESIA, MISS.—The installation of a municipal electric light plant is under consideration.

HATTIESBURG, MISS.—The Love Lumber Company, Poplarville, Miss., contemplates the erection of a new power house at its local plant. R. N. Stadman is president.

CAMDEN, ARK.—The Council voted to install an underground conduit system on Washington and Adams Streets, to cost about $20,000.

DUNCAN, OKLA. — Contract has been awarded to the Merkle Machinery Company, Kansas City, Mo., for the construction of a distributing system and ornamental street-lighting system. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is engineer.

FAIRLAND, OKLA.—Bids will be received by the Board of Trustees until June 30 for the erection of an electric distributing system in Fairland. H. G. Olmsted & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

GAGE, OKLA. — Contract has been awarded to E. A. Brown & Company, Kansas City, Kan., for the construction of a municipal electric plant. H. G. Olmsted & Company, Tradesmen's National Bank Building, Oklahoma City, are engineers.

FORT WORTH, TEX. — The Magnolia Petroleum Company is planning to install a series of electrically operated pumping stations in connection with its pipe line from Fort Worth to Corsicana.

Pacific and Mountain States

SPOKANE, WASH. — The Washington Water Power Company, we are informed, does not contemplate the construction of a new hydro-electric plant at lower Spokane Falls or rebuilding its plant at the Monroe Street Bridge, as reported in the issue of June 17. The company may make some repairs at the latter plant this season.

PORTLAND, ORE.—The present steam-driven power plant of the Portland Railway, Light & Power Company is to be dismantled and replaced with a 3,000-kw. turbo-generator. New boilers and auxiliary equipment will also be installed. The cost is estimated at about $170,000.

WHEELER, ORE.—Harvey E. Rinehart, Wheeler, is organizing a company to construct and operate a hydro-electric power plant on Classic Lake, with transmission and distributing system. Application for permission has been made to the State Engineer.

BAKERSFIELD, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Chester Avenue from Fifteenth to Twenty-fifth Street.

BUTTONWILLOW, CAL. — The San Joaquin Light & Power Corporation, Fresno, contemplates an addition to its local steam-driven power plant, to cost about $1,250,000, including equipment.

LOS ANGELES, CAL. — The Southern California Edison Company will build a two-story substation on Moulton Street, near Main Street, to cost about $40,000.

LOS ANGELES, CAL.—The Mutual Dairy Company will build a power house in connection with its new bottling plant at Naomi and Walnut Streets. Clifford A. Truesdell, Jr., Purington & Newton, San Fernando Building, are engineers.

LOS ANGELES, CAL. — The Lighting and Power Bureau will install ornamental lamps on portions of Hayworth Avenue, North Main Street and Buckingham Road.

LOS ANGELES, CAL.—The Little Rock Power & Water Company, Chapman Building, has applied to the State Water Power Commission for permission to build a hydro-electric power plant to develop 2,440 hp., at a cost of about $350,000.

MARE ISLAND, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates extensions to the power house at Mare Island (Specification 4,665).

TRACY, CAL.—The Banta-Carbona Irrigation District contemplates the installation of new electric pumping machinery, etc., to cost about $250,000.

BOISE, IDAHO. — The Federal Power Commission has granted the city of Boise a preliminary permit for the use of certain lands in and out of the Payette National Forest for the construction of a municipal hydro-electric plant on the north and south forks of the Payette River, near Banks, to develop 12,000 hp.

HOLBROOK, ARIZ.—The Holbrook Light & Power Company has been granted permission by the Public Service Commission to issue $30,000 in capital stock, part of the proceeds to be used for the installation of an oil-engine-driven unit.

CASPER, WYO. — The Natrona Power Company has awarded a contract for the construction of a new power house on East Railroad Street between Beach and Kimball Streets.

CASPER, WYO.—A power house will be constructed in connection with the proposed new oil refinery (in this section) of the Texas Company, 17 Battery Place, New York, N. Y., to cost about $500,000.

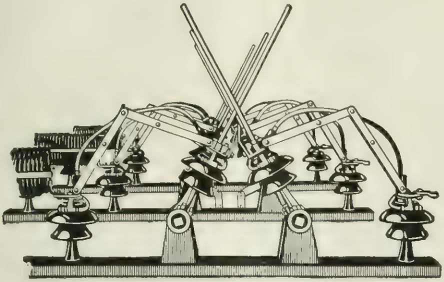
Canada

BURGOYNE, ONT.—The Ontario Hydro-Electric Power Commission, Toronto, is considering a hydro-electric development on the Saugeen River at Burgoyne, to cost about $500,000. A. Jeffrey, 190 University Avenue, Toronto, is engineer.

PAPINEAUVILLE, QUE.—The Papineauville Electric Company, Portage de la Nation, is planning to erect a new local power house, to cost about $30,000.

GALT, ONT.—Plans are being prepared by the Hydro-Electric Power Commission for erecting a 2,200-volt transmission line in rural districts, to cost about $28,000. A. B. Scott is engineer.

The Famous Elpeco Pole Top Switch—The Guardian of the High Tension



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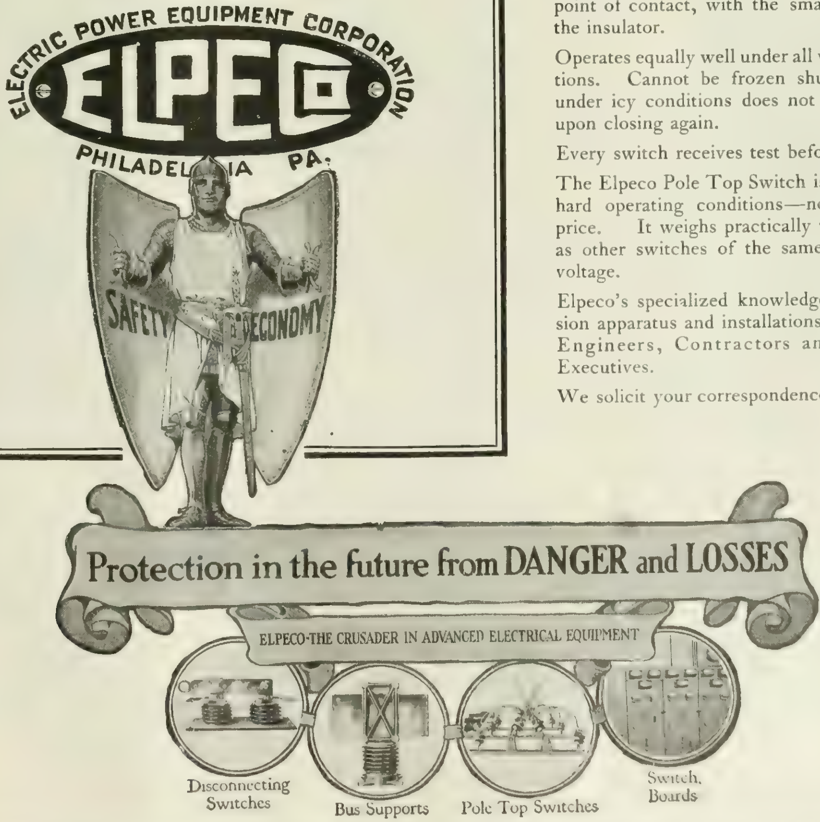
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1	50	Ft. Wayne revolving field (can be used for direct-connection) 220 or 440 v.	300
1	50	Gen. Elec., type TRE, form D, rev. field, 240 or 480-volt, to New York Safety, horizontal, self-oiling center crank steam engine	300
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1	55	Westinghouse, rev. field, 2200-volt to McEwen, horizontal, tandem comp. automatic, self-oiling steam engine	257
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1	75	Ridgeway, revolving field 220-volt to Ridgeway horizontal, self-oiling, automatic steam engine	300
1	75	Crocker-Wheeler, rev. field, 2300-volt to McEwen, horizontal, center-crank, self-oiling auto., steam engine	275
1	90	Allis-Chal., rev. field, 2300-volt	1200
1	150	Gen. Elec., type ATB, form PB, rev. field, 220 or 440-volt, 3-phase	900
1	150	Crocker-Wheeler, revolving field, 2300-volt to Harrisburg-Fleming, 4-valve, self-oiling, automatic steam engine	257
1	625	Westinghouse, rev. field, 2300-volt, 3-phase, turbogenerator, direct-connected to Westinghouse-Parsons, horizontal, 3-stage, steam turbine,	3600
1	625	Allis-Chalmers revolving field, 3-phase, 2300-v., D.C. to Parsons horizontal, 3-stage steam turbine	

250-volt, D. C. Generators

	Kw.		*Speed*
5	3	Gen. Elec., RC, interpole (50°), new	2200
1	6	Northern	600
1	7½	Sturtevant, MP	11[illegible]0
1	10	Fairbanks-Morse	1500
1	13	Crocker-Wheeler	900
1	15	Crocker-Wheeler	1350
1	15	Westinghouse, type S	675
1	20	Holtzer-Cabot	1250
1	25	Ft. Wayne	875
1	25	Northern, 125-250-volt, 3-wire, with balance coil	750
1	25	Milwaukee to 9½ x 10 in Erie-Ball auto., center-crank, self-oiling steam engine	340
1	30	Western Elec.	1250
1	30	Ft. Wayne	750
1	30	Westinghouse, type S	725
1	40	Gen. Elec., 125-250-volt, 3-wire, to Harrisburg-Fleming, steam engine	360
1	45	Westinghouse, type M	525
1	50	Gen. Elec., type DLC, interpole	1150
1	75	Westinghouse, type M	750
1	100	Triumph	700
1	100	Elec. Machinery, 6-pole	350
1	150	Gen. Elec., MP, type C-4, compound, to Curtis form I, non-condensing steam turbine	2000

250-volt, D. C. Generators

	Kw.		*Speed*
1	125	Gen. Elec., 6-pole, form L3, comp., to Ball-wood, tandem compound, self-oiling, automatic steam engine	250

110-Volt, D. C. Generators

	Kw.		*Speed*
1	2¾	Allis-Chal., type K	1300
5	3	G. E., type RC, interpole (50°)	2300
1	3	Roth, interpole	1950
2	3	Imperial interpole	1800
1	3	Westghse., SK, interpole	1500
2	3	G. E., CVC, interpole	1450
1	5	Imperial, interpole, new	1200
3	5	Westinghouse, type SK, interpole (50°), new	700
1	5¾	Crocker-Wheeler	1550
1	6	Westghse., type SK, int'p	1480
1	6	Northern	1200
1	6	Card	1150
1	6½	Crocker-Wheeler	1100
3	6½	Gen. Elec.	950
1	7	G. E., type CVC, int'pole	1800
1	20	Western Elec.	675
1	25	Westinghouse	975
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1	30	Westinghouse, type S	850
1	30	Crocker-Wheeler	825
1	35	G.E.-Curtis steam turbine	3600
1	35	Triumph, MP	575
1	35	Western Elec. to Chuse horizontal steam engine	325
1	45	Westinghouse	550
1	50	Willey	800
1	50	Western Electric	260
1	55	Westinghouse	850
1	67½	Sprague, 6-pole	875
1	75	C. & C., 6-pole, comp., direct con. to Ames, center-crank, automatic steam engine	275
1	75	National	750
1	75	Western Electric direct connected to Ball horiz., self-oiling steam engine	250
1	85	Westghse., MP, type S	725
1	125	Triumph, 6-pole	600

220-Volt, D. C. Motors—C

	Hp.		*Speed*
1	3½	Roth	1575
1	3¾	G. E., type RC, interpole	800
1	3¾	G. E., type CQ	750
1	3¾	Browning	675
1	4	Crocker-Wheeler, form L	1300
1	4	G. E., type RLC, interpole, var. speed	500-1500
1	4	Allis-Chalmers, type N	575
1	4	Watson	450
1	5	Westghse., SK, interpole	1800
2	5	G. E., CVC, interpole	1575
1	5	Westinghouse, type M	1300
1	5	Peerless	1275
1	5	G. E., type CQ	1175
2	5	Crocker-Wheeler, form F	980
1	5	Crocker-Wheeler, form E	950
1	5	Westinghouse, type M	925
1	5	Sprague-Lundell, RT	680
1	5	G. E., type CE	675
8	5	Gen. Elec., type RF, shunt, interpole, adjustable speed	450-1350
1	6	Westinghouse, type S	1465
1	6½	Crocker-Wheeler, form F	1150
1	7½	G. E., RC, interpole	1575
1	7½	Western Elec., type E	1475
1	7½	G. E., CVC, comp., int'p.	1300
2	7½	Allis-Chalmers, type K	875
4	7½	G. E., CE	875
1	7½	Crocker-Wheeler, form I	875
1	7½	Gen. Elec., CQ	825
2	7½	Northern, MP	800
1	7½	Sturtevant, comp., interpole, var. speed	545-1090
1	10	Westinghouse, type S	1325
2	10	Sprague (G. E.), comp., interpole	1000
1	10	Browning	850
1	10	Crocker-Wheeler	800
2	10	G. E., MP, CE	700
1	12½	Ft. Wayne, shunt, interpole, variable speed	400-800
3	15	Northern	1200
1	15	G. E., CQ	625
1	15	Westinghouse, type S, comp.	560
1	20	Crocker-Wheeler, comp.	775
1	20	Gen. Elec., DLC, int-pole	600
1	20	Northern, var. speed	400-1000
1	25	Fairbanks-Morse	950
1	25	Crocker-Wheeler	750
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1	250	450	G. E., M
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2	200	900	G. E., L
1	160	900	G. E., syn.*
1	125	600	G. E., form M
1	100	[illegible]00	Westg., I, sl. rg.
2	100	720	G. E., K
1	75	900	Allis-Chal., ANY
1	75	900	G. E., K
2	75	720	G. E., K
1	75	450	G. E., M*
1	60	300	West., CW
3	50	900	Cr.-Wh. & G. E.
2	35	[illegible]00	G. E., sq. cage
1	0	[illegible]00	Westg., MS
1	0	1800	Westg., CW
1	25	1200	West., CS
1	25	1200	G. E. K.
1	25	900	Cr.-Wh.
1	25	600	G. E.
1	5	1800	West., A

2-Phase Motors on request

D.C. Motors, 230-Volt

No.	*Hp.*	*Rpm.*	*Make*
1	300	500	G. E.
1	100	800	G. E.
4	50	1250	Allis-Chal.
1	50	700	West.
1	35	875	West.
1	25	1300	Sprague
4	25	600 1200	Allis-Chal.
1	15	1250	Allis-Chal.
1	10	1200	Allis-Chal
5	10	275 1575	Allis-Chal

D.C. Motors, 125-Volt

3	2[illegible]	650	Allis-Chal
1	1[illegible]	775	Sk. West.
2	7½	1100	G. E.
1	5	700	[illegible]
3	3	1100	G. E.
2	3	1700	G. E.

A. C. Generators, 440 and 2300-Volt

No.	*Kw.*	*Rpm.*	*Make*
1	200	720	G. E., form B
1	130	900	G. E., form PB
1	100	900	Cr.-Wh.
2	30	1200	West.

D.C. Generators, 250-Volt

1	200	575	G. E.
1	100	900	G. E.
1	100	675	G. E.
1	75	575	G. E.
1	50	600	West.
1	[illegible]	[illegible]	West.
2	[illegible]	900	Allis-Chal.

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100-kw., 250-v. Gen. Elec. Gen., 150-hp., 900-rev., 440/2200-v. syn.

1—50-kw., 1200 r.p.m., 125-v., Cr.-Wh. with 75-hp., 220/440-v. motor.

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Stk No.	*Hp.*	*Volts*	*Speed*	*Ph*	*Cy*	*Make and Type*
608	500	2200	600	3	60	G. E., "M", slip ring, 3-bearing
2131	425	440/220	600	3	60	Westghse., synchronous, 3-bearing
Cons.	400	440	450	3	60	Westghse., "CW", slip ring, 2-bearing
763	300	440/220	600	3	60	G. E., "M", slip ring, 3-bearing
796	300	2200	720	3	60	G. E., "K", sq. cage, 2-bearing
1022	250	440/220	900	3	60	G. E., "M", slip ring, 2-bearing
299	250	2200	600	3	60	G. E., "K", sq. cage, 2-bearing
Cons.	250	2200	900	3	60	Westghse., slip ring, "CW", 3-bearing
Cons.	250	550	900	3	60	Westghse., slip ring, "CW" 3-bearing
992	200	2200	600	3	60	G. E., "K", sq. cage, 2-bearing
9401	150	440/220	690	3	60	Westghse., "HF", slip ring, inter. duty
1501	150	440/220	690	3	60	Westghse., "HF", slip ring, inter. duty
5501	150	440/220	720	3	60	G. E., "M", slip ring
4501	125	440/220	720	3	60	Westghse., "HF", slip ring
1045	100	550	700	3	60	G. E., "L", wound rotor
5401	100	440/220	720	3	60	G. E., "M", slip ring
1049	100	550	720	3	60	Westghse., "HF", slip ring
1051	100	440/220	720	3	60	Westghse., "HF", slip ring
1052	100	440/220	720	2	60	Westghse., "HF", slip ring
1053	100	2200	720	3	60	Westghse., "HF", slip ring
1054	100	2200	720	2	60	Westghse., "CW", slip ring
5921	100	440/220	600	3	60	G. E., "K", sq. cage
1055	100	550	720	3	60	G. E., "M", slip ring
1231	82	440/220	485	3	60	G. E., "ITC", inter. duty
1232	82	440/220	514	3	60	G. E., "ITC", inter. duty
2401	75	440/220	1200	3	60	Allis-Chal., synchronous
1295	75	440/220	600	3	60	G. E., "K", sq. cage
3121	75	440/220	514	3	60	G. E., "M", slip ring
2321	75	440/220	514	3	60	G. E., "M", slip ring
1233	75	440/220	580	3	60	G. E., "ITC", inter. duty
1234	75	440/220	580	3	60	G. E., "ITC", inter. duty
3321	60	440/220	600	3	60	G. E., "M", slip ring
4321	60	440/220	600	3	60	G. E., "M", slip ring
5321	60	440/220	600	3	60	G. E., "M", slip ring
6321	60	440/220	600	3	60	G. E., "M", slip ring
8821	50	440/220	600	3	60	G. E., "M", slip ring
1271	37	440/220	3600	3	60	G. E., "KT", sq. cage (new)
1306	37	440/220	3600	3	60	G. E., "KT", sq. cage
1221	25	440/220	1200	3	60	Allis-Chal, slip ring
826	25	440/220	1200	3	60	Westghse., "CCL", sq. cage
828	25	440/220	600	3	60	G. E., "KT", sq. cage
1248	22	440/220	900	3	60	G. E., "ITC", inter. duty
1239	22	440/220	1200	3	60	G. E., "ITC", inter. duty
953	20	220	900	3	60	Westghse., "CS", sq. cage
948	20	440/220	1200	3	60	G. E., "M", slip ring
1299	15	440/220	1800	3	60	G. E., "KT", sq. cage (vertical)
831	15	440/220	900	3	60	G. E., "L", wound rotor
8421	15	440/220	900	3	60	G. E., "MT", slip ring
1298	15	440/220	900	3	60	G. E., "KT", sq. cage
1025	10	220	1200	2	60	Allis-Chal., sq. cage
1252	10	440/220	1200	3	60	G. E., "KT", sq. cage
1273	10	440/220	1200	3	60	G. E., "KT", sq. cage
3721	10	220	1200	2	60	G. E., "KT", sq. cage
1253	10	440/220	1200	3	60	G. E., "MT", slip ring
1272	10	440/220	900	3	60	G. E., "KT", sq. cage
1254	7½	440/220	900	3	60	G. E., "KT", sq. cage
1275	7½	440/220	1200	3	60	G. E., "KT", sq. cage
6721	7½	220	1200	2	60	G. E., "KT", sq. cage
5521	7½	440	1200	2	60	G. E., "KT", sq. cage
(5)	6	440	1800	3	60	G. E., "KT", sq. cage (mult. speed) 600/900/1200/1800
(2)	5	440/220	1200	3	60	G. E., "KT", sq. cage
(3)	5	440/220	1800	3	60	Westghse., sq. cage
(1)	5	440/220	1800	3	60	G. E., "MT", slip ring
(1)	5	440/220	900	3	60	G. E., "KT", sq. cage

The above is a partial list; quotations covering other machines upon request.

25-CYCLE A.C. MOTORS

Stk. No.	*Hp.*	*Volts*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
806	300	440	500	3	25	G. E., "M", slip ring, 3-brg.
1226	200	440/220	500	3	25	G. E., "M", slip ring, 3-brg.
1354	57	440/220	750	3	25	Westghse., sq. cage
1317	50	440/220	750	3	25	G. E., "K", sq. cage
1333	50	440/220	750	3	25	G. E., "K", sq. cage
1356	50	440/220	750	3	25	Allis-Chal., sq. cage
822	40	440/220	750	3	25	Burke, sq. cage
1320	37	440/220	750	3	25	G. E., "ITC", inter. duty
1321	37	440/220	750	3	25	G. E., "ITC", inter. duty
1322	37	440/220	750	3	25	G. E., "ITC", inter. duty
1350	37	440/220	750	3	25	G. E., "ITC", inter. duty
1331	35	440/220	1500	3	25	Westghse., sq. cage
1342	35	440/220	750	3	25	G. E. "K" sq. cage
1353	35	440/220	750	3	25	G. E. "K" sq. cage
1238	32	440/220	750	3	25	G. E. "ITC" Inter. duty
1338	32	440/220	750	3	25	G. E. "K" sq. cage
1319	30	440/220	750	3	25	G. E., "K", sq. cage
1231	30	440/220	750	3	25	G. E., "M", sl. ring
1357	25	440/220	750	3	25	Westghse., slip ring
1324	22	440/220	750	3	25	G. E., "ITC", inter. duty
1325	22	440/220	750	3	25	G. E., "ITC", inter. duty
6231	20	440/220	750	3	25	G. E., "M", slip ring
7231	20	440/220	750	3	25	G. E., "M", slip ring
8231	20	440/220	750	3	25	G. E., "M", slip ring
9231	20	440/220	750	3	25	G. E., "M", slip ring
1344	20	440/220	750	3	25	Westghse., sq. cage
0331	20	440/220	750	3	25	G. E., "M", slip ring
1151	20	440/220	750	3	25	Westghse., "CX", sq. cage
1345	15	440/220	750	3	25	G. E., "KT", sq. cage
1240	10	440/220	750	3	25	G. E., "MT", slip ring

25-CYCLE A. C. MOTORS (Continued

Stk. No.	*Hp.*	*Volts*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
835	10	440/220	750	3	25	Burke, "EM", sq. cage
1315	10	440/220	750	3	25	Westghse., sq. cage
1339	10	440/220	750	3	25	G. E., "KT", sq. cage
1340	10	440/220	750	3	25	Westghse., sq. cage
1352	10	440/220	750	3	25	G. E., "KT", sq. cage
1358	10	440/220	750	3	25	Allis.-Chal, sq. cage
1337	7½	440/220	750	3	25	G. E., "KT", sq. cage
1341	7½	440/220	750	3	25	G. E., "KT", sq. cage
1359	7½	440/220	750	3	25	G. E., "KT", sq. cage
836	7½	440/220	750	3	25	Burke, "EM", sq. cage
(3)	5	440/220	1500	3	25	G. E., "KT", sq. cage
(4)	5	440/220	750	3	25	Burke, "EM", sq. cage
(1)	5	440/220	500	3	25	G. E., "KT", sq. cage
(2)	[illegible]	440/220	750	3	25	G. E., "KT", sq. cage
(3)	1	440/220	750	3	25	G. E., "KT", sq. cage
(2)	1	440/220	1500	3	25	G. E., "KT", sq. cage

The above is a partial list; quotations covering othermachines upon request.

D. C. MOTORS

Stk. No.	*Kw.*	*Volts*	*Speed*	*Make and Type*
1360	500	230	440	G. E. (Spr.), "C", interpole, 3-brg.
1361	500	230	440	G. E. (Spr.), "C", interpole, 3-brg.
1631	250	115	210	G. E. (Spr.), "C", interpole, 3-brg.
0630	230	115	210/420	G. E. (Spr.), "C", interpole, 3-brg.
909	200	500	430	G. E., "CLB", 2-bearing
4909	185	230	415	G. E., "CLB", 2-bearing
2221	150	230	550	G. E., "DLC", interpole
1222	125	230	560	G. E., "DLC", interpole
2631	75	115	600	G. E. (Spr.), "C", interpole
209	60	115	650	G. E., "DLC", interpole
1362	60	115	500/700	G. E. (Spr.), "C", interpole
902	50	115	650	G. E., "DLC", interpole
2211	40	230	725	G. E. (Spr.), "LC", interpole
952	35	500	650	G. E., "CLB"
1122	30	230	725	G. E. (Spr.), "LC", interpole
1123	30	230	725	G. E. (Spr.), "LC", interpole
1124	30	230	725/1000	G. E. (Spr.), "LC", interpole
1011	30	230	1200	G. E. (Spr.), "LC", interpole
1289	30	115	600/720	G. E. (Spr.), "LC", interpole
1217	25	230	250/1000	Westghse., "SK" interpole rev. duty (new)
1218	25	230	250/1000	Westghse. "SK" interpole rev. duty (new)
1125	25	230	750/1000	G. E. (Spr.), "LC" interpole
1126	20	230	1150	G. E., "RC", interpole
1127	20	230	1150	G. E., "RC" interpole
1128	20	230	1150	G. E., "RC" interpole
1129	20	230	1150	G. E., "RC" interpole
1130	15	230	850	G. E., "RC" interpole
1131	15	230	800	G. E., "RC" interpole
975	7½	115	825	G. E., "CQ"
978	7½	115	825	G. E., "CVC" interpole
(2)	5	230	975	G. E., "RC", interpole
(1)	5	230	1100	Crocker-Wheeler, "CM"
(2)	5	230	1700	G. E., "RC", interpole
(2)	3	230	1700	R. & M., interpole
(2)	3	230	1150	G. E., "RC" interpole
(5)	2	230	1100	G. E., "RC", interpole
(2)	1	230	2550	R. & M.
(6)	1	230	1700	G. E., "RC", interpole

The above is a partial list; quotations covering other machines upon request.

D. C. GENERATORS

Stk. No.	*Kw.*	*Volts*	*Speed*	*Make and Type*
9630	375	250	500	G. E., Spr., "C", interpole, 3-bearing
8631	200	125	230	G. E., Spr., "C" interpole, 3-bearing
909	150	550	500	G. E., "CLB", 2-bearing
9094	150	250	485	G. E., "CLB", 2-bearing
9023	125	250	650	G. E., "DLC", interpole
7023	100	250	625	G. E., "DLC", interpole
7631	60	125	650	G. E. (Spr.), "C", interpole
2902	40	125	750	G. E., "DLC", interpole
839	30	550	750	G. E., "CLB"
2211	30	250	850	G. E., (Spr.), "LC", interpole
7122	25	250	825	G. E. (Spr.), "LC", interpole
6211	17½	230	1150	G. E., "RC", interpole
9211	15	230	1150	G. E., "RC", interpole
1311	12½	250	950	G. E., "RC", interpole
2311	10	250	975	G. E., "RC" interpole
7979	7½	125	950	G. E., "RC", interpole
879	5	125	950	G. E., "RC", interpole

The above is a partial list; quotations covering other machines upon request.

ROTARY CONVERTERS

1—330-kw., practically new, 275 volt, 1200 r.p.m., compound wound General Electric, type HCC, each complete with three 110-kw., 2200-volt primary, single phase, 60-cycle transformers (for 3-phase operation). This unit with or without complete switchboard equipment.

MOTOR-GENERATOR SETS

(Each complete with starter, rheostat, etc.)

Gen.	300-kw., 250-volt, 720-r.p.m. Gen. Elec., comp. wd.
Motor,	450-hp., 2300-volt, 700 r.p.m., 3 ph., 60 cy. Gen. Elec., sq. cage
Gen.	200-kw., 125 volt, 600-r.p.m. Westghse., compound wound, 6-pole
Motor,	300 hp., 2300 volt, 600 r.p.m., 3-ph., 60-cy. Westghse. synchronous
Gen.	185-kw., 550 volt, 600-r.p.m. Gen. Elec. "CLB", 6 pole
Motor,	300-hp., 2300 volt, 600 r.p.m., 3 ph., 60-cy. Gen. Elec., "ATI" syn.
Gen.	100-kw., 1200 r.p.m., 250 volt, 6 pole, "RC" Gen. Elec.
Motor,	150-hp., 1200 r.p.m., 440/220-volt, 3 ph. 60 cy. Gen. Elec., sq. c. KT
Gen.	50-kw., 250 volt, 900 r.p.m., comp. wd. "RC" Gen. Elec.
Motor,	75 hp., 440 volt, 900 r.p.m. Gen. Elec. 3 ph., 60 cy. "KT"
Gen.	50-kw., 125-volt, 900 r.p.m. comp. wd. Gen. Elec., "DLC"
Motor,	75-hp., 440/220 volt, 900 r.p.m., 3 ph., 60 cy. Gen. Elec. "KT"
Gen.	40 kw., 250-volt, 700 r.p.m. Westghse. type "CLB"
Motor	60-hp., 440/220 volt, 700 r.p.m., 3 ph., 60 cy. Gen. Elec., sq. cage
Motor,	60-hp., 440/220 volt, 720 r.p.m., 3 ph., 60 cy. West. sq. cage
Gen.	15-kw., 250 volt, 1140-r.p.m., comp. wd. Cr.-Wh., "CCD"
Motor,	25-hp., 440 or 220-volt, 1140 r.p.m., 3 ph., 60-cy. sq. cage

The above is a partial list; quotations covering other machines upon request.

Power Machinery Exchange

1 Montgomery Street, Jersey City, N. J.

A. C. Direct-Connected Units—3- or 2-Phase

Kva.	Generator	Engine
640	Wghse.	Hamilton Corliss
625	Wghse.	Parsons Horiz. Turbine
600	Gen. Elec.	Rice-Sargent-Corliss
500	Allis-Chal.	Allis-Chal.-Corliss
500	Allis-Chal.	Allis-Chal. Turbine
400	Wghse.	Erie Ball, 4-valve
400	Wghse	Hamilton Corliss
375	Gen. Elec.	Erie Ball, 4-valve
375	Gen. Elec	Curtis Horiz. Turbine
360	Gen. Elec.	Harris Corliss
350	Wghse.	Murray Corliss
300	Gen. Elec.	Allis-Chal.-Corliss
250	C.-W.	Harrisburg, 4-valve
250	Wghse.	Erie City, 4-valve
250	Wghse.	Murray Corliss
200	Wghse.	Erie Ball
200	Wghse.	Harrisburg, 4-valve
187	Gen. Elec.	Skinner compound
180	Gen. Elec	Chandler Taylor, side crank
150	Gen. Elec.	Ames Uniflow
125	Gen. Elec.	Curtis Horiz. Turbine
125	Wghse.	Harrisburg, 4-valve
100	Ridgway	Ridgway, side crank
100	Wghse.	Erie Ball
90	Allis-Chal.	Skinner
75	Gen. Elec	Harrisburg
75	Ridgway	Ridgway, side crank
70	Wghse.	Skinner
50	West. Elec.	Erie Ball
40	Fbks.-Morse	Lycoming

A. C. Belted Generators, 3- or 2-Phase

Kva	Make	Speed
800	Allis-Chalmers, 3 Brg.	360
500	Allis-Chalmers	600
400	General Electric, 3 Brg.	600
360	Westinghouse	360
312	General Electric	450
280	Allis-Chalmers	450
250	Allis-Chalmers	600
200	General Electric	600

Kva	Make	Speed
200	Westinghouse	600
170	General Electric	400
150	General Electric	600
100	General Electric	900
75	Westinghouse	900
60	Electric Machinery	600
50	General Electric	1200
40	Electric Machinery	1200
37½	General Electric	1200
30	General Electric	1200
15	Fairbanks-Morse	1200

A. C. Motors 3- and 2-Phase

Hp.	Make	Volts	Speed
300	Gen. Elec., Synch.	2300	720
200 (3)	Gen. Elec., slip ring	2300-440-220	585
150	Gen. Elec., slip ring	440	720
100	Wghse., slip ring	2300	580
100	Allis-Chal	440-220	680
85	Gen. Elec.	2300-550-220	720
50	Wghse.	440-220	850
40	Wghse.	440-220	850
30	Wghse.	440-220	850

Also smaller sizes

Direct-Current Units 220-250-Volt

Kw.	Generator	Engine
17½	Wghse.	Erie
20	Gen. Elec.	Gen. Elec
25	Gen. Elec., 3 wire	Troy Vertical
35	Ridgway	Ridgway
35	Allis-Chal.	Skinner
50	Wghse., 3-wire	Ames
50	Gen. Elec.	Erie Ball
75	Sturtevant	Sturtevant
75	Burke, 3-wire	Ames

Kw.	Generator	Engine
75	Allis-Chal.	Erie Ball
85	Cr.-Wh.	Erie Ball
100	Cr.-Wh	Harrisburg, side crank
100	Allis-Chal.	Skinner
125	Wghse.	Erie, side crank
125	Gen. Elec.	Ball Tandem
150	Wghse	Hewes Phillips Corliss
150	Ridgway	Ridgway
150	Gen. Elec	Erie, 4-valve
200	Gen. Elec.	Bates Corliss
200	Ridgway	Ridgway
250	Cr.-Wh.	Harrisburg
250	Gen. Elec.	Erie Lentz
250	Triumph, 3-wire	Skinner tandem
300	Cr.-Wh.	Watts-Campbell-Corliss
300	Wghse.	Lane & Bodley Corliss
400	Gen. Elec	Buckeye comp.
800	Ridgway	Ridgway Turbine

Oil Engines

Hp	Make	Type
300	De La Vergne	FH
180	Allis-Chal.	Semi-Diesel
100	Fairbanks-Morse	Y
85	Bessemer	Elec. Light
75	Fairbanks-Morse	Y
60	Muncie	C Heavy Duty
50	Fairbanks-Morse	Y
50	De La Vergne	HA
37½	Fairbanks-Morse	Y
30	Muncie	A
25	Fairbanks-Morse	Y
20	Fairbanks-Morse	
15	Meitz & Weiss	Hor.

Direct-Connected Oil and Gas Units

Kva.	Generator	Engine
160	G. E., 3-60-2300-v.	Diesel Oil, 3-cyl.
100	G. E., 3-60-2300-v.	Diesel Oil, 4-cyl.
150	Allis-Chal., 250-v.	Diesel Oil, 3-cyl.
125	Allis-Chal., 230-v.	Turner Frick, gas, 4-cyl.
75	Wghse., 230-115-v.	Diesel Oil, 3-cyl.

MOTORS

220-440-Volt, 3-Ph., 60-Cy., 40-Deg., List 3

Qu.	Hp.	New or Used	Sp. Rpm.	Type	Make
1	30	U	865	Sl Ring	Allis

Above has drum starter and is especially suited for operating ice making or refrigerating machines o air compressors.

*3	75	U	900	Int Starter	G. E.
*4	100	U	720	Int Starter	G. E.
*1	100	U	720	Int Starter	G. E.
*1	100	U	720	Sl. Ring	G. E.

Above is 50° motor with drum starter and oil switch

3	100	N	900	KT356	G. E.

Above motors are 50° motors with No. 1003 acid proof insulation Were bought new in 1921 and never uncrated.

1	300	U	590	Sl. Ring	Allis

Above is mill type motor

1	350	N	575	Sl. Ring	WH
1	400	U	505	Sl. Ring	Allis

Above motor for direct connections

1	500	U	450	Sl Ring	Cr.-Wh

Above is mill type motor.

2200-Volt, 3-Ph., 60-Cy., List 3K

1	200	U	600	Sl. Ring	G. E.
1	300	U	705	Sl. Ring	Allis
1	350	U	350	Sl. Ring	WH

220-440-Volt, 3-Ph., 25-Cy., List 6

1	200	U	480	Sl Ring	G. E.
1	350	U	480	C-Sq Cage	WH

Above is coupled motor.

1	350	U	475	CCL Sq. Cg	WH

Above is 3 bearing motor for belting but is without pulley.

1	500	U	161-242	Sl. Ring	WH

Above is 2-speed motor for direct connections

Motors—220-440-Volt, 3-Ph., 25-Cy., List 6

2	750	U	500	IK	G. E.

Above is for direct connection also has shaft and pulleys and flexible coupling for belting drive.

2200-Volt, 3-Ph., 25-Cy., List 6K

*1	450	N	375	Sl. Ring	G. E.
1	450	U	365	Sl. Ring	G. E.

D. C., 220-Volt, List 9

1	150	U	250-400	K-Cpd.	Diehl

Above motor most suitable for economically operating ammonia or air compressor at variable speeds in accordance with seasonable or demand loads. Also have available a number of new D. C. motors 3 to 60 hp. from stock shipments.

A. C. Turbo-Generator Set

1—Used 780-kva. LOW pressure Horz. Generator: Westinghouse, 3-ph., 60-cy., 480-volt, 3600-r.p.m. Turbine: Westg. low pressure steam 16¾ lbs. abs; has auxiliary admission valve to make up deficiency by high pressure steam at 125 lb. Condenser: Westinghouse Le Blanc Jet with turbine driven circulating and air pumps. Exciter: Westinghouse 16-kw., D.C., 125-volt shunt wound, direct connected to Vertical WH single acting twin cyl. steam engine. Sw. Bd: 2 panels for generator and exciter and 2 feeder panels. Cooling Tower: Wheeler Cooling Tower complete except 35-hp electric motor to drive fans. Also have some spare parts.

Motor Generator Set, List 51

1 New 750-kw., D.C., 125-250-volt, cpd. wb., direct connected to a 1150-kva., 3-ph., 60-cy., 2300-volt WH Syn motor. Aux. Sw. Bd.

Above has 2—375-kw., 125-volt Generators. The motor is 1150-kva. capacity to operate at 70 per cent Leading Power Factor at full load on generators to correct the low power factor on the inductive load portion of the plant.

D. C. Engine Generator Sets

1—Used 4 kw. Vertical [illegible] D.C., 100-v. dynamo dir. conn. to Vertical [illegible] type steam, [illegible] r.p.m. Price $[illegible]

1—Used 1½ kw. Vertical [illegible] Gasoline Engine, two cylinder with flywheel governor and magneto, dir. conn. to 1½ kw. Robbins & Myers D.C., 120-v. generator. Price $[illegible]00.00 net.

1—Used 7½ kw. Vertical Diehl Generator, D.C., 115-v., dir. conn. to Westinghouse Vertical single acting automatic steam engine, 750 r.p.m. Price $300.00.

1—Used Horizontal 10 kw. Eddy, D.C., 110-v. Generator dir. conn to LH center crank horizontal Ideal 6 x 6 non cond. engine with wood governor. Price $325.00.

S—P—E—C—I—A—L—S

1—Used 15 kw., D.C., 125-v. Generator, 285 r.p.m., dir. conn. to 20-hp. N. Y. safety horizontal engine, LH center crank, wood governor [illegible] x 9. There is no sub base between engine and generator but same can be assembled on [illegible] foundation. Price $[illegible]

1—Used Horizontal 35-kw. General Electric, late type [illegible], compound wound, D.C., 125-v., dir. conn. to a [illegible] late type 10 x 10 left hand engine, [illegible] r.p.m., [illegible] wheel governor, [illegible] floor space 7 ft. 6 in. long by [illegible]. This unit [illegible] condition, [illegible]. Price $800.00 net. Switchboard $100 net.

1—Used Horizontal 40 kw. Eddy D.C., 125-v. generator, dir. conn. to a Watertown 11 x 10 right hand center crank, [illegible] engine. This unit has always given good service. Floor space 8 ft. long by 8 ft. wide. Price $700.00 net. Switchboard $100 net.

Electric Welding Equipment

1—Electric Welding Co. of America, Gasoline Driven Outfit, self-contained in steel frame, capacity 160 amp., max. voltage 60 v., 700 r.p.m., 4 cyl. vertical automobile type gasoline engine with magneto, carburetor, fan and large radiator. Price $975.00.

Dynamos for Plating and Electro-Galvanizing

1—Used complete Electro Galvanizing Plant for angles, tubes and other parts, complete with 12½-kw., 2500 amp., 5-v. plating dynamo, self-exciting, dir. conn. to 20-hp., 220-v., D.C., 625 r.p.m. motor (If necessary a different motor can be substituted). Includes 7 large wooden tanks, racks, bus bars. This is an unusual opportunity to purchase an up to date plant at a fraction of its cost and thereby cut your "Overhead" and investment.

STANDARD ELECTRIC MACHY. CO. BALTIMORE

7 and 9 East Hill St., Baltimore, Md., U. S. A.

MAC GOVERN & COMPANY, INC.
POWER MACHINERY

114 Liberty St. New York, N.Y.

FOR PROMPT DELIVERY

TURBO-GENERATOR UNITS

60 CYCLE

1—4000 kw. Westinghouse Parsons horizontal turbo unit, 3 ph., 2400 v., 1040 amps., 3600 r.p.m., turbine double flow, 150 lbs. steam pressure, 20 in. vacuum. Complete with exciter, switchboard, condenser and auxiliaries.
1—4000 kw. Allis-Chalmers horizontal turbo unit, 3 ph., 4150 or 2300 v., 4-wire, 1800 r.p.m., multiple expansion, parallel and full annular flow, 185 lbs. steam, with condenser and auxiliaries.
1—3000-kw. Westinghouse-Parsons horizontal turbo unit, 3 ph., 4400 or 2300 v., 1200 r.p.m., single flow, 150 lbs. steam, 28 in. vacuum, with switchboard, condenser and auxiliaries.
1—1500 kw. Westinghouse-Parsons horizontal turbo unit, 2 ph., 2400 v., 390 amps. 3600 r.p.m., 150 lbs. steam, 28-in. vacuum, complete with switchboard, condenser and auxiliaries.
2—1000-kw. Westinghouse-Parsons horizontal turbo unit, 3 ph., 2400 v., 4 pole 360 r.p.m., multiple expansion, parallel flow, 3-stage, 150 lbs. steam pressure, 100 deg. superheat, 28-in. vacuum, complete with switchboard, condenser and auxiliaries.
1—1000-kw. Allis-Chalmers horizontal turbo unit, 3 ph., 2300 v., 3600 r.p.m., 165-lb. gauge throttle pressure, 125 deg. superheat, 28-in. vacuum, with condenser and auxiliaries (80% P. F.)
1—500-kw. General Electric-Curtis horizontal turbo units, 3 ph., 2300 v., 3600 r.p.m., complete with condensers.
3—500-kw. Westinghouse-Parsons horizontal turbo units, 3 ph., 60 cy., 2400 v., 3600 r.p.m., complete with No. 5 LeBlanc jet condenser, switchboard, etc.
1—400-kw. Allis-Chalmers horizontal turbo unit, 3 ph., 2300 v., 126 amps., 3600 r.p.m., 125 lbs. steam pressure, with condenser and auxiliaries.
1—300-kw., Allis-Chalmers horizontal turbo unit, 3 ph., 4400 v., 3600 r.p.m., 150 lbs. steam 28 in. vacuum with exciter switchboard, condenser and auxiliaries.

ENGINE-GENERATOR SETS

60 CYCLE, 2 AND 3 PHASE

1—500-kw. Westinghouse, 2300 v., 120 r.p.m., direct connected to 26-in. x 42-in. Hamilton Corliss engine.
1—500-kw. Westinghouse, 2300 v., 3 ph., 120 r.p.m., direct connected to 26-in. x 42-in. Hamilton Corliss engine.
1—500-kw. Allis-Chalmers, 2300 v., 120/150 r.p.m., direct connected to 26-in. x 36-in. Allis-Chalmers engine.
1—450-kw. General Electric, 2300 v., 100 r.p.m., direct connected to 22 in. x 42-in. x 48 in. E. P. Allis cross compound engine.
1—325-kw. Allis-Chalmers, 2300 v., 120 r.p.m., direct connected to 16½-in. and 40-in. x 36 in. Buckeye horizontal tandem engine.
1—260-kw. Allis-Chalmers, 2300 v., 120 r.p.m., dir .conn. to 16½-in. and 40-in. x 36-in. Buckeye horizontal tandem engine.
nected to 23-in. x 30-in. Erie City 4-valve engine.
1—300-kva. General Electric, 2300 v., 150 r.p.m. direct con-
1—300 kw. General Electric, 2400 v., 150 r.p.m., direct connected to 24-in. x 30-in. Ball Corliss valve engine.
1—250-kw. Allis-Chalmers-Bullock, 240 v., 150 r.p.m., direct connected to Erie Ball 4-valve engine.
1—225-kw. Westinghouse, 2300 v., 150 r.p.m., direct connected to 14-in. and 26-in. x 30-in. Hamilton Corliss horizontal cross compound engine.
1—200-kw. Westinghouse, 2200 v., 180 r.p.m., direct connected to 18-in. and 30-in. x 24-in. Harrisburg cross compound engine.
1—150-kw. General Electric, 220/240 v., 157 r.p.m., direct connected to 16-in. x 16-in. Chandler and Taylor slide valve engine.

This is only a partial list. Complete list will be mailed upon request.
We are in the market to buy—Advise us what you have to dispose of.

NOTHING BUT GOOD EQUIPMENT

New and Used—Guaranteed Condition—Ready to Ship

Slip Ring Motors—3-Phase, 60-Cycle

Hp.	*Volt*	*Speed*	*Make*	*Type*
500	2200	600	General Electric	M
250	2200	600	General Electric	M
200	220/440	600	Allis-Chalmers	ANY
200	2200	600	General Electric	M
200	440/220	450	General Electric	M
200	220/440	600	General Electric	M
150	2200	720	General Electric	M
150	2200	600	General Electric	M
150	440/220	720	General Electric	M
100	440/220	720	General Electric	M
100	2200	720	General Electric	M
100	440/220	900	General Electric	M
75	550	900	General Electric	MT
75	550	600	General Electric	M
75	2200	720	General Electric	M
75	220/440	720	General Electric	M
75	440/220	900	General Electric	M
60	440/220	900	General Electric	MT
50	550	900	General Electric	MT
50	440/220	1200	General Electric	MT
50	2200	900	General Electric	MT
40	440/220	900	Allis-Chalmers	ANY
40	440/220	1200	General Electric	MT
30	440/220	900	Allis-Chalmers	ANY

Squirrel Cage -3-Phase, 60-Cycle

Hp.	*Volt*	*Speed*	*Make*	*Type*
150	2200	720	General Electric	K
150	2200	600	Western Electric	SS
100	2200	600	General Electric	K
100	440/220	900	General Electric	K
100	440/220	720	General Electric	K
100	2200	900	General Electric	K
75	440/220	900	General Electric	K
50	440/220	1200	General Electric	K
50	440/220	900	General Electric	K
50	550	900	General Electric	K
40	220/440	1200	General Electric	KT
35	220/440	720	General Electric	K
30	220/440	900	Allis Chalmers	AN
30	220/440	900	Westinghouse	CS
30	220/440	1200	Allis-Chalmers	AN
30	220/440	720	Allis Chalmers	AN
25	440/220	900	General Electric	KT
25	440/220	600	General Electric	K
25	440/220	600	Allis-Chalmers	AN
25	220/440	720	General Electric	K
25	440/220	1200	Westinghouse	CS
20	440/220	1200	General Electric	L
15	440/220	1200	General Electric	L
10	440/220	1200	General Electric	L
10	440/220	900	General Electric	KT

3-Phase, 25-Cycle

Hp.	*Volt*	*Speed*	*Make*	*Type*
500	2200	500	General Electric	Sl. rg.
300	440	500	General Electric,	sl. rg.
200	440	500	General Electric,	sl. rg.
50	220/440	750	General Electric,	sq. ca

DIRECT CURRENT MOTORS

Hp.	*Volt*	*Speed*	*Make*	*Type*
100	230	900	General Electric	RC
100	230	500	General Electric	DL
90	230	500	General Electric	CL-A
75	230	1100	Westinghouse	S
75	115	475	Westinghouse	SA
75	500	750	Westinghouse	M
75	230	500	General Electric	DLC
50	230	1125	Westinghouse	S
35	230	800	Westinghouse	S
30	230	300	Westinghouse	M
30	230	700	G. E.-Sprague	D
15	230	1000	General Electric	CQ
10	230	1150	General Electric	RC
10	115	1460	Allis-Chal.	B

DIRECT CURRENT GENERATORS

Kw.	*Volts*	*Speed*	*Make*	*Type*
125	125	850	General Electric	DLC
100	250	1050	General Electric	RC
100	250	575	General Electric	CL-A
85	125	750	General Electric	MP-H
75	250	575	General Electric	DLC
70	125	575	Westinghouse	SA
33	125	725	General Electric	Sprague
30	250	850	G. E. Sprague	D
23	125	1175	Crocker-Wheeler	I

MOTOR GENERATOR SETS

1—125-kw., 125-volt, 900-r.p.m. General Electric, D.L.C. Interpole Generator, coupled to 150 kva., 440/220-volt, 3-phase, 60-cycle Westinghouse self-starting synchronous motor.
1—90-kw., 250-volt, 1150-r.p.m., Gen. Elec., RC interpole Generator, coupled to 150-hp. 440/220 volt, 3-phase, 60-cycle Gen. Elec. S Cage motor.
1—70-kw., 125-volt, 580-r.p.m. Westinghouse SA interpole Generator, coupled to 100-hp., 2200/440/220-volt, 3-phase, 60-cycle Gen. Elec. S Cage motor.
1—50-kw., 125-volt, 1150-r.p.m., Gen. Elec. RC interpole Generator coupled to 75-hp., 440/220 volt 2 or 3 ph., 60-cy. Gen Elec S cage motor.
1—23-kw., 125-volt, 1150-r.p.m. Crocker-Wheeler, type I, compound wound Generator, coupled to 35-hp., 220/440, 3-ph., 60-cy. G. E., form K Motor.

ALTERNATING CURRENT GENERATORS

1—225-kva. Westinghouse, 220 volt, 514 r.p.m., 2- or 3-phase, 60-cycle, R. F. Generator, with belted exciter.
1—200 kw. Allis-Chalmers, 2300-volt, 600 r.p.m. 3 or 2 phase, 60-cycle, RF Generator with direct connected Exciter.
1—150 kva. Westinghouse 240/480-volt, 900-r.p.m., 3 ph., 60-cy., R. F. Generator with belted exciter complete.
1—100-kva. Westinghouse, 240/480 volt, 900-r.p.m., 3 phase, 60 cycle, R. F. Generator, with belted exciter, complete.
1—50-kw. Westinghouse 2300/480/240-volt, 1200-r.p.m., 3-phase, 60-cycle RF Generator, with belted exciter.

ENGINE GENERATOR SETS

1—160-kw., 250-volt, 230-r.p.m. General Electric, type MP, form L, direct current Generator, direct connected to 17 x 16 Harrisburg Standard side crank engine.
1—150-kw., 250-volt, 225-r.p.m. General Electric, type MP form RB, direct current Generator, direct connected to 16 x 18 Harrisburg side crank left hand engine.
1—80-kw., 250/125-volt, 280-r.p.m., 3-wire Sprague D.C. Generator, direct connected to 13 x 14 Ridgway side crank right hand engine.

We also have a number of other desirable Engine Generator Sets—both A.C. and D.C. and a large stock of 2-phase Motors.

STEPHEN HALL & CO., Inc., 7th and Adams Streets, Hoboken, N. J.

TELEPHONES: New York Direct Wire: Rector 3891; HOBOKEN 3750

ARCHER & BALDWIN, Inc.

114-118 LIBERTY ST., NEW YORK CITY

TELEPHONES 4337-4338 RECTOR

250 VOLT UNITS

1—500 kw., Burke, 150 r.p.m., dir. con. 22 and 38 x 27 in. Erie Ball, 4-valve engine.
1—180 kw., Ft. Wayne, 250 r.p.m., dir. con. 16 x 18 McEwen engine.
1—100 kw., Crocker-Wheeler, 250 r.p.m., dir. con., Harrisburg engine.
1—75 kw., Westg., 275 r.p.m., dir. con. 13 x 12 Ballwood engine.
1—50 kw., Westg., 300 r.p.m., dir. con. 11 and 19 x 11 Westg. engine, 3 wire.

125 VOLT UNITS

1—75 kw., Northern, 270 r.p.m., dir. con. 15 x 14 Payne engine.
1—75 kw., Gen. Elec., 275 r.p.m., dir. con. 14 x 14 straight line engine.
1—30 kw., Westg., 325 r.p.m., dir. con. 10 x 10 Harrisburg engine
1—30 kw., Sturtevant, 325 r.p.m., dir. con. 9 x 9 Sturtevant engine.

550 V. BELTED GENER. AND MOTORS

1—300 kw., Sprague Lundell, 470 r.p.m.
1—100 kw., Westg., 720 r.p.m., 2-bearing.
1—20 hp., Bullock, 925 r.p.m.

250 V. BELTED GENER. AND MOTORS

1—100 kw., Allis-Chal., 115 r.p.m., 3 bearing
1—150 kw., Gen. Elec., 470 r.p.m., 2 bearing
1—80 hp., Gen. Elec., 490 r.p.m., hoist type.
1—25 hp., Bullock, 1175 r.p.m.
1—20 hp., Diehl, 725 r.p.m.
1—15 hp., Gen. Elec., 1100 r.p.m.

125 V. BELTED GENER. AND MOTORS

1—200 kw., Bullock, 300 r.p.m., [illegible]-bearing.
1—200 kw., Westg., 365 r.p.m., 2-bearing.
1—90 hp., Gen. Elec., 500 r.p.m.
1—40 kw., Westg., 550 r.p.m.
1—25 hp., Triumph, 1100 r.p.m.
1—20 hp., Western Elec., 900 r.p.m.
1—15 hp., Gen. Elec., 690 r.p.m.
1—15 hp., Westg., 725 r.p.m.
1—15 kw., Crocker-Wheeler, 250 r.p.m.
1—10-hp. Crocker-Wheeler, 1100 r.p.m.
1—8-kw. Ft. Wayne, 1050 r.p.m.

MOTOR GENERATOR SETS

1—300-kw., G. E., 220-v. Generator, with a 450-hp., G. E., 2300/4150-v., 3-ph., 60-cy., 720 r.p.m. motor.
1—150 kw., Westg., 250-v. Generator, with a 225-hp., Westg., 3-ph., 25-cy., 6600- or 2200-v., synch. motor, 550 r.p.m.
1—150-kw., Westg., 250-v. Generator, with a 250-hp., Westg., 3-ph., 60-cy., 2200-v., ind. motor, 580 r.p.m.
1—100 kw., Elec. Machy. Co., 250-v. Generator, with 150-hp., 2- or 3-ph., 60-cy., synch. motor, 900 r.p.m.
1—100 kw., Westg., 230-v. Generator, with 150 hp., 3 ph., 60-cy., 2200-v. ind. motor, 580 r.p.m.
1—10-kw., Westg., 125-v. Generator, with 15-hp., 3-ph., 60-cy., 440-v. motor, 1120 r.p.m.
1—10-kw., Sprague, 240-v., Generator, with 15-hp., 3-ph., 60-cy., 220-v., 1800 r.p.m. motor.

THE NATIONAL POWER MACHINERY CO.

ELECTRICAL ENGINEERS
POWER PLANT EQUIPMENT

1914-1918 SCRANTON ROAD, CLEVELAND, OHIO

Government Turbine Generating Units For Sale—Practically New—Prompt Shipment

Location: Government Plant at Nitro, West Virginia

3—1250 kva. horizontal General Electric Curtis non-condensing turbine generating units each consisting of

GENERATOR—1000 kw., 80 per cent P. F., 1250 kva., General Electric, 3 ph., 60 cy., 6600 or 2300 v., 3600 r.p.m. type ATB-2-1250 form T, serial Nos. 1353490, 1353503, 1353625, direct connected to

TURBINE—General Electric non-condensing single stage form B 3600 r.p.m. 175 lbs. steam pressure, 100 deg. F Superheat, serial Nos. 19117, 19118, 19119.

EXCITER—13 kw. 125 volt, 104 amp., 3600 r.p.m., type E.D., form T, serial Nos 661971, 661972, 661973, direct connected to generator.

These outfits are of the latest type turned out by the manufacturers. Two of these units have been in service approximately eighteen months and one only six months

They can be operated at steam pressure of 150 to 200 lbs., and a superheat from 0 deg. F to 100 deg. F.

The electrical end of these units can be readily changed for the following voltages:—240 volts, 480 volts, 550 volts.

Special prices and detailed information will be quoted on application

In addition to the above outfits, we also have a large stock of **Engine Driven Generating Units, Motor Generator Sets, Rotary Converters, Transformers, Motors, Generators** and **Boilers.** Send for our Stock Catalogue No 42 for complete list.

POWER

A.C. ENGINE SETS

90-kva., Westinghouse, 2-ph., 60-cy., 2300-v., with Erie Ball side crank engine.
150-kva., General Electric, 3-ph., 60-cy., 2300-440 220 v., with Hamilton 4-valve engine.
175-kva., General Electric, 2-ph., 60-cy., 240-v., with Skinner Uniflow engine.*

D.C. ENGINE SETS

6-kw., Milwaukee with 6 x 5 Vertical engine
10 kw., C & C, 125-v., with 6 x 6 vertical Racine engine
20 kw., Diehl, 115-v., with American Blower eng
20-kw., Crocker-Wheeler, 125-v., with Harrisburg engine.
30-kw., General Electric, 125-v., with Harrisburg engine.
50-kw., Westinghouse, 125-v., with Ames eng
50-kw., Westinghouse, 250-v., with Skinner eng.
75-kw., Crocker-Wheeler, 125-v., with Ames eng.
150-kw., General Electric, 3-wire, 125-250-v., with Erie Ball side crank engine.
150-kw., Westinghouse, 250-v., with Erie Ball engine.
150-kw., Western Electric, 3-wire, 125-250-v., engine type generator, 200 r.p.m.
225-kw., C & C, 250 v., with Hamilton, 4-valve engine.*

BELTED ENGINES

7 x 8 Sturtevant vertical.
7 x 8 Ames, [illegible] automatic
8 x 8 O & S vertical
12 x 12 Buffalo Forge, center crank automatic
11 x 12 Ames automatic, center crank.
14 x 16 Erie City, automatic.
15 x 14 Ames, automatic, side crank.

SQUIRREL CAGE MOTORS

3 Phase—60 Cycle

Hp	*Volts*	*Speed*	*Make*	*Type*
10	440-220	1740	Westinghouse	C.S.
10	440	1750	Triumph	B-8 5
10	440	1745	Allis-Chalmers	.....
10	440	1200	Fairbanks-Morse	N.I.
50	440-220	900	General Electric	I.
50	440-220	900	Fort Wayne	.....
75	440-220	900	General Electric	I.
50	440	865	Allis-Chal. (S.R.)	Y

SQUIRREL CAGE MOTORS

2 Phase—60 Cycle

Hp	*Volts*	*Speed*	*Make*	*Type*
35	220 440	900	General Electric	I.Q.
35	220-440	720	General Electric	I.Q.

DIRECT CURRENT MOTORS

Quantity of small motors, 1 hp. to 25-hp. in stock.

*Above equipment owned by us except items marked **

COLEMAN-SHOEMAKER, Inc., Office, Plant and Siding 20th and Clearfield Sts., Phila.

"HONESTLY REBUILT" ELECTRICAL MACHINERY

3-Ph., 60-Cy., 220 440-Volt Motors

Qu	*Hp*	*Make*	*Type*	*Speed*
	5	General Electric	KT	1200
	5	Wagner	BM	1720
6	7	General Electric	KT	1800
2	10	Allis	AN	1200
	10	General Electric	KT	1800
2	10	General Electric	KT	900
50	15	General Electric	KT	900
75	20	General Electric	KT	900
45	25	General Electric	KT	900
3	30	Westinghouse	CN	1200
1	30	Westinghouse	CCL	1800
55	30	General Electric	KT	900
40	35	General Electric	KT	900
21	40	General Electric	KT	900
1	50	Westinghouse	CCL	900
5	50	General Electric	KT	1200
6	60	General Electric	KT	1200
1	60	Westinghouse	CS	900
1	75	General Electric	KT	1200
	100	General Electric	KT	1200

Direct Current Motors

Make	*Kw*	*Rpm*	*Volt*
General Electric	105	[illegible]	250
General Electric	100	290	250
Crocker-Wheeler	100	900	250
General Electric	75	1200	250
General Electric	75	1200	500
General Electric	75	850	250
General Electric	70	700	250
General Electric	55	845	250
Westinghouse	50	850	250
General Electric	50	550	500
Westinghouse	50	650	250
General Electric	35	550	250
General Electric	30	1700	250
General Electric	25	750	250

3-Ph., 25-Cy., 220 440-Volt Motors

Qu	*Hp*	*Make*	*Type*	*Speed*
2	10	General Electric	KT	750
7	25	Westinghouse	CS	750
1	35	General Electric	CS	750

MILLER-OWEN ELECTRIC CO., Inc.

LEXINGTON AVE. AND THOMAS BOULEVARD **PITTSBURGH, PENNA.**

Direct Current Generators

Make	*Kw.*	*Rpm*	*Volts*
General Electric	500	360	250
General Electric	400	450	250
Allis-Chalmers	200	425	250
General Electric	150	550	250
General Electric	100	550	250
Crocker-Wheeler	75	1200	250
General Electric	60	900	250
Westg. Erie City	100	250	250
Allis Skinner	100	250	125
G. E. Buckeye	150	200	250
Westg. Ball	200	200	250
Westg. Buckeye	300	150	250
G. E. McIntosh	450	150	250
G. E. Hamilton	500	150	250

Also a number of very attractive offerings in Alternating Current Belted and Engine Driven Generators.

Motor Generator Sets

Make	*Kw.*	*D.C. Volt*	*A.C Volt*
General Electric	200	250	2300
General Electric	150	250	2300
Allis	150	500	2300
General Electric	100	250	2300
Burke	75	500	2300
Crocker-Wheeler	75	250	220 440
Allis	75	250	2300
General Electric	65	250	220 440
General Electric	50	250	220 440
Westinghouse	50	125	220, 440

A. C. Motors

Make	*Hp*	*Rpm.*	*Cycles*
General Electric	750	514	60
General Electric	750	750	25
Crocker-Wheeler	600	514	60
Westinghouse	400	450	60
General Electric	300	500	25
General Electric	275	600	60
General Electric	200	450	60
General Electric	150	720	60

Independent Electric Machinery Co.

Twentieth and Central Sts., Kansas City, Mo.

SEE THE INDEPENDENT FIRST

PARTIAL STOCK LIST

All Apparatus Listed Below in Stock for Prompt Shipment

SEE THE INDEPENDENT FIRST

3-Ph., 60-Cy., ALTERNATORS

2—20-kva., 2300-volt, 60-cycle, 3-phase, 1800-r p m., Type A B. Fairbanks-Morse Belted Alternators, complete with exciter and etc.

1—62-kw., 2200-volt, 60-cycle, 3-phase, 300-r.p.m. Bullock Alternator, direct connected to an Aimes steam engine, all complete

1—75-kva., 2300-volt, 900-r.p.m., Rev. Field Belted Allis-Chalmers complete with belted exciter.

1—100-kva , 2300-volt, 3-phase, 60-cycle, 900 r.p.m., W. E. Belted Alternator complete.

2—100-kw., 440-volt, 60-cycle, 3-phase, 3600-r.p.m. General Electric Curtiss type turbines, complete with jet condensers for each machine, driven by steam pumps, two synchronous motor generator exciter sets, one Curtiss turbine exciter set, all complete with necessary rheostats and nine-panel switchboard.

1—150-kva., 2300-volt, 720-r p m. Rev. Field Belted Elec. Machinery Co., complete with belted exciter.

3 Ph., 60 Cy., 220/440 Volt Motors

No.	Hp.	Make	Speed
4	30	G. E., New	1200
6	30	Robbins & Myers	1150
1	30	Allis-Chalmers, Rebuilt	860
1	30	W. E., Rebuilt	900
1	30	G. E., slip ring, New	900
4	30	G. E., Rebuilt	1200
2	30	F.-M., Rebuilt	1200
1	30	Westg., 2200-v., Reblt.	1120
1	35	Wagner, Rebuilt	1730
1	35	Wagner typeBW Reblt.	900
6	40	Watson, Rebuilt	1200
3	40	Watson, New	1200
1	150	G.E., slip ring, Rebuilt.	695

220-VOLT, D. C. GENERATORS

Kw.	Make	Speed
2—15	Imperial	900
1—30	Northern	650
1—40	Western Electric	775
1—60	Commercial	700
1—75	Fairbanks-Morse	750

220-VOLT, D.C. MOTORS

Hp.	Make	Speed
1— 25	Crocker-Wheeler, Re.	750
2— 30	G. E. (vertical)	1500
1— 35	Westinghouse	1420
2— 35	Crocker-Wheeler	750
1— 40	Jenny	2000
1— 100	Westinghouse	450
1— 110	Crocker-Wheeler.	560

Direct Current Engine Sets

1—100-kw., 220-volt, 400-amp., 225-r.p.m., comp. wd. Jenny Generator, direct connected to 14 x 18 Four-valve Ideal steam engine.

2—100-kw., 220-volt, 150-r.p.m. Western Elec. Generator, direct connected to Fitchburg Tandem comp. steam engine.

1—400-kw., 220-volt Western Electric compound wound Generator, 140-r.p.m., direct connected to 18x28x30 Fitchburg tandem compound steam engine.

BALANCER SETS

2—5-kw , Type CCM, 125-volt, 1500-r p m , 35-amp. Crocker-Wheeler, 2 bearing.

1—5-kw., 110-volt, 45-amp , 1250-r p m. Gregory, 2 bearing

1—15-kw., 110-volt, 1250-r.p.m. Jenny, 2 bearing.

2—20-kw., 115-volt, 1200-r.p.m , type EOB4 Western Electric, 4 bearing and coupling.

1—27½ kw., 115-volt, 1025-r.p.m., type EB4A Western Electric, 4 bearing and coupling

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JUST PURCHASED LOT OF

500 NEW MOTORS

From Manufacturers of Special Machinery in Original Crates

WAGNER MOTORS

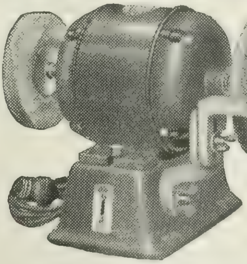
Split Phase, Continuous Duty, 40 Degrees
¼ Hp., 110 Volt, Single Phase, 60 Cycle, 1725 R.P.M.
with Pulley

$14.50

Discounts in Quantities
Complete Stock of Motors up to 200 H.P.

500 MARATHON OK $25.00

Grinder and Buffer, complete with Motor



thoroughly efficient shop tool, solidly built for long service.
Weighs 38 lbs. bare or 52 lbs. boxed.
Driven by ¼ hp., motor, guaranteed for 1 year.
Has 6-inch Grinder and 6-inch Buff.
Other makes ask $15.00 to $65.00.

Davis Machine & Motor Co., Inc.

59 Mechanic Street, Newark, N. J.
Tel. Market 8580

Compare These Motor Prices

These are only a few of the bargains we offer, picked at random from our large stock.

New Motors

Hp.	Make	Ph.	Cy.	Type	Volts	Rpm.	Price
550	Cr.-Wh.	3	60	Sl. ring	2200	1170	$1875.00
60	Gen. Elec.	3	60	KT.	220	1160	555.00
4— 50	Gen. Elec.	3	60	Sl. ring	440	690	959.00
8— 50	Gen. Elec.	3	60	Sl. ring	220	1200	792.00
50	Gen. Elec.	3	60	Sq. cage	550	600	600.00
40	Westghse.	3	60	CS.	220	1200	440.00
40	Gen. Elec.	3	60	Sl. ring	220	1200	711.50
30	Gen. Elec.	3	60	Sl. ring	440	720	749.75
2— 25	Gen. Elec.	3	60	Sl. ring	220	1200	573.50
12— 25	Gen. Elec.	3	60	KT.	220	1200	302.00
20	Gen. Elec.	3	60	Sl. ring	220	1200	473.00
5— 20	Gen. Elec.	3	60	KT.	220	1200	267.00
15	Gen. Elec.	3	60	Sl. ring	220	1200	422.00
4— 15	Gen. Elec.	3	60	KT.	220	1800	216.00
10	Gen. Elec.	3	60	Sl. ring	440	1200	388.00
5— 10	Bell	3	60	Compensat.	220	1800	216.00
6— 10	Gen. Elec.	2	60	KQ.	220	1200	216.00
6— 7½	Bell	3	60	Compensat.	220	1800	190.00
13— 5	R. & M.	3	60		220	1700	94.00
15— 3	Gen. Elec.	3	60	KT.	550	1800	75.00
200— ¼	W. E.	1	60	SA	110	1800	17.75
55— ¼	W. E.		DC	SD	110	1725	18.75

Used Motors

Hp.	Make	Ph.	Cy.	Type	Volts	Rpm.	Price
400	Westgnse.	3	60	Synchron.	2200	450	$1000.00
200	Gen. Elec.	3	60	Sl. ring	2200	600	1400.00
200	Gen. Elec.	3	60	Wound ro.	220	580	975.00
200	Westghse.	2	60	Sl. ring	220	580	1275.00
133	Gen. Elec.	2	60	Synchron.	2200	900	600.00
150 kva.	Stanley	2	60	Alternator	2400	900	550.00
2—100	Gen. Elec.	3	60	Sl. ring	440	514	1100.00
75	Gen. Elec.	3	60	Sl. ring	2200	900	825.00
75	Burke	2	60	Sq. cage	220	360	750.00
2— 50	F.-M.	3	60	Sq. cage	220	900	325.00
2— 50	Burke	3	60	Sl. ring	220	1200	475.00
50	Westghse.	3	60	Sq. cage	440	580	500.00
50	Allis-Chal.	3	60	Sq. cage	2300	850	500 00
3— 50	Gen. Elec.	2	60	Sq. cage	220	865	400.00
50	Gen. Elec.	3	60	Wo. rotor	220	514	600.00
50	Gen. Elec.	3	25	Sq. cage	220	715	400.00
40	Westghse.	2	60	Sq. cage	220	1120	300.00
40	Allis-Chal.	3	25	Sq. cage	440	720	375.00
2— 37	Gen. Elec.	3	60	Sl. ring	220	750	450.00
3— 35	Lincoln	3	60	Sq. cage	440	1200	245.00
2— 30	Ideal	3	60	Sq. cage	440	1150	300.00
2— 30	Westghse.	3	25	Sq. cage	220	710	300.00
30	Gen. Elec.	3	25	Sl. ring	220	500	500.00
2— 25	Wagner	3	60	Sl. ring	440	1150	375.00
3— 20	Westghse.	3	25	Sq. cage	220	720	265.00
2— 15	Westghse.	3	25	Sq. cage	220	700	200.00

Direct Current

90	Cr.-Wh.	Comp. wo.	500	690	575.00
90	Diehl	Shunt wo.	240	460	575.00
90	Gen. Elec.	Comp. wo.	220	625	775.00
90	Westghse.	Comp. wo.	220	675	625.00
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1 - 47	Westghse.	Comp. wo.	500	600	375.00

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¼ hp. Westinghouse, A.C.	$14.00
1/3 hp. Westinghouse, 1140 r.p.m., A.C.	29.00
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1/3 hp. Westinghouse, 32 volt, D.C.	25.00
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Send for Complete List and Prices

210-220-*Volt D.C. Motors*

	HP.	R.P.M.	MAKE
2 —	2	1750	Peerless
1 —	2	1150	Western Elect RC
1 —	3	1650	G. E. C.V.C.
1 —	3	1050	Crocker-Wh. MC
1 —	5	1150	Westinghouse S.
2	5	1650	G. E. C.V.C.
1	5	950	Crocker-Wheeler
1	7½	1525	G. E. C.V.C.
1 —	7½	1200	Robbins & Myers
1 —	10	850	Crocker-Wheeler
1 —	10	1050	Westinghouse, S
1 —	15	1750	Westinghouse, SK
1 —	20	600	Peerless
1 —	20	1300	Westinghouse S.
1 —	25	875	Crocker-Wheeler
2 —	27½	600	Northern
1 —	30	650	Bullock
1 —	40	680	Western Elect
1 —	40	450	Northern Comp.

220-440-*Volt*, 3-*Phase*, 60-*Cycle*, *A.C Motors*

	HP.	R.P.M.	MAKE
3 —	3	1800	Lincoln (new)
1 —	3	1800	Gen Elec.
1 —	3	1800	Wagner
1 —	3	1200	G. E., Slip-Ring
6 —	5	1800	Lincoln (new)
1 —	5	1200	Lincoln, new
1 —	5	720	Gen. Elec., KT
1 —	7½	1200	G. E. (new)
1 —	7½	1200	Gen. Elec., KT
1 —	10	1200	Western Elec.
1 —	10	1200	G. E. (new)
1 —	15	1200	Westghse., C.C.L
1 —	15	720	Crocker-Wheeler
1	20	1200	Wagner (new)
2	40	1150	Allis-Chalmers
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1 —	100	1150	Gen. Elec.

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1—100 hp., 900 r.p.m., 3 ph., 220-v., 60-cy., new G. E. Motor.
13—50-hp., all speeds, 3 ph., 220 or 440-v., 26- or 60-cy.
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1—100 kw., 900 r.p.m., 3 ph., 2300 v., 60-cy., G. E. Generator.
1—30-kw., 110-v., D.C., Western Elec. Vertical Eng. Generator Set.
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Large stock A.C. and D.C. Motors and Generators. All sizes.

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1—30 kw. 125 v., 350 r.p.m., Bullock generator, direct connected to 1—Skinner automatic steam engine, complete with valves, piping, and switchboard
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1—150 kw., 250-125 v., D.C., 3-wire engine generator set, consisting of 2—75 kw., 125 v., D.C. Burke generators, mounted on common shaft, and coupled to 1—Fleming Harrisburg single cylinder, 2 valve, steam engines, to operate on 125 lb. steam pressure, complete with all accessories, including switchboard

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1—150 kw., 125-250 v., cp. wd., 1200 r.p.m., Westinghouse, rotary converter, complete with transformer for 2200 v., high tension, 3 ph., 60 cy., 187 v., low tension, with starting taps, complete with starting equipment
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No.	*Hp.*	*R.p.m.*	*Type*	*Make*
3	40	1200	IK	Gen Elec
4	40	1200	CS	Westghse
1	75	720	IM-Sl.Rg.	Gen Elec.
1	100	900	CS-Sq.Cg.	Westghse.

3-Ph., 60-Cy., 240/480-V. Alternators

No.	*Kva.*	*R.p.m.*	*Type*	*Make*
1	90	900	AB	Fair.-Mor.
1	125	900	ATB	Gen. Elec.

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No.	*Kw.*	*R.p.m.*	*Volts*	*Type*	*Make*
1	150	575	250		Ridgeway
1	50	950	250	H	Bullock

1—30 kw., 125 v. Ideal Generator, direct connected to 3-ph., 60-cy., 220-volt Ideal Motor.
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1—50 hp. Allis-Chalmers Induction Motor, continuous duty, 110 v., 3 ph., 60 cy., speed 965, 40 deg., complete with Cutler Hammer starting controller, oil circuit breaker, base and 14 in. x 9 in. belt pulley
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2—450 b.hp. vert. 6 cyl. coupled to 3 ph., 60 cyc., A.C. generators
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1—120 b.hp. vert. 3 cyl. coupled to 85 kw., 3 ph., 60 cy., 2300 volt genr.
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1—60 b.hp. vert. sgl. cyl. 2 cyc. bltd.
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1—150 b.hp. vert. 3 cyl. coupled to 100 kw., 250 v. D.C. Genr.
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Feed Water Heaters

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1—16 x 27 x 16, 300 Indicated H.P. Westinghouse Automatic Compound Engine complete, in good operating condition. 150-kw., 110-220-v., Duplex Compound Wound, Direct Current Generator, Speed 300 r.p.m., 26 ft. of 30-in. wide, double ply endless leather belt. This Generating Set is being taken out and replaced by a 1000-kw. Steam Turbine. Will be sold as a unit or in parts, also 125-hp. Westinghouse Automatic Compound Engine, complete, in good operating condition.

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2—New Worthington 1000 G.P.M. against 635 ft. head (with base for 300 hp. motor.)

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Four 8 x 10 Gould Vertical Triplex, 350 G.P.M., 150 pounds water pressure, brass valves, direct driven by 40 HP., 440 Volt, 3 Phase, 60 Cycle, Westinghouse Slip Ring A.C. Motor, or without motor.

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1 Style F 20 Selector, capacity switchboard with 21 selectors installed.
10 Desk Phones No. 930, 33 pts. on dial.
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System complete for 21 phones without storage battery.

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A.C. 2300 V. 3 Phase, 60 Cycle Generators

2—A.T.B., 900-rev., 112½-kva. G. E. Generators, with dir. conn. exciters used about one year, good as new. Belted.

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1—250-kw., 250-rev., 250-v., 3 bearing Electric Machinery, excellent condition.

D.C. MOTORS

3—35-hp., 400-rev., 220 v., Electric Machinery.
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5—25-hp., 650-rev., 220-v. Allis-Chalmers.
2—25-hp., 800-rev., 220-v., R. C. Type, Gen. Elec., nearly new.

All of above complete with starting boxes, pulleys and rails.

Two Spot Welders

25 kw. and 10 kw.

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G. E. Induction Voltage, Type I. R. S.-2.
11.5 K. V. A. 50 amp. 2300 v.

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20—18 x 36 Corliss Engines, 350 HP., heavy duty mill type, either right hand or left hand. Fly wheel 11 ft. x 32 in. Can furnish either new or used. Complete specifications and photographs on request.

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GENERATOR

1—40-kw. General Electric, 1050 r.p.m., form H, 125-v., D.C., with switchboard.

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0230

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Purchased for the U.S. Army

THE alert Electrician Contractor will find use for many of the items included in this sale. They are too widely varied in character to completely itemize in this advertisement, but there is a place and use for each one—at a good profit for the man who can connect the goods and the need. If you are a *merchandiser* this is *your* opportunity.

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- Switch boards
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- Motor bases
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- Circuit breakers
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- Generators
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- Fuses
- Spark plugs
- Electric glue pots
- Electric time recorders
- Reflectors and shades
- Searchlights
- Starters
- Transformers and motors

Get the complete catalog of the sale. There are many items of interest to Electrical Contractors among the other classifications of material, and you should check them carefully. Go to Buffalo, if possible.

U.S. AIR SERVICE

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Commanding Officer, Curtis-Elmwood Air Reserve Depot,
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Largest stock of its kind in
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GENERATOR

1000-1500 kw., direct current railway generator, 600-600 volts, compound wound, 300 r.p.m., complete with bedplate, field rheostat, etc., with shaft suitable for direct connection to synchronous motor which we now have.

**Portland Railway, Light
and Power Company**
Electric Building, Portland, Oregon.

WANTED TO BUY

TURBINE EXCITER

Second Hand Steam Driven, 25 kw. 125 volt compound wound 150 lb. steam, no superheat, geared or direct drive. Give full description and price.

Northwestern Engineering & Supply Co., Ltd.
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Used D. C. Watthour Meters

G. E. or Westinghouse Mfg., Type C or C 6
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ARMATURE winder, experience on A.C. and D.C. machines; permanent and steady position to right party; state age, experience and salary expected. Smith-Bishop Electric Co., P. O. Box 216, Owensboro, Ky.

ELECTRICAL graduate wanted to act as assistant to distribution engineer; good education necessary, also experience in overhead and underground distribution; location vicinity of New York City. P-29, Elec. World.

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POSITIONS VACANT

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OPERATING engineer wanted by an industrial concern in Jersey City, N. J., having two steam boilers, steam-driven electric generator, numerous electric motors and electric-driven refrigerating plant. Applicant should have experience in the operation of the above as well as thoroughly understanding economies in steam for steam is used in the process of manufacture. Position is permanent. State age, experience and references. P-35, Elec. World.

RADIO engineer wanted by large electrical manufacturing company. Applicant should be technical college graduate in electrical engineering, with experience in experimental radio development problems involving both transmitting and receiving. None but high grade development engineers need apply. State age, education and experience. Address P-988, Elec. World.

SALES manager for city of 30,000; both gas and electric appliances; modern salesroom; good field, state of New York. P-5, Elec. World.

SWITCHBOARD and panelboard draftsman for template layout work; must be rapid and accurate and thoroughly familiar with panelboard construction; must have sufficient electrical knowledge to understand common systems of wiring distributions for light and power; excellent chances for advancement for the right party. P-6, Elec. World, Real Estate Trust Bldg., Phila., Pa.

WANTED—Electrical engineering graduate with experience selling induction motors. The Electric Controller & Mfg. Co., Cleveland, Ohio.

EMPLOYMENT AGENCIES

GENERAL ENGINEERING AGENCY, Pittsburgh, serving employers everywhere overnight. Proposals gratis, require superintendents, electrical engineers, design draftsmen, factory foremen, electricians, metermen, winders, salesmen, auditors, office managers, power maintenance engineers, hydroelectric operators.

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A LEADING organization desiring to fill an important position, for obvious ethical and other reasons, cannot invite directly the candidacy of any particular man. Similarly, no well-connected man will exploit personally his own qualifications, no matter how receptive he may be to overtures. The undersigned has been retained by a national clientele for many years, as a medium for negotiating preliminaries in such cases. Your permission to send booklet discussing this problem and describing the service, will in no degree obligate or compromise you. Strictly confidential. R. W. Bixby, Inc., 310 Lockwood Building, Buffalo, N. Y.

ENGINEERS

Men with college training in engineering or the physical sciences, may obtain permanent positions in our Central Office Engineering Division. Practical telephone experience may take the place of college training.

Write, or call at our Employment Office.

WESTERN ELECTRIC CO., INC.
48th Ave. & 24th St.
Chicago, Ill.

EMPLOYMENT SERVICE

PROFESSORS, assistant professors and instructors of technical and engineering subjects wanted immediately for colleges and universities; write fully; no advance charge. Educators' Department, H. H. Harrison & Co., employment service, 19 S. La Salle St., Chicago, Ill.

POSITIONS WANTED

AUDITOR or accountant, with 6 years' experience in public utility accounting, mainly electric and gas, desires to make change; references furnished. PW-28, Elec. World, Old Colony Bldg., Chicago, Ill.

CHIEF electrician, high grade man, fifteen years' practical experience in industrial power and lighting, power plant and substations, desires permanent position; excellent organizing and managing capacity; ten years in charge of work; references. PW-997, Elec. World, Leader-News Bldg., Cleveland, O.

DEVELOPMENT engineer, university graduate, with 3 years' experience in development of manufacturing processes with large electrical manufacturing company, desires development of electrical apparatus or any line of work requiring the practical application of the fundamental engineering laws; age 27. PW-18, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer, age 30, married, completed graduate students' engineering course of General Electric Company. Experienced in high-tension transmission and distribution, also industrial plant applications. PW-2, Elec. World, Real Estate Trust Bldg., Phila., Pa.

DESIGNER, technical graduate, experienced on generating and substation layouts, transmission line work and hydroelectric developments, wants position. PW-31, Elec. World.

ELECTRICAL engineer, age 43, technical education; 26 years' unusually broad experience; electrical machinery design, all types, commercial and automotive; also sales service and business management and industrial engineering; available July 1. PW-12, Elec. World, Leader-News Bldg., Cleveland, O.

ELECTRICAL mechanical engineer of 23 years' experience, familiar with modern power plant equipment, operation and combustion, transmission and distribution, etc.; superintendent with public service corporation and municipal utilities; A-1 recommendation submitted. PW-14, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL superintendent; technical education; 18 years' experience in manufacturing and repairing of dynamos, electrical machinery; good organizer, capable of handling men and building an efficient organization; at present with large Middle-Western repair company; A-1 reference; available within one month after an agreement. PW-22, Elec. World, Leader-News Bldg., Cleveland, O.

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POSITIONS WANTED

ELECTRICAL, 18 years' technical at practical experience, layout, testing, installation, maintenance operation in power and industrial plants, desires permanent position. PW-993, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer, age 32, having 15 years' experience, desires responsible position. Experience covers power plant operation and construction, teaching electrical subjects, winding and redesigning, batteries, telephone engineering, general wiring; familiar with steam, gas and machine shop practice; good business training and interested in selling or executive positions. PW-23, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer, technical graduate, 17 years on drafting, designing and construction power stations, sub-stations, electrical transmission lines, also operating work, desires position as engineer or superintendent with large system; now employed in charge of thirty men; age 38, married; member of A. I. E. E.; can handle men and produce results. PW-19, Elec. World, Real Estate Trust Bldg., Phila., Pa.

ELECTRICIAN. 10 years' practical experience in installing, maintenance and general repair of all types electrical equipment; expert A.C. and D.C. Armature winder. Only permanant and steady position preferred (Middle West); available at once. PW-991, Elec. World.

ENGINEER, technical graduate; age 21; desires position as assistant engineer or construction and wiring man, in the Central West states. PW-8, Elec. World, Old Colony Bldg., Chicago, Ill.

ENGINEER, technical graduate, wide experience in general electrical and mechanical engineering in connection with steam electric power plant and industrial equipment, design, construction, maintenance, test and report work, wants position; location anywhere. PW-30, Elec. World.

ENGINEER, graduate, desires position as chief electrician or assistant maintenance engineer of an industrial plant; 2 years' mechanical, 4 years' electrical construction and maintenance; age 29. PW-24, Elec. World.

EXECUTIVE, graduate electrical engineer, age 32, single, desires responsible commercial position with public utility company; 11 years' broad engineering and commercial experience with gas, railway and electric companies covering operation, construction, power sales, rates, statistics, etc. PW-20, Elec. World, Leader-News Bldg., Cleveland, O.

GENERAL line foreman. American, 45, married, 25 years' practical experience, electric light, power trolley construction and maintenance, 15 years having complete charge lineman and construction departments; will accept position East or West where living conditions are good and position permanent. P. O. Box 652, Bristol, Virginia.

GRADUATE electrician wants work; can do house wiring, testing, meter work, A.C. and D.C. armature winding, reconnect motors, motor generator repair and maintenance. Joe Frankovich, Washoe, Mont.

MARRIED man, age 27, wishes position as assistant in meter department, sub-station or power plant; correspondence course on meters and 4 years machine shop. PW-17, Elec. World.

MECHANICAL engineer, 13 years' experience in factory equipment, layout installation and maintenance, familiar with boilers, economy power generation and distribution in large manufacturing plants. PW-998, Elec. World, Real Estate Trust Bldg., Phila., Pa.

POSITION wanted as central station operator or power house superintendent; familiar with up-to-date systems, also those used for 20 years; can make any necessary repairs; used to steam or water driven plants; middle-aged, single, Yankee. PW-15, Elec. World, Old Colony Bldg., Chicago, Ill.

RADIO and general electrical experience of a young man of 30 available on or after June first. Desire connection preferably with some large organization, shop or store intending to develop their radio and electrical trade. PW-987, Elec. World, Leader-News Bldg., Cleveland, O.

POSITIONS WANTED

RADIO man, with 4 years' experience in Navy radio laboratory, designing and testing radio apparatus, condensers, meters, etc., and 4 years as a radio operator, would like to connect with good concern. PW-16, Elec. World.

SUPERINTENDENT of construction, competent to take full charge electrical distribution, electric light, power or trolley; 25 years' practical experience; married and will go any place where living conditions are good; state salary and particulars, size of distribution, also condition same is in. PW-10, Elec. World, Real Estate Trust Bldg., Phila., Pa.

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Condensed course in electrical engineering. Complete in one year. For men of character, ambition and limited time. Diploma in one year. Theoretical principles and practical applications of electricity, mathematics, steam and gas engines, mechanical drawing, extensive shop work. Construction, installation, testing. Fireproof dormitories, dining hall, laboratories, shops. 30th year begins Sept. 27th, 1922. Write for catalog. 428 Takoma Ave., Washington, D. C.

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We are looking for a sales or industrial engineer to handle our line of electric motor control apparatus in the Philadelphia territory which includes the eastern half of Pennsylvania, southern half of New Jersey and part of Delaware. Our line is well established in the territory though a great deal of missionary work remains to be done. Position offers very good opportunity and future for man who is not looking for sinecure; compensation based on salary and bonus. AS-33, Elec. World.

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Wanted to get in touch with a first-class electrical salesman to take charge of sales in number of small towns and do house to house solicitation. This position is open in the Middle-West. AS-26, Elec. World, Old Colony Bldg., Chicago, Ill.

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With experience in selling phonographs to jobbers and dealers to become traveling sales and service engineer for long established firm manufacturing and distributing highest grade radio equipment. Character references required. Man of good education with some knowledge of fundamental principles of electricity preferred. Write stating age, education, experience and salary desired. AS-994, Elec. World.

Wanted—Young Man

To sell insulated wire. A knowledge of the trade would be an advantage. Write, giving full particulars, AS-21, Elec. World.

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Representation in Great Britain

Electrical engineer, returning to London, is desirous of introducing one or more lines not already represented there; has wide acquaintance in engineering circles. SR-27, Elec. World.

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With offices and showrooms in Central London are open to accept agencies for wireless sets, motors and electrical apparatus of all kinds. Colley Ltd., 51 Great Ormond Street, London, W. C. 1.

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One 25 kw., 3,600 r.p.m., 125 v. non-condensing turbo generator set, completely rebuilt; f.o.b. cars Terre Haute, Ind.; price right. Write, wire or phone Power Supply Co., Terre Haute, Ind.

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PROPOSALS FOR 4 DIESEL ELECTRIC SEAGOING HOPPER DREDGES. Office Chief of Engineers, Room 2802, Munitions Bldg., Washington, D. C.—SEALED PROPOSALS will be received here until 12 o'clock noon, August 2, 1922, and then opened, for the construction of 4 Diesel Electric Seagoing Hopper Dredges. Further information on application.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 15, 1922.—SEALED PROPOSALS will be opened in this office at 3 p.m., June 29, 1922, for supplying to the various Federal Buildings, Marine Hospitals, and Quarantine Stations under the control of the Treasury Department, portable desk lamps during the fiscal year ending June 30, 1923, in accordance with the drawing and specifications, copies of which may be had at this office in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 19, 1922.—SEALED PROPOSALS will be opened in this office at 3 p.m., June 30, 1922, for supplying to the various public buildings under the control of the Treasury Department hand electric portable vacuum cleaners during the fiscal year ending June 30, 1923, in accordance with the specifications, copies of which may be had at this office in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

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Electrical Resistance Wire

For electrical measuring instruments and resistance Units requiring extreme accuracy; Temperature coefficient nil.

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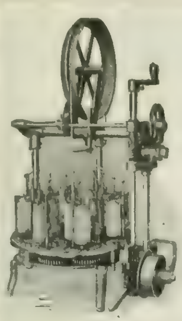

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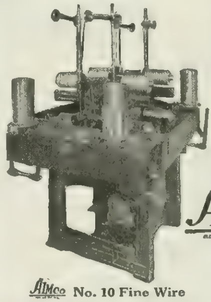

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Around hydro-electric power stations or in sections of the country where the atmosphere is moisture laden—"Sherarduct" should protect your current carrying wires and cables. "Sherarduct" is rust proof inside and outside. This is an important feature because it often becomes necessary to replace wires—and if the interior of the conduit is rusted, IT CAN'T BE DONE.

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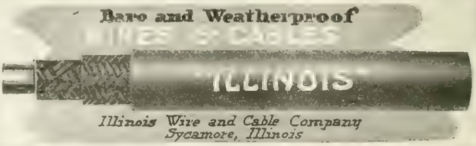

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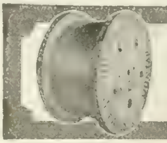

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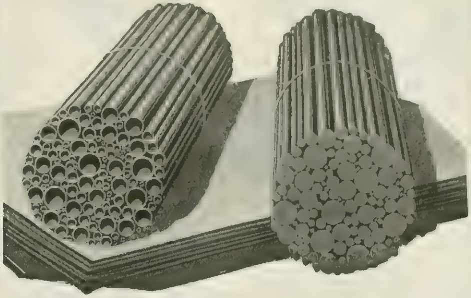

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Be Sure to Specify

"Wilmington Fibre"

Sheets Rods Tubes
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"FYBEROID"

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Wilmington, Del. Branch Offices "Everywhere"

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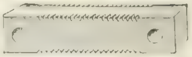

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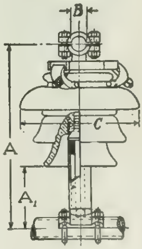

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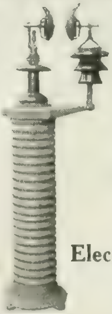

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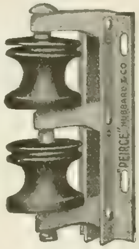
For Vertical Secondary Distribution



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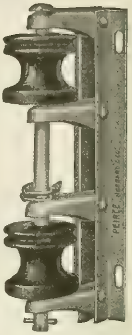

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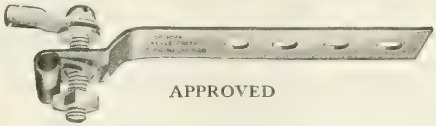

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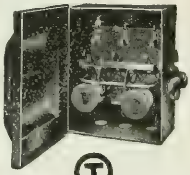

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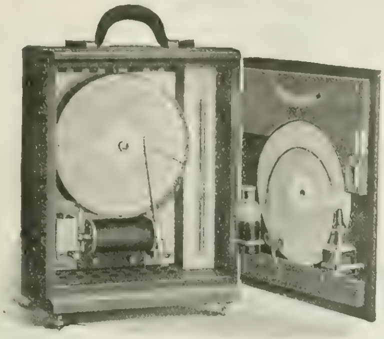

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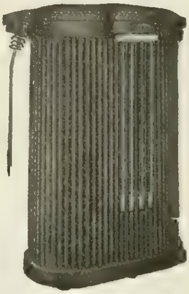

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users pay less for repairs. They enjoy more continuous and more consistent service from their transformers.

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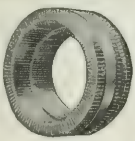

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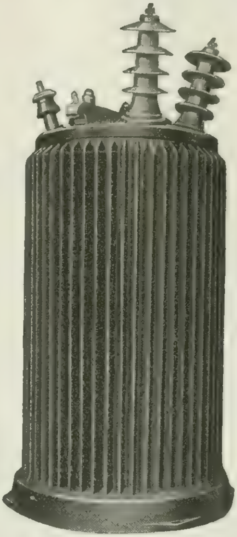

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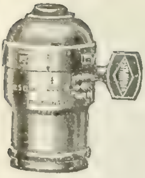
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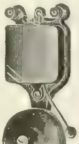
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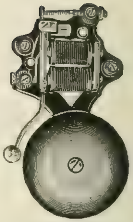
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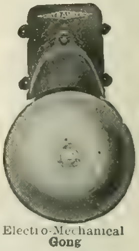
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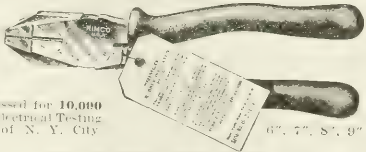

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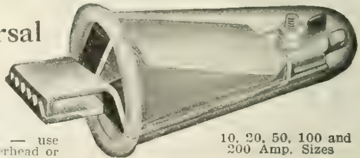

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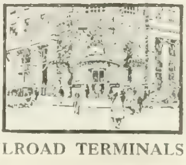

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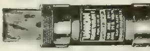

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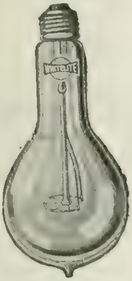

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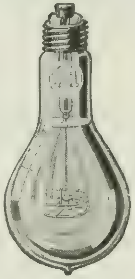

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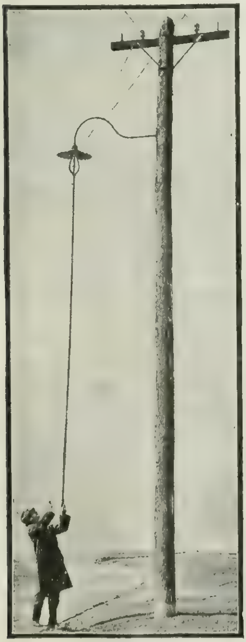

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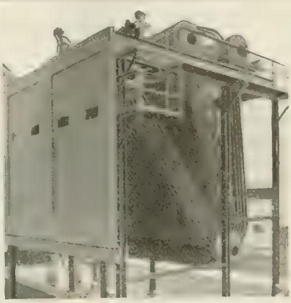

This picture shows a 1058 H P unit at Andrews Steel Co., Newport, Ky.

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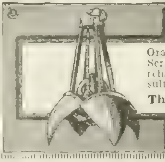

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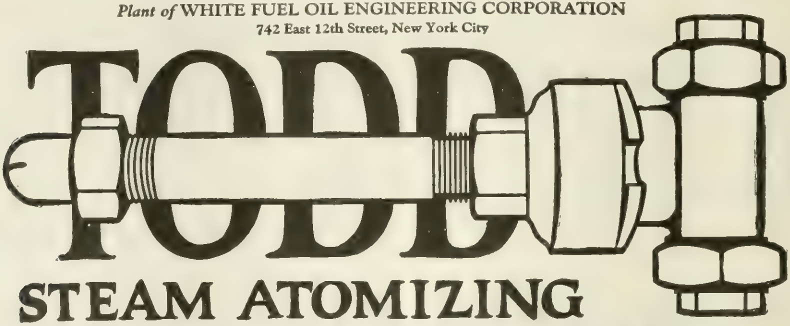

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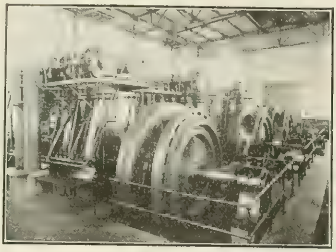

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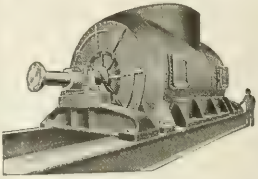

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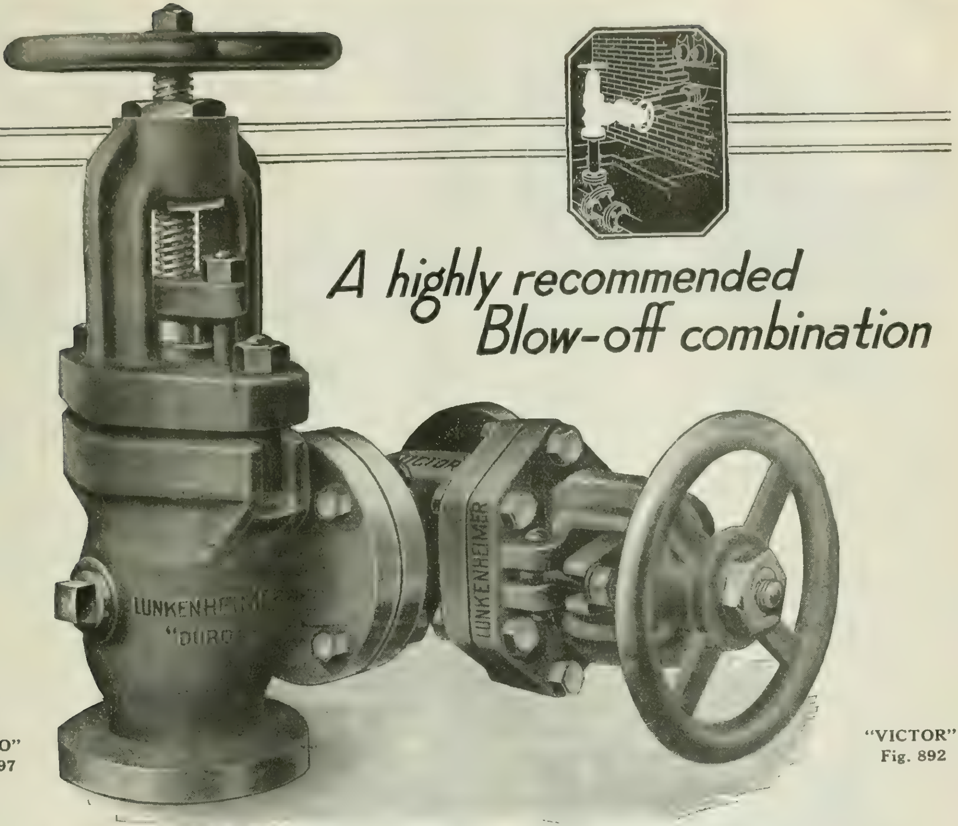

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"DURO"
Fig. 897

"VICTOR"
Fig. 892

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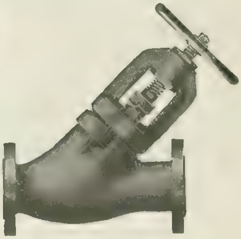

Fig. 1352
Straightway or
Y Pattern

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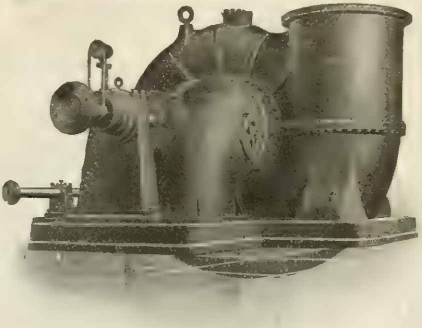

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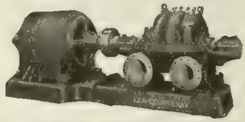

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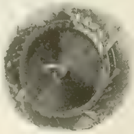

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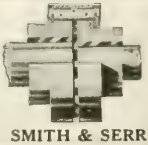

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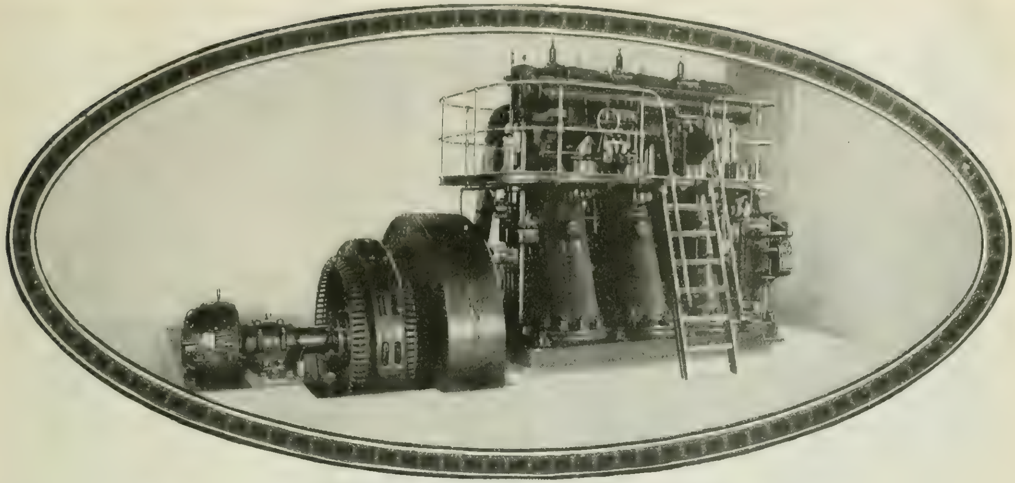

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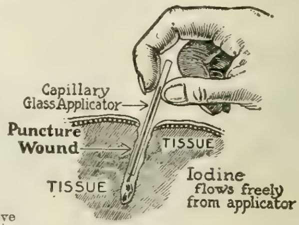
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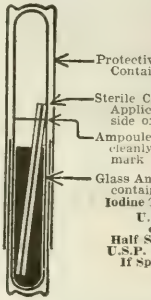
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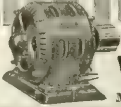

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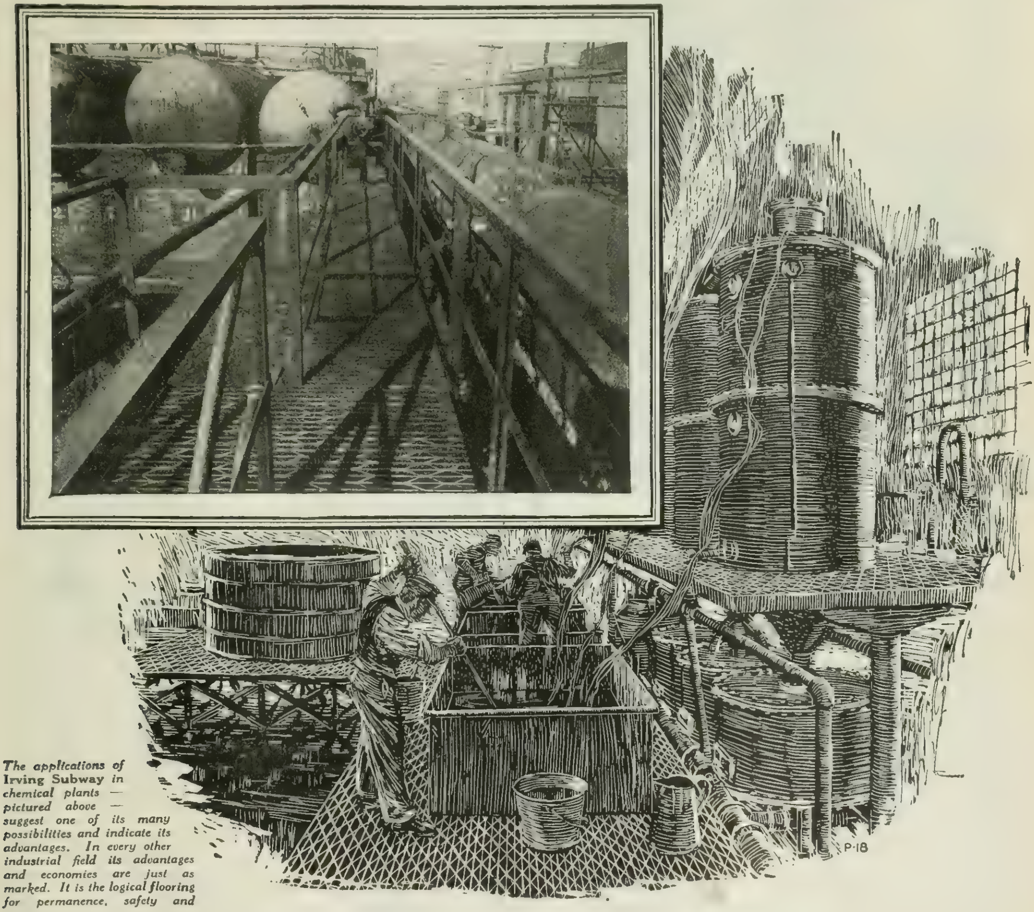

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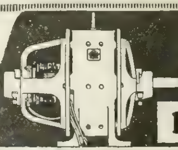

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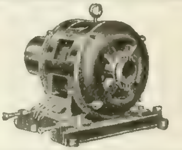

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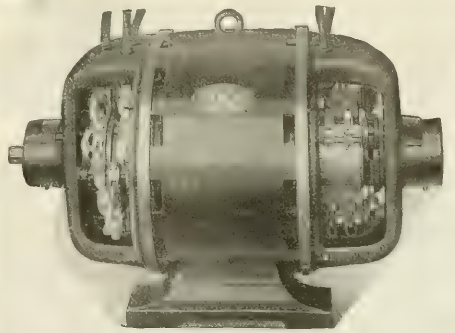

Economical Battery Charging with the New MARTIN Converter

The "Martin" Rotary Converter is self-starting and has been designed to replace motor generators and rectifiers for charging batteries. The use of this improved converter eliminates the loss of the motor end of motor-generator sets and does away with the high maintenance cost of Mercury rectifiers.

The ease with which these converters can be started and operated recommends their use in a variety of installations. They are as simple to start as a motor and require about the same attention in the matter of oiling and care.

The "MARTIN" rotary with charging panel is a very compact unit, self-contained, and these advantages reduce the cost of installation.

Complete description sent on request.

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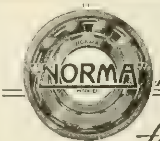

NORMA PRECISION BEARINGS for FRACTIONAL HORSE-POWER MOTORS

THE NORMA COMPANY OF AMERICA
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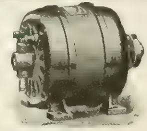

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For fifteen years we have been designing and building fractional motors for the most critical buyers. Are you interested in having that new machine of yours equipped with a motor that will give uninterrupted service? Your answer will undoubtedly be yes

Our engineering department will be pleased to make recommendations. No obligation.

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Generators and Generating Sets

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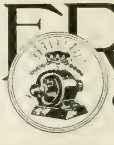

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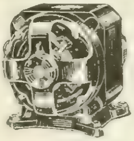

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Ball Bearing Repulsion Induction
Single Phase Motors

Competitive in price
Superior in performance and construction.

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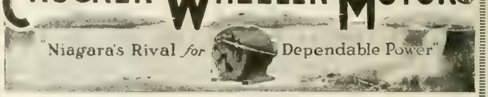
"Niagara's Rival *for* Dependable Power"

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When Quiet Operation is required

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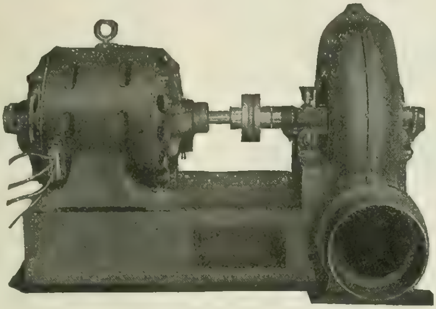

Five horsepower motor direct connected to a pressure blower

Their construction and design are such as to reduce to a minimum the inherent magnetic humming and vibrations, not only while starting, but also while running under full load. This fact makes them very desirable for operating such apparatus as church organ blowers, vacuum cleaners, refrigerating machines, heating and ventilating fans for public buildings, etc.

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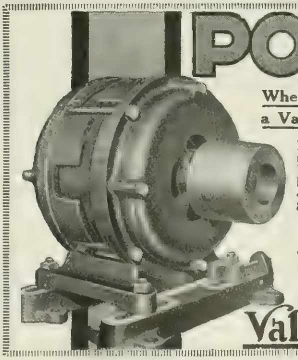

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When you need power put a Valley Motor on the job.

It will deliver now—and many years from now. Valley Motors are built to last, are all ball-bearing, all 40° rise and best ventilated. Sizes from 1-2 to 30 h. p.

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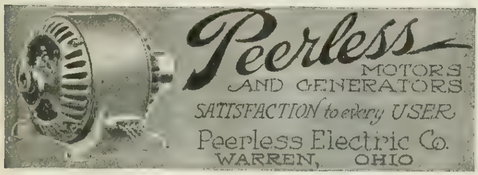
Valley Motors



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SATISFACTION to every USER
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Sales Agents Underwood Electric Co., Cincinnati; W. T. Osborn, Kansas City

MARBLE-CARD MOTORS
Builders of Direct Current Ball Bearing Commutating Pole Motors of ¼ H.P. to 60 H.P. at Induction Motor Speeds.
Bulletin 200 contains complete information.
Marble-Card Electric Company
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Built to a Standard

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Advertised in this Issue with Names of Manufacturers and Distributors

Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

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Ganschow

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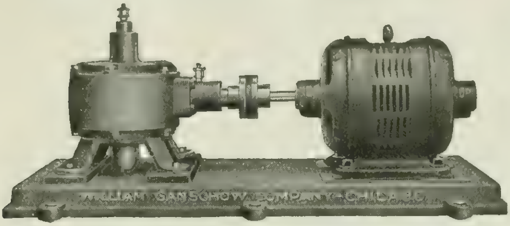

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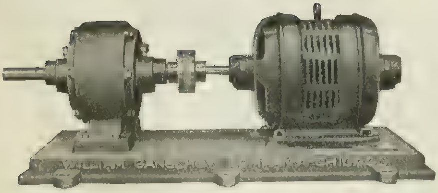
WHEREVER a motor is installed to drive a given unit at a given speed there should be a Ganschow Speed Transformer installed.

This method of transmitting power from motor to machine is done without pulleys, belts, chains, gears or shafts or the need of attention that other forms of reduction require.

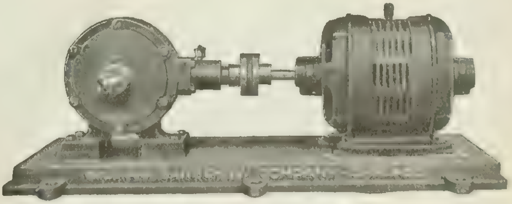
By virtue of its simple construction there is but little resistance encountered. Dust, smoke or fumes will not injure Ganschow Speed Transformers. They can be installed anywhere at small expense.

Ganschow Speed Transformers are made in several designs and sizes, for reductions as high as 250 to 1 and from ½ to 100 H.P.

William GANSCHOW Company
Chicago, Illinois



Ganschow Direct Drive Speed Reducer



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Philadelphia Evening Bulletin

Oil Burners
Todd Shipyards Corp.

Oil Engines (See Engines)

Oils
Fuel
Empire Refineries, Inc.
Lubricating
Empire Refineries, Inc.

Packing
Johns-Manville, Inc.

Panel Boards
Adam Electric Co., Frank
General Electric Co.
Trumbull Vanderpool Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Panels, Switchboard
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Photometric Apparatus
Electrical Testing Laboratories
Leeds & Northrup Co.

Pipe Coils
Superheater Co.
Copper Heating Tubing
Chase Metal Works

Pipe Fittings
Crane Co

Pipe Frame Fittings, Electrical
Schweitzer & Conrad, Inc.

Pipe (Riveted Steel)
Riter-Conley Mfg. Co.
Brass
Chase Metal Works

Platinum
Baker & Co., Inc.

Pliers (Rubber Insulated)
Rubber Insulated Metals Corp.

Plugs, Attachment
General Electric Co.
Westinghouse Elec. Mfg. Co.

Plugs
Delta Star Electric Co.
General Electric Co.
National Metal Molding Co.
Westinghouse Elec. Mfg. Co.

Pole Line Hardware
Hubbard & Co.
Western Elec. Co.

Poles
Iron
Archbold-Brady Co.
Bates Exp. Steel Truss Co.
Milliken Bros. Mfg. Co.
Steel
Aermotor Co.
Pacific Coast Steel Co.
Wood
Bell Lumber Co.
Bruce Co., M. L.
Hubbard & Co.
Naugle Pole & Tie Co.
Partridge Lumber Co., T. M.
Western Elec. Co.

Poles, Reinforcing of
Hubbard & Co.

Posts
Wood
Naugle Pole & Tie Co.

Potentiometers
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.
Westinghouse Elec. Mfg. Co.

Potheads
Elec'l Development & Machine Co
G. & W. Elec. Spec. Co.
Johns-Manville, Inc.

Presses Cutting
Ferracute Machine Co.

Projectors, Floodlighting
Electric Service Supplies Co.

Protective Devices
Condit Elec'l Mfg. Co
Elec. Power Equip. Corp
General Electric Co
Johns-Manville, Inc
Schweitzer & Conrad, Inc.
Wadsworth Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Pulleys, Paper
Rockwood Mfg. Co.

Pulverized Fuel Equipment
Combustion Engineering Co.

Pumps
Centrifugal
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
Fairbanks, Morse & Co.
Goulds Mfg. Co.
Lea-Courtenay Co.
Manistee Iron Works
Terry Steam Turbine Co.
Power
Lea Courtenay Co.
Reciprocating
Allis-Chalmers Mfg. Co.
Fairbanks, Morse & Co.
Terry Steam Turbine Co.

Pyrometers
Bristol Co., The
Leeds & Northrup Co.
Taylor Instrument Co.

Radio Apparatus
General Elec. Co.
Westinghouse Elec. & Mfg. Co.

Rail Bonds
Ohio Brass Co.

Rectifiers
General Electric Co.
Valley Electric Co.
Westinghouse Elec. & Mfg. Co.

Reels
Gleason & Co., J. L.

Repairing
(See Searchlight Section)
Bonstead Elec. & Mfg. Co.
Brown Hunkele Corp.
Commonwealth Edison Co.
I. R. Nelson Company

Resistance Materials, Electrical
Electrical Alloy Co.

Resistance Units
General Electric Co.
Industrial Controller Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Rheostats
Biddle, Jas. G.
General Electric Co.
Sundh Electric Co.
Valley Electric Co.
Westinghouse Elec. & Mfg. Co.
Miscellaneous
Ward Leonard Elec. Co.
Motor Speed Regulating
Ward Leonard Elec. Co.
Starting and Controlling
Ward Leonard Elec. Co.

Rivets, Brass, Copper and Bronze
Rome Brass & Copper Co

Rods, Brass, Copper and Bronze
American Brass Co.
Chase Metal Works
Rome Brass & Copper Co.

Rolls, Brass, Copper and Bronze
Chase Metal Works
Rome Brass & Copper Co.

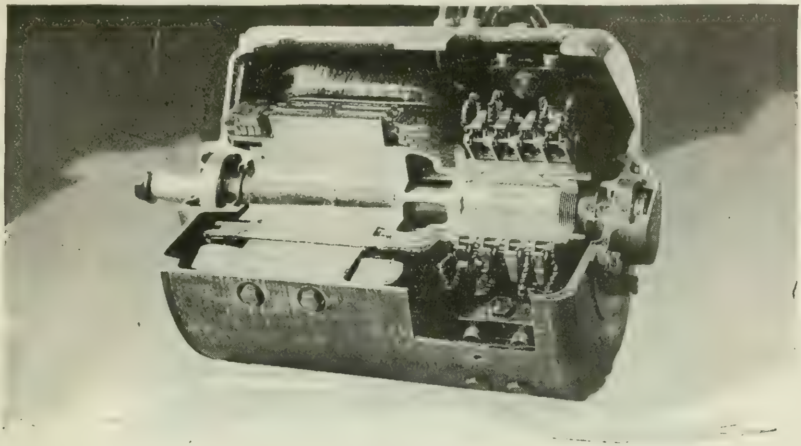
Rosettes
National Metal Molding Co.

Screwdrivers (Rubber Insulated)
Rubber Insulated Metals Corp.

Searchlights
General Electric Co.
Westinghouse Elec. Mfg. Co.

Second-Hand Apparatus
(See Searchlight Section)
Archer & Baldwin, Inc.
Coleman & Shoemaker
Commonwealth Edison Co.
Davis, J. F.
Davis Machine & Motor Co., Inc.

SKF



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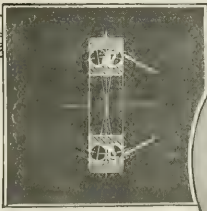
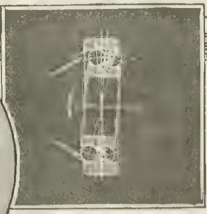


Normal View



Deflected View

Duquesne Elec. & Mfg. Co.
Elliott Electric Co.
Gregory Electric Co.
Hall & Co., Stephen
Hemphill & Co., J. L.
Independent Elec. Mchy. Co.
Klein & Co., Nathan
MacGovern & Co.
McMillan, A.
Markman Engr. Co.
Miller Owen Elec. Co.
Miller Seldon Elec. Co.
Nashville Industrial Corp
Newark Elec. Repair Co.
Nussbaum Co., V. M.
Power Machinery Exchange
Randle Machy. Co.
Ross Power Equip. Co.
Scheinert & Co., R.
Stewart Elec. Co., John A.
Stewart & Co Pau
Surety Motor Bonding Co.
Wickes Mchy. Co.
Willey Wray Elec. Co

Separators
Oil
Elliott Company
Steam
Elliott Co.

Shades, Tin
Ostrander & Co., W. R.

Sheets, Brass, Copper and Bronze
American Brass Co.
Chase Metal Works
Rome Brass & Copper Co.
Electrical
American Sheet & Tin Plate Co.

Sheet Metal
American Sheet & Tin Plate Co.

Shelving, Steel
Lupton's Sons Co., David

Silencers, Exhaust
Maxim Silencer Co.

Silent Chain Drive
Morse Chain Co.

Slate
Portland Monson Slate Co.

Sleeves, Splicing
Memco Engr. & Mfg. Co.

Sockets & Receptacles
General Electric Co.
National Metal Molding Co.
Ostrander & Co., W. R.
Westinghouse Elec. & Mfg Co.

Solder
Mitchell-Rand Mfg. Co

Soldering Flux
Blake Signal & Mfg Co.
Mitchell-Rand Mfg. Co.

Soldering Irons
Cutler-Hammer Mfg. Co.

Solenoids, (see Coils)

Speed Reducers
Ganschow Co., Wm.

Sprockets, Silent Chain
Morse Chain Co.

Staples
Blake Signal & Mfg. Co.

Starters, Motor Electric
Condit Elec'l Mfg. Co.
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Ward Leonard Electric Co
Westinghouse Elec. & Mfg. Co.

Steam Insulation
Johns-Manville, Inc.

Steam Specialties
Lunkenheimer Company
Power Specialty Co.

Steel, Structural
Pacific Coast Steel Co

Stokers
Babcock & Wilcox Co
Combustion Eng'g Co
General Elec. Co.
Riley Stoker Co., Sanford
Westinghouse Elec. & Mfg. Co.
Mechanical
American Engineering Co.

Stokers, Pulverized Coal
Combustion Engineering Co.

Stoves, Electric (See Rangers, Etc.)

Strainers
Oil
Elliott Co.
Water
Elliott Co.

Structural Steel
Milliken Bros. Mfg. Co.

Sub-Stations, Outdoor
Aermotor Co.
Delta Star Electric Co.
Elec. Power Equip. Corp.
Elec. Engineers Equip. Co
Electro Service Co.
General Electric Co.
Memco Engr. & Mfg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Superheaters, Steam
Babcock & Wilcox Co.
Power Specialty Co.
Superheater Co.

Supplies, Railway
General Electric Co.
Johns-Manville, Inc.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Supplies
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Switchboard Supplies
Elec. Power Equip. Corp.
General Electric Co
Johns-Manville, Inc.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Switchboards
Allis-Chalmers Mfg. Co.
General Electric Co.
Roller-Smith Co.
Trumbull Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Switches
Air Break and Pole Top
Condit Elec'l Mfg. Co.
Delta-Star Elec. Co.
Elec. Power Equip. Corp .
General Electric Co.
Hi-Voltage Equipment Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad Inc
Westinghouse Elec. Mfg. Co.
Battery
Trumbull-Vanderpoel Elec.
Disconnecting
Anderson Mfg. Co., A. & J. M.
Delta Star Electric Co.
Elec. Power Equip. Corp.
Elec'l Development & Machine Co.
Elec'l Engineers Equip. Co.
General Electric Co.
Schweitzer & Conrad, Inc.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
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General Elec Co.
Sundh Elec. Co.
Westinghouse Elec. & Mfg. Co
Fuse
General Electric Co.
Hi-Voltage Equipment Co
Schweitzer & Conrad, Inc.
Westinghouse Elec. Mfg Co.
Knife
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Condit Elec'l Mfg. Co.
Cutter Co.
General Electric Co.
Trumbull Elec. Mfg. Co.
Trumbull Vanderpoel Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
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Condit Elec'l Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
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Anderson Mfg. Co., A. & J. M.
General Electric Co.
Industrial Controller Co
Payne Deane, Ltd.
Railway & Industrial Eng Co.
Sundh Elec Co
Westinghouse Elec. & Mfg. Co.
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Johns-Manville, Inc.
Square D Company
Trumbull Elec. Mfg. Co.
Trumbull Vanderpoel Electric Mfg. Co.
Wadsworth Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Series
G. & W. Elec. Spec. Co.
General Electric Co.
Westinghouse Elec. Mfg. Co.
Snap and Push Button
General Electric Co
Western Electric Co .
Westinghouse Elec. Mfg. Co.
Time
Anderson Mfg. Co., A. & J. M.
General Electric Co.
Paragon Electric Co.
Westinghouse Elec. & Mfg. Co.

Synchroscopes
Bristol Co., The
General Electric Co.
Roller Smith Co.
Schweitzer & Conrad, Inc
Westinghouse Elec. & Mfg. Co.
Weston Electrical Inst. Co.

Tachometers
Biddle, James G.
Bristol Co., The
Foxboro Co.
Johns-Manville, Inc.
Roller-Smith Co.

Tanks
Riter-Conley Mfg. Co.

Telephones
Western Elec. Co.

Testing Apparatus
American Transformer Co.
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Testing Laboratories
Electrical Testing Laboratories

Theatre Dimmers
General Electric Co.
Industrial Controller Co.
Westinghouse Elec. Mfg. Co.

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Bristol Co., The
Foxboro Co.

Tie Bands
Copper Clad Steel Co.

Ties
Naugle Pole & Tie Co.

Toaster
Westinghouse Elec. & Mfg Co .

Tools
Construction
Klein & Sons, Mathias
Oshkosh Mfg. Co.
Underground Conduit
Railway & Industrial Eng Co.

Towers
Radio
Milliken Bros. Mfg. Co., Inc.
Pacific Coast Steel Co.
Transmission
Aermotor Co.
Archbold-Brady Co.
Bates Exp. Steel Truss Co.
Milliken Bros. Mfg. Co. Inc.
Pacific Coast Steel Co.
Railway & Industrial Eng. Co.
Riter-Conley Mfg. Co.

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Allis-Chalmers Mfg. Co.
American Transformer Co.
General Electric Co.
Kuhlman Electric Co.
I. R. Nelson Company
Moloney Electric Co.
Packard Electric Co.
Pittsburgh Transformer Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Transformers, Bell Ringing
General Elec. Co.
Packard Electric Co
Westinghouse Elec. & Mfg. Co.

Transmission, Silent Chain
Morse Chain Co.

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Irving Iron Works Co.

Tubes
Brass, Copper and Bronze
Chase Metal Works
Rome Brass & Copper Co.

Turbines
Hydraulic
Allis-Chalmers Mfg. Co.
Leffel & Co., James
Smith Co., S. Morgan
Steam
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
General Electric Co.
Kerr Turbine Co.
Terry Steam Turbine Co.
Westinghouse Elec. & Mfg. Co.

Turbo-Generators
Allis-Chalmers Mfg. Co.
General Electric Co.
Terry Steam Turbine Co
Westinghouse Elec. & Mfg. Co.

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Ward Leonard Elec. Co.

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Western Elec. Co.

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Balanced Throttle
Lunkenheimer Company
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Elliott Co.
Lunkenheimer Company
Gate
Lunkenheimer Company
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Lunkenheimer Company
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Ohio Brass Co.
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Lunkenheimer Company
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Lunkenheimer Company
Renewable Seat
Lunkenheimer Co.
Steam
Crane Co.
Lunkenheimer Co.
Ohio Brass Co.
Steel
Lunkenheimer Company
Superheated Steam
Lunkenheimer Company

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Shelton Elec. Co.

Washers
Mass. Machine Shop, Inc.

Washing Machines
Western Elec. Co.

Water Wheels, Impulse Turbines
Allis-Chalmers Mfg. Co.

Water Wheel Governors
Woodward Governor Co.

Wattmeters, Watt-Hour Meters (See Instruments)

Welder
Portable
Ohio Brass Co.
Rail Joint
Ohio Brass Co.

Welders, Arc
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Welding Machines
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Winding Machinery
Coto-Coil Co.
New England Butt Co.

Wire and Cables
Auto
Rome Wire Co.
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American Brass Co.
American Ins. Wire & Cable Co.
Amer. Steel & Wire Co.
Anaconda Copper Mining Co.
Illinois Wire & Cable Co.
Rome Wire Co.
Brass and Bronze
Chase Metal Works
Copper Clad
Copper Clad Steel Co.
Standard Underground Cable Co.
Enamel
Belden Mfg. Co.
Dudlo Mfg. Co.
Maring Wire Co.
Rome Wire Co.
Magnet
American Brass Co.
American Enameled Magnet Wire Co.
Belden Mfg. Co.
Dudlo Mfg. Co.
Hazard Mfg. Co.
Maring Wire Co.
Rome Wire Co.
Western Electric Co.
Resistance
American Brass Co.
Electrical Alloy Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Rubber Covered and Weatherproof
American Brass Co.
American Ins. Wire & Cable Co.
Belden Mfg. Co.
Hazard Mfg. Co.
Illinois Wire & Cable Co.
Indiana Rub. & Ins. Wire Co.
Packard Electric Co.
Roebling's Sons Co., John A.
Rome Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Wire & Cable Co
Western Electric Co.
Steel
American Steel & Wire Co.
Trolley
American Brass Co
Anaconda Copper Mining Co
Rome Wire Co.
Underground (Cable)
Hazard Mfg. Co.
Rome Wire Co.
Standard Underground Cable Co.

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General Electric Co
Westinghouse Elec. & Mfg Co.

Wood Preservatives
Anderson Mfg. Co., A. & J. M.

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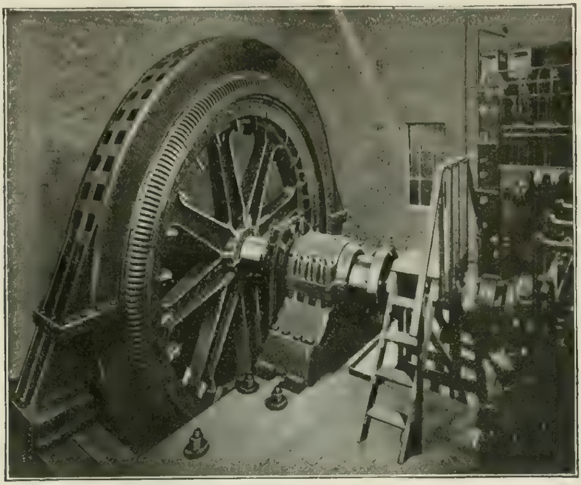

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Crushing Machinery
Cement Machinery
Flour Mill Machinery
Saw Mill Machinery
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Steam and Electric Hoists
Farm Tractors
Power Transmission Machinery

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Milwaukee, Wisconsin

District Offices in All Principal Cities

ALPHABETICAL INDEX TO ADVERTISEMENTS

Page

A

Adam Electric Co., Frank...... 9
Aermotor Co. 58
Allis-Chalmers Mfg. Co. 87
Allison & Co., Jas. E.......... 38
American Circular Loom Co. 54
American Enameled Magnet Wire Co. 52
American Engineering Co...... 71
American Fibre Conduit Co.... 54
American Insulated Wire & Cable Co. 53
American Insulating Machy Co. 53
American Lava Corp.......... 56
American Sheet & Tin Plate Co. 56
American Steel & Wire Co 52
American Transformer Co..... 64
American Vulcanized Fibre Co.. 55
Anaconda Copper Mining Co 54
Anderson Mfg. Co., A. & J. M.. 58
Archer & Baldwin Inc 44
Archbold-Brady Co............ 58
Arnold Co., The.............. 38

B

Babcock & Wilcox Co......... 70
Baehr, Wm. A 38
Baker & Co., Inc.............. 56
Baldor Electric Co............ 80
Bates Expanded Steel Truss Co. Front Cover
Baum, Frank G............... 38
Belden Mfg. Co............... 52
Bell Lumber Co............... 58
Belyea Co., Inc............... 46
Biddle, James G.............. 63
Blake Signal & Mfg. Co....... 53
Bodine Electric Co............ 80
Bonstead Elec. & Mfg. Co 50
Brenholts, Roy 48
Bristol Co., The.............. 63
Brown-Hunkele Corp.......... 46
Bruce Co., M. L.............. 58
Buffalo Forge Co............. 72
Burke Electric Co............ 81
Busch-Sulzer Bros.—Diesel Eng. Co 72
Byllesby 38

C

Cameron Elec. Mfg. Co....... 65
Carrier Air Conditioning Co. of America 72
Centrifugal Fan Co 76
Century Electric Co........... 81
Chase Metal Works 29
Cheney, Edw. J. 38
Chicago Fuse Mfg. Co...... 66
Cleveland Worm & Gear Co.... 76
Coal & Iron National Bank... 55
Coleman & Shoemaker, Inc.... 44
Colonial Fan & Motor Co.... 80
Combustion Engr. Corp...... 69
Commonwealth Edison Co...... 46
Condensite Co. of America.... 55
Condit Electrical Mfg. Co.... 11
Connelly Boiler Co., D....... 68
Consolidated Electric Lamp Co 65
Continental Fibre Co.......... 56
Cooper & Co., Hugh L. 38
Copper Clad Steel Co....... 53
Corliss Carbon Co 80
Cory & Son, Inc., Chas...... 63
Coto-Coil Company, The....... 52
Crane Co.................. 74
Crawford Mfg. Co 80
Crocker-Wheeler Co 80
Cutler-Hammer Mfg. Co...... 19
Cutter Co.................... 63

D

Davis & Sons Co., J. F........ 68
Davis Mach. & Motor Co...... 45
Day & Zimmermann Inc 38
De Laval Steam Turbine Co.... 74
Delta Star Electric Co......12, 13
Detroit Electric Furn. Corp..... 72
Diehl Mfg. Co 81
Directory of Engineers 38, 39
Doehler Die Casting Co........ 68
Dudlo Mfg. Co. 53
Duncan Elec. Mfg. Co.... 10
Duquesne Elec. & Mfg. Co...... 47

E

Electric Macy Mfg. Co........78
Electric Power Equip. Corp.... 37
Electric Service Supplies Co.... 14
Electrical Alloy Co........... 52
Electrical Development & Mach. Co. 57
Electrical Engineers Equip. Co.. 62
Electrical Testing Laboratories. 38
Electrical World 3
Electro Dynamic Co.......... 81
Electro Service Co............ 59
Elliott Co.................... 28
Empire Refiners, Inc.......... 79
Engineering Service Corp....... 38
Engineers, Directory of......38, 39

F

Fairbanks-Morse & Co......... 80
Fargo Engineering Co......... 38
Federated Engrs. Development Co.. 51
Ferguson Engineers 38
Fergusson Engr. Co............38
Ferracute Machine Co.......... 64
Ford, Bacon & Davis, Inc...... 38
Ft. Wayne Corres. School...... 50
Fowle & Co., Frank J......... 38
Foxboro Company, Inc........ 62
Fulton Iron Works Co........ 75

G

G. C. A. Mfg. Co............. 67
G. & W. Elec. Spec. Co........ 59
Gannet, Seelye & Fleming..... 38
Ganschow Co., Wm............ 87
Garfield Mfg. Co.............. 57
General Electric Co..32, 33, 34, 35
George Constr. Co............ 38
Gifford-Wood Co 68
Gleason & Co., J. L. 68
Goulds Mfg. Co............. 71
Government Adv. 49
Greenwood Engr. Co.......... 38
Gregory Electric Co........... 40

H

Hall & Co., Inc., Stephen...... 43
Harris Bros. Co............... 47
Hayward Co.................. 68
Hazard Mfg. Co.........3rd Cover
Hemphill & Co., J. L. 40
Hi-Voltage Equip. Co......... 63
Hubbard & Co................ 60

I

Ideal Commutator Dresser Co... 78
Illinois Electric Porcelain Co... 57
Illinois Wire & Cable Co...... 54
Imperial Electric Co.......... 80
Imperial Porcelain Works 55
Independent Electric Machy Co. 45
Indiana Rubber & Ins. Wire Co. 36
Industrial Controller Co........ 65
Irving Iron Works Co......... 77
Ives & Davidson.............. 38

J

Jeandron, W. J. 78
Jeffrey-Dewitt Insulator Co..... 57
Johnson, Jr., T. F............. 38
Johns-Manville, Inc............ 22

K

Kansas City Power & Lt. Co.... 46
Kerite Ins. Wire & Cable Co. 36
Kerr Turbine Co. 74
Ketcham & Tipton 38
Kimble Electric Co........... 78
Klein & Co., Mathias 20
Klein & Co., Nathan....45, 48, 50
Krehbiel Company 38
Kuhlman Electric Co.......... 65

L

Land, J. L............... 46, 48
Lapp Insulator Co., Inc........ 57
Le Carbone Co............... 78
Lea-Courtenay Co............ 74
Lee, Wm. S.................. 38
Leeds & Northrup Co......... 59
Leffel & Co., James........... 72
Lincoln, Inc., E. S............ 38
Locke Insulator Corp......... 57
Lunkenheimer Co., The 73
Lupton's Sons Co., David...... 65

M

MacGovern & Co., Inc......... 43
McClellan & Junkersfeld....... 38
McGraw-Hill Book Co.......23, 61
McIntosh & Seymour Corp..... 72
McMillan, A.................. 48
Manistee Iron Works Co....... 74
Marble-Card Electric Co....... 81
Maring Wire Co.............. 52
Maris Bros 76
Markman Engr. Co........... 48
Massachusetts Machine Shop, Inc. 74
Maxim Silencer Co............ 70
Mead, Daniel W 38
Mechanical Appliance Co....... 76
Memco Engr. & Mfg. Co....... 59
Merrill & Co., M. H........... 39
Miller-Owen Elec. Co., Inc..... 44
Milliken Bros. Mfg. Co........ 58
Minerallac Electric Co........ 57
Mitchell-Rand Mfg. Co........ 66
Moloney Electric Co........... 64
Morse Chain Co............... 72
Mullergren, Arthur L......... 39
Munsell & Co., Eugene 56
Mueller Electric Co........... 66

N

Nashville Industrial Corp...... 48
National Business Bourse...... 50
National Metal Molding Co.... 54
National Power Machy. Co.... 44
Naugle Pole & Tie Co......... 21
Neall, N. J.................. 39
Nelson Co., I. R.............. 46
New England Butt Co........ 53
Noetling & Betz 76
Norma Co. of America........ 80
Northern Engr. Works 76
Northern Industrial Chem. Co.. 55
Northwestern Electric Co...... 80
Nussbaum Co., V. M.......... 46

O

Ohio Brass Co............... 57
Ophuls, Hill & McGreery, Inc.. 39
Oshkosh Mfg. Co............ 60
Ostrander & Co., W. R........ 66

P

Pacific Coast Steel Co......... 59
Packard Electric Co.......... 65
Paragon Electric Co.......... 64
Parsons, Klapp, Brinckerhoff & Douglas 39
Partridge Lumber Co., T. M.... 58
Payne Dean, Ltd............ 74
Peerless Electric Co.......... 81
Philadelphia Elec'l & Mfg. Co.. 25
Philadelphia Evening Bulletin.. 66
Philadelphia Insulated Wire Co. 53
Phoenix Utility Co............ 47
Pittsburgh Elec. Furnace Corp.. 72
Pittsburgh Transformer Co..... 64
Portland Monson Slate Co..... 62
Power Machy Exchange Inc... 42
Power Specialty Co........... 68
Proctor, Inc., John R.......... 39
Public Service Prod. Co........ 39

R

Railway & Industrial Engineering Co...................... 58
Redmanol Chemical Prod. Co... 26
Reed, W. Edgar.............. 39
Reliance Elec. & Eng. Co...... 78
Rensselaer Valve Co 72
Riley Stoker Co., Sanford...... 68
Riter-Conley Co............. 58
Robbins & Myers Co...Back Cover
Robinson & Co., Dwight P..... 39
Rockwood Mfg. Co........... 24
Roebling's Sons Co., John A.... 53
Roller-Smith Co............. 62
Rome Brass & Copper Co...... 30
Rome Wire Co............... 36
Ross Power Equip. Co........ 48
Rubber Insulated Metals Corp.. 66

S

S. K. F. Industries 85
Safety Ins. Wire & Cable Co.... 52
Samson Cordage Works........ 53
Sanderson & Porter........... 39
Sargent & Lundy 39
Sayer, E. Y., Engrg. Corp..... 39
Scheidenhelm, F. W.......... 38
Scheinert Co., R.............. 46
Schweitzer & Conrad, Inc...... 15
Scofield Eng'g Co............ 39
Searchlight Section 41, 52
Shelton Electric Co........... 63
Sherman Mfg. Co., H. B....... 60
Simplex Wire & Cable Co...... 36
Smith Co., S. Morgan......... 74
Smith & Serrell 74
Spooner & Merrill 39
Spray Engineering Co..........74
Square D. Company..........6, 7
Standard Elec. Machy Co...... 42
Standard Underground Cable Co. 56
Star Electric Motor Co........ 78
Sterling Varnish Co........... 55
Steward Mfg. Co., D. M........ 55
Stone & Webster, Inc......... 4
Sturtevant Co., B. F.......... 80
Sundh Electric Co............ 62
Sunlight Elec'l Mfg. Co........ 65
Superheater Co............... 68
Surety Motor Bonding Co...... 47

T

Taylor Instrument Co......... 62
Telenduron Company 27
Terry Steam Turbine Co...... 74
Thebo, Starr & Anderton, Inc.. 39
Thomas & Sons Co., R......... 57
Thompson & Jameson, Inc...... 46
Tiffany Elec. Co.............. 41
Todd Shipyards Corp.......... 70
Trumbull Elce. Mfg. Co....... 62
Trumbull Vanderpoel Elect. Mfg. Co. 62

V

Valley Electric Co............ 81

W

Wadsworth Elec. Mfg. Co...... 8
Wagner Elec. Mfg. Co......... 31
Ward Leonard Electric Co...... 63
Wesche Electric Co., B. A...... 81
Western Electric Co.......... 5
Westinghouse Elec. & Mfg. Co., 16, 17, 18
Weston Elec'l Instr. Co........ 2
White, J. G. Engr. Corp....... 39
Whitelite Electric Co.......... 67
Willey-Wray Elec. Co.......... 47
Williams, Gardner S.......... 39
Wilmington Fibre Spec. Co.... 56
Woodward Governor Co........ 72

[illegible] 3

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~~Applied Sci.~~
~~Serials~~

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